PARSONS

DRAINAGE, HYDROLOGY AND STORMWATER MANAGEMENT REPORT

Municipal Class Environmental Assessment

DRAFT

Montrose Road and Lyons Creek Road/Biggar Road – Municipal Class Environmental Assessment and Detailed Design

Prepared for:

The Regional Municipality of Niagara

October, 2021

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1 Introduction

1.1 GENERAL

Parsons Inc. has been retained by the Regional Municipality of Niagara to undertake a Schedule C Municipal Class Environmental Assessment (MCEA), Detailed Transportation Assessment, and Detailed Design and Contract Document Preparation for Montrose Road (Regional Road 98), Lyons Creek Road (Regional Road 47)/Biggar Road, in the City of Niagara Falls. The Project limit for the Montrose Road and Lyons Creek Road/Biggar Road MCEA study is shown in **Figure 1**.

The intent of the MCEA study is to identify the recommended alternative solutions and designs so that the project can proceed to obtain the necessary approvals and to undertake detailed design and construction of suitable transportation and municipal infrastructure to service the South Niagara Hospital Site and future developments in the area. As currently positioned, the supporting infrastructure shall be constructed by the fall of 2023 to support the South Niagara Hospital Site.

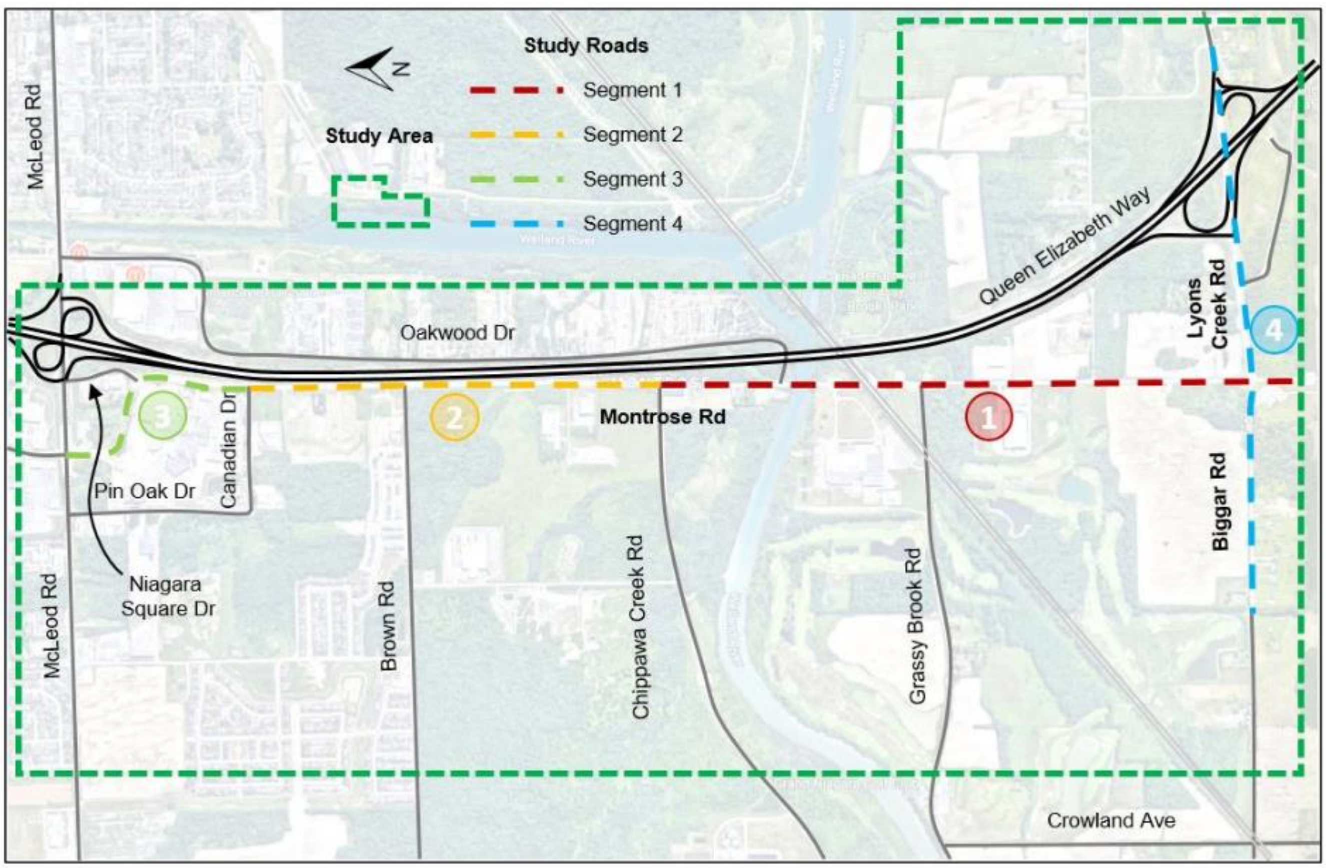


Figure 1 Study Area

As part of the MCEA, a Drainage, Hydrology and Stormwater Management (SWM) study was carried out to assess the existing drainage, hydrology and SWM systems within the Project Limit and to design an integrated drainage and SWM plan for the proposed improvement works.

1.2 PROJECT BACKGROUND/SITE DESCRIPTION

Montrose Road within the project limit is a major north/south roadway extending from Lyons Creek Road/Biggar Road to McLeod Road. Lyons Creek Road/Biggar Road is a major east/west roadway extending from the west limit of the South Niagara Hospital to the QEW in the City of Niagara Falls.

The study area, as shown in **Figure 1**, includes four (4) segments.

- **Segment 1** is approximately 2.1 kilometers of Montrose Road between Lyons Creek Road/Biggar Road and Chippawa Creek Road (Regional Road 63). Segment 1 is currently an undivided two-lane arterial road with a rural cross-section, with one (1) bridge crossing over Welland River and one (1) Canadian Pacific Railway at-grade crossing.
- **Segment 2** is approximately 1.5 kilometers of Montrose Road between Chippawa Creek Road and Canadian Drive. Segment 2 is currently an undivided two-lane arterial road with a rural cross-section.
- **Segment 3** is approximately 0.8 kilometers of Montrose Road between Canadian Drive and McLeod Road. Segment 3 is currently a divided four-lane arterial road with an urban cross-section.
- **Segment 4** is approximately 2 kilometers of Lyons Creek Road and Biggar Road between QEW and West Limits of South Niagara Hospital Site. Segment 4 is currently an undivided four-lane/two-lane arterial road with an urban/rural cross-section, with one (1) overpass bridge crossing Queen Elizbeth Way.

The study area is situated within the South Niagara Falls and Lower Welland River Watershed under the jurisdiction of the Niagara Peninsula Conservation Authority (NPCA). There are four watercourses in the study area which are a tributary of the Lyons Creek, Grassy Brook Creek, Welland River and Warren Creek. Floodplain mapping reports have been developed by NPCA for Welland River and Lyons Creek. In addition, the City and NPCA developed and implemented Warren Creek Watershed Master Plan. These floodplain mapping and master drainage plan studies resulted in hydrology and hydraulic models and floodplain maps which are used for this Project.

1.3 STUDY SCOPE AND OBJECTIVES

The intent of the road improvements is to increase roadway capacity, improve connectivity, and to integrate network of cycling and pedestrian facilities, transit, roads and highways. The Niagara Region Transportation Master Plan (TMP) envisions that this will be facilitated by widening the roadway from a two-lane/four-lane rural cross section to a four-lane urban cross section with active transportation facilities.

As part of the MCEA, the drainage, hydrology and SWM study scope includes:

- Investigate and confirm existing drainage patterns within the study area, including catchment delineations of internal and any off-site (external) areas draining into the project,
- Investigate and confirm existing outfall locations,
- Assess the existing drainage, hydrology and SWM systems within the study area to identify any opportunities, deficiencies, and constraints, which would serve as a baseline for assessing alternative designs and requirements for the preferred improvement works,
- Undertake appropriate hydrologic/hydraulic analysis to evaluate and assess proposed work impact on regulated floodplains identified by NPCA, and
- Identify and evaluate potential storm water management practices (SWMPs) to address water quality, quantity, water balance, and erosion impacts for the proposed roadway improvements.

1.4 BACKGROUND DOCUMENTS AND REFERENCES

The following is a list of the reference documents, design guidelines, background studies, and data sources reviewed or used for this study. In addition, NPCA has provided the hydrology and hydraulic models for the crossing watercourses which are updated to evaluate the Project impacts on floodplain.

- City of Niagara Falls, Engineering Design Guidelines Manual, January 2012,
- Floodplain Mapping – Lyons Creek Including Tee Creek, Niagara Penninsula Conservation Authority, March 2011,
- Functional Servicing Report and Stormwater Management Report–South Niagara Hospital, Stantec, December 2020.
- MECP Stormwater Management Planning and Design Manual, March 2003,
- MTO Highway Drainage Design Standards (HDDS), January 2008,
- Niagara Peninsula Conservation Authority, Stormwater Management Guidelines, March 2010,
- Ontario Ministry of Agriculture and Food, The Soils of the Regional Municipality of Niagara, report No. 60 of the Region of Niagara, Niagara Region Roadway Design Guideline, 2016,
- Region of Niagara, Niagara Region Roadway Design Guideline, 2016,
- Request for Proposal - Montrose Road and Lyons Creek Road/Biggar Road – Municipal Class Environmental Assessment and Detailed Design, January 2020,
- Stormwater Management Plan–Warren Woods Estates Phase 3, Upper Canada Consultants Engineers, May 2014,
- Stormwater Management Plan–Warren Woods Estates Phase 4, Upper Canada Consultants Engineers, January 2015,
- Stormwater Management Report–Grand Niagara Secondary Plan, WSP/MMM Group Limited, November 2016,
- Stormwater Management Plan–Warren Woods Estates Phase 5, Upper Canada Consultants Engineers, August 2017, and
- Stormwater Management Plan–Niagara Falls Industrial Park, Upper Canada Consultants Engineers, September 2018,
- Warren Creek – Watershed Master Plan, Phillips Engineering Limited, December 1999,
- Warren Creek – Watershed Plan Implementation, Upper Canada Consultants Engineers, May 2007, and
- Welland River Floodplain Mapping Update, WSP, Vovember 2018.

2 Drainage Design Criteria and SWM Objectives

2.1 DRAINAGE DESIGN CRITERIA

Drainage design criteria have been summarized in accordance with the City of Niagara Falls's Engineering Design Guidelines Manual (2012), Region of Niagara's Roadway Design Guideline (2016), NPCA's Stormwater Management Guidelines (2010), and Ministry of Transportation of Ontario (MTO)'s Highway Drainage Design Standards (2008). Generally, the City and the Region design guidelines specify the design criteria for storm sewer. These guidelines do not define design criteria fpr culverts and therefore, MTO design standards were used for culvert design. Additional design criteria from NPCA's stormwater management guidelines are incorporated into the design of proposed stormwater management measures.

2.1.1 Pavement Drainage

The City Design guidelines defines design storm, sewer design methods, and pipe materials and the Region's guidelines specifiy the maximum catchbasin spacing and allowable ponding on the road as follow:

1. Storm sewer system shall be designed to convey 5-year storms without any surcharging. The values of the rainfall intensity shall be determined using the approved Rainfall Intensity Duration Curve (IDC) for Niagara Falls,
2. Major overland flow routes shall be designed to convey 100-year design storm,
3. No ponding allowed on roadway for 25-year design storm,
4. Ponding during 100-year design storm must not inhibit safe passage for emergency vehicles,
5. Minimum pipe diameter for storm sewers main and double catchbasin connections is 300mm and for single catchbasin connections is 200mm,
6. Minimum time of concentration of 10 minutes should be considered in sewer design,
7. The actual velocity in storm sewers shall be limited to minimum of 0.8m/s and a maximum of 6.0 m/s,
8. The minimum cover to top of the pipe shall generally be 1.20m,
9. Maximum spacing of catchbasins shall be 75m for two lane roadways. In sags, when drainage is received from more than one direction, double catchbasins shall be installed and the maximum length of gutter contributing from each side shall be 75% of the spacing permitted above,
10. Storm sewers may be constructed of concrete pipe, polyvinyl chloride pipe or polyethylene pipe. All pipe used for storm sewer shall have a smooth interior wall. Polyvinyl chloride and Polyethylene pipe can be used for diameters up to 600mm when installed under roadways.

2.1.2 Bridges and Culverts

MTO's HDDS design criteria are normally applicable to infrastructures under Provincial jurisdictions; however, the MTO standards were applied since the City and the Region guidelines do not identify the design criteria for bridges and culverts. The following is a summary of design requirements:

1. Culverts with total span less than 6.0 m in Urban Arterial Roads shall be designed to convey 50-year design storm,
2. Conveyance capacity of culverts not on a watercourse should match the design characteristics of the Roadside Ditch located immediately upstream of the culvert with minimum freeboard of 0.3 m,
3. The effect of climate change shall be considered in designing drainage infrastructure. This could be done through MTO's Intensity Duration Frequency (IDF) Curve Lookup Tool which includes the option for estimating future rainfall intensities associated with climate change impacts,
4. Minimum freeboard for culvert crossings on a watercourse shall be 1.0m,

5. Maximum flood depth (HW/D) for culverts with diameter or rise <3.0 m shall be less than 1.5,
6. Circular culverts in Urban Arterial Roads shall have minimum diameter of 800 mm and box culverts shall have minimum rise of 900 mm,
7. Water level generated by the Check Flow shall not exceed the elevation of the edge of the travelled lane for Arterial Roads,
8. Suggested Design Service Life (DSL) for culverts under an Arterial Road is 50 years.

2.2 SWM OBJECTIVES

All new developments are required to provide stormwater management in accordance with provincial and municipal policies. Through guidance from the Ontario Ministry of the Environment's (MECP) Stormwater Management Planning and Design Manual (2003), Niagara Peninsula Conservation Authority (NPCA) Stormwater Management Guidelines, 2010, Lyons Creek Floodplain Mapping report, 2011, Welland River Floodplain Mapping Update, 2018, and Warren Creek Watershed Master Plan Implementation, 2007, the following SWM objectives have been developed:

- Sufficient SWM controls are required by the NPCA to ensure that flooding, pollution, surface erosion and conservation of land impacts due to any developments do not occur,
- Safe drainage conveyance shall be provided to reduce potential flood risks and to prevent damage to private and public properties, and
- Stormwater quality shall improve prior to discharge to the identified site outlets.

2.2.1 Stormwater Quantity Control

Generally, accepted criteria are that the SWM quantity controls are required to match or to reduce post-development peak flows to pre-development peak flows for a range of design storm events (2, 5, 25 and 100-year storm events), unless directed otherwise. The stormwater quantity control criteria summarized as follow:

- Different design storm distributions and durations shall be assessed to determine the critical storm that yields the lowest pre-development peak flow and the highest post-development peak flow. At a minimum, the 3-hour Chicago, 12-hour AES and 24-hour SCS distributions should be considered,
- All SWM plans are to assess the capacity of the receiving system to identify hydraulic constraints or existing flooding hazards. These existing constraints/risks may require additional quantity controls over and above the typical post to pre peak flow controls, and
- Consideration may be given to not requiring peak flow controls if the assessment of receiving system capacity demonstrates little or no benefit to such controls. This would include situations such as discharge to major river systems or directly to a Lake. Pre-consultation with the NPCA and additional approval requirements are necessary for this to be considered.

2.2.2 Stormwater Quality Control

The level of fish habitat sensitivity dictates the required stormwater quality control within NPCA jurisdiction. NPCA SWM guideline has classified fish habitat as Critical (Type1), Important (Type2), Marginal (Type3), and Unclassified (No Data). The "Enhanced" level of stormwater quality treatment is required for Critical fish habitats and a minimum of "Normal" level of stormwater quality treatment is required for other categories. The required stormwater quality control within the Project Limit is as follow:

- Welland River and Grassy Brook are classified as Critical Fish Habitat and as such, “Enhanced” level of water quality treatment (80% Total Suspended Solids (TSS) reduction) will be required,
- Lyons Creek Tributary is an Important Fish Habitat, but considering vicinity to a Provincially Significant Wetland (PSW), an “Enhanced” level of stormwater quality treatment (80% TSS reduction) shall be provided,
- Warren Creek is an Important Fish Habitat and therefore, “Normal” level of water quality treatment (70% TSS reduction) will be required,
- A minimum of “Normal” level of water quality treatment, as defined in the MOE design guidelines (2003) is required for all other crossings. This is equivalent to a 70% TSS reduction,

2.2.3 Water Balance

As per the SWM Design Manual (MECP, 2003), water balance impacts should be evaluated during the design of a site SWM system. All efforts should be made to match pre- and post-development infiltration volumes to maintain groundwater recharge, hydrogeologically sensitive areas shall be identified as part of the SWM plan, and untreated stormwater shall be prevented from being directly infiltrated.

2.2.4 Erosion and Sediment Control Criteria

NPCA SWM Guidelines specifies the following Erosion and Sediment Control Criteria for new developments:

- Where a wet or dry SWM facility service the development, extenteded detention control (detain and release the 25mm, 4-hour Chicago Design Storm over a 24-hour period) shall be provided. It is also recommended to provide extended detention control for all receiving systems that are demonstrated to be stable watercourses or for proposed development that comprise less than 10% of the total area that drains to the receiving system,
- Criteria identified in larger-scale studies that have directly evaluated the receiving systems, such as Subwatershed Studies or Master Drainage Plans, shall take precedence over the criteria presented in NPCA SWM Guidelines,
- The geomorphologic assessments and criteria contained in the SWM Design Manual (MECP, 2003) shall be used for all receiving systems that are unstable under existing conditions or for proposed developments that comprise a significant proportion of the total area draining to the receiving system, and
- Outlets to be designed to control dissipated energy to not causing any erosion.

3 Existing Conditions

Roads within the Project limit mostly have a rural cross section except two urbanized segments at the north and east end of the Project. Roadside ditches collect the runoff generated on the pavement and drain to the crossing watercourses. There are four watercourses in the study area namely the Lyons Creek tributary, Grassy Brook Creek, Welland River and Warren Creek. A bridge and eight culverts (two structural and six non-structural culverts) convey flow from these watercourses and their tributaries within the Project limit. Culverts within the study area were inspected to determine their condition and the summary results of these investigations are provided in **Section 3.2.1**.

There are two Secondary Plans within the study area which are the Garner South and Grand Niagara Secondary Plan. The Secondary Plans provide a detailed land use plan and policy framework for development of lands within the Garner South and Grand Niagara Secondary Plan. SWM strategy to support the Secondary Plan approvals are made available by the City of Niagara Falls and it is expected that the proposed strategies will mitigate the impacts of the developments. No increase in peak flow will be expected at watercourses crossing the Project limit as the result of these developments.

3.1 OVERVIEW AND STUDY APPROACH

Parsons' Drainage team performed the drainage and SWM study as part of the MCEA. An effective drainage and SWM strategy/plan has been developed in conformance with the Regional Municipality of Niagara, City of Niagara Falls standards, NPCA, and current provincial i.e., MTO, MECP and Ministry of Natural Resources and Forestry (MNRF) guidelines.

The following approaches were adopted for this Drainage and SWM study:

- Compile, review and integrate the existing data and previous studies related to the Project area,
- Perform hydrologic analysis of existing culverts, including documentation of the catchment areas, impervious coverage, soil characteristics, and estimate Design Flow for proposed culverts considering climate change,
- Evaluate hydraulics for all existing culverts within the study area and evaluate culvert extension/replacement options,
- Design storm sewer system for the pavement drainage, and
- Evaluate stormwater management measures to provide stormwater quality, stormwater quantity, water balance and erosion control requirements.

NPCA has provided available hydrology and hydraulic models for watercourses crossing the Project area. As the provided models have been developed at different times by different consulting engineers, the design storm used to estimate the Design Flow as well as applied models to evaluate the hydraulics of watercourse crossings are different. For consistency, Design Flows have been estimated by Visual OTTHYMO (VO) or HEC-HMS using 3-hour Chicago, 12-hour AES, and 24-hour SCS Type II Design storm and the highest value has been selected for the culvert sizing.

3.2 EXISTING DRAINAGE PATTERNS

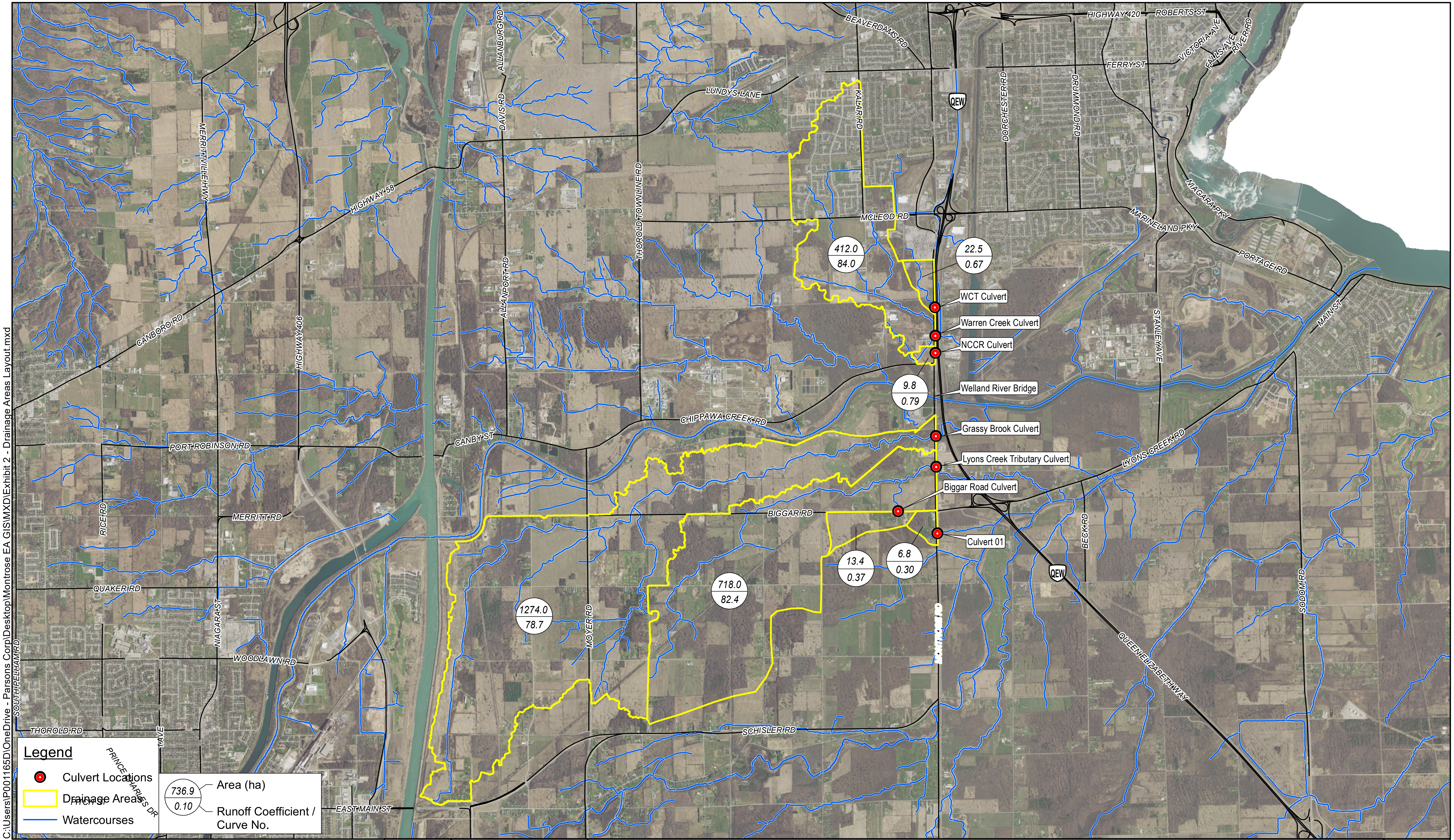
Figure 2 shows the existing drainage catchments within the Project limit. Montrose Road contains eight (8) crossings, i.e., Welland River bridge and seven (7) culverts within the study area. Drainage catchments of the culverts were delineated based on available topographic information (i.e., contours) through the GIS database. It is revealed that the overall drainage pattern is west to east, which ultimately drain to Welland River. The right-of-way (ROW) catchment for all existing culverts includes pavement, gravel shoulders and grassland. Existing roads mostly (except two segments) drain via overland flow through roadside ditches to culverts. The external drainage area for most of catchments, except the drainage area for Warren Creek, primarily includes agriculture and undifferentiated rural land along with swamp areas, golf course and woodlands. The catchment areas vary between 7 and 1274 ha.

3.2.1 Field Reconnaissaince

Parsons' Drainage team carried out a field reconnaissance of the study area on September 22, 2020. The field reconnaissance consisted of:

- Visually inspecting the existing drainage pattern, all drainage structures, and crossings,
- Noting any observable drainage deficiencies within the Project limit,
- Verifying the size and dimension of the culverts,
- Evaluating the shape and material condition of the culverts, and
- Investigating the inlet and outlet conditions (i.e., erosion issue, blockage, siltation, etc.) of the culverts.

A summary of major field observations is presented in Table 1 and Appendix A includes the photographs which were captured during field inspection.



DATE
AUGUST 2021

PROJECT NO.
477511

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Niagara Region

PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

DRAINAGE AREAS LAYOUT

EXHIBIT
2

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Table 1 Field Inspection Observations

Culvert Location/ ID	Station	Type of Structure	Dimension		Field Inspection	
			Span or Diameter. (mm)	Rise (mm)	Observations	Recommendations
Tributary of Warren Creek	11+540	Non-Rigid Frame Open Footing	1200	1500	• Dense vegetation at the outlet; • Culvert is in good condition.	• Overall, in good condition
Warren Creek Culvert (98325)	11+950	Non-Rigid Frame Open Footing	5500	2100	• Culvert is in good condition; • Dense vegetation at the outlet; • Open footing culvert with headwall at both ends; • No erosion protection measures were observed; • Road widening to the west requires Warren creek realignment.	• Overall, in good condition
North of Chippawa Creek Rd	12+195	Rigid Frame box culvert	1200	1200	• Culvert in good condition; • Vegetation at both ends; • Standing water at the outlet; • No erosion protection measures were observed.	• Overall, in good condition
South of Welland River	12+998	CSP	800		• Culvert is corroded; • Almost 50% of culvert filled with sediment; • Culvert is short at the outlet end (does not extend to the ditch).	• Replace culvert
Grassy Brook Culvert (98340)	13+394	Two cell Box Culverts	3000 2400	2100 1800	• Both cells are in good condition; • Leakage stains at the interface of precast units; • No erosion protection measures were observed; •No infiltration or infiltration stain was observed at soffits.	• Extend culverts to accommodate road widening.
Lyons Creek Tributary (98230)	13+839	Reinforced Open Footing Culvert	4300	1200	• Culvert is in fair condition with isolated light delaminations; • several patch repairs in the soffit; • Vegetation at both ends; • Rip-rap protection was observed at both ends.	• Replace culvert
Biggar Rd Culvert	4+447	HDPE	600		• Culvert is in good condition with minor damage at both ends.	• Overall, in good condition • Extend culvert to accommodate road widening.

3.3 SITE SOIL CONDITIONS

The soil map was prepared based on the Soils of the Regional Municipality of Niagara (Report No. 60). The predominant soil in the study area are Niagara and Welland soils which are imperfectly drained and moderately to slowly permeable. The groundwater levels are usually close to the surface until late spring. The soils have moderate to high water-holding capacities and surface runoff ranges from slow on level topography, to rapid on slopes. Surface horizon texture of Niagara soils ranges from clay loam to clay. Niagara soils have reddish hues and prominent brown to strong brown mottles. From a surface hydrology perspective, this soil series falls within hydrologic soil groups (HSG) “C” and “D”. Exhibit 3 in Appendix B presents the soil layout within the study area.

4 Existing Drainage Assessment

Four watercourses, (i.e., Warren Creek, Welland River, Grassy Brook and Lyon Creek Tributary) cross the Project Limit from west to east. The floodplain limits of the Welland River, Grassy Brook and Lyon Creek Tributary were determined in the following studies and are illustrated in the NPCA's online information system:

- Welland River Floodplain Mapping Update, WSP, November 2018,
- Floodline Analysis for the Grand Niagara Resort, Burnside Golf Services, October 2000,
- Flood Plain Mapping – Lyon Creek including Tee Creek, NPCA, December 2009 (revised March 2011).

Also, City of Niagara Falls and NPCA prepared the Warren Creek Master Watershed Plan in 1999 and implemented the recommendations in the report and stabilized/channelized the Creek in 2007.

These studies have developed hydrologic models and documented the hydrologic parameters for each watershed. A few subdivisions have been constructed (mainly in the Warren Creek watershed) since the development of initial models and these developments have been documented in subdivision development plans. To evaluate the existing hydrologic condition of the study area, the Visual OTTHYMO model for Grassy Brook and the HEC-HMS model for Lyons Creek were received from NPCA. The hydrologic parameters for Warren Creek were extracted from subdivisions' SWM report and coded in Visual OTTHYMO to estimate the Design Flow for culverts crossing the Montrose Road. Peak flows were estimated using 12-hour AES, 3-Hour Chicago and 24-Hour SCS Type II design storm and the maximum value was selected as the Design Flow. Welland River flow data extracted from the existing report and no modelling was performed.

The Rational Method was utilized to estimate the Design Flow for the culverts with drainage area less than 100 ha.

4.1 HYDROLOGIC ANALYSIS FOR EXISTING CONDITION

The design storm hyetograph for the existing condition was developed using the City of Niagara Falls IDF curves. These parameters were estimated by Visual OTTHYMO model which fitted a curve to rainfall depth using the following equation. **Table** 2 Summarizes the rainfall data.

$$i = \frac{a}{(t+b)^c}$$

where, i is the rainfall intensity (mm/hr), t is the storm duration (min), and a,b,c are parameters.

Table 2: Niagara Falls IDF Parameters

Return Period	IDF Parameters		
	a	b	c
2-year	514.90	6.006	0.755
5-year	711.50	6.375	0.768
10-year	848.38	6.75	0.773
25-year	1069.81	7.5	0.788
50-year	1182.16	7.5	0.787
100-year	1308.16	7.5	0.79

Design Flow for existing condition at watercourse crossings are summarized as follow:

4.1.1 Warren Creek

The Warren Creek Watershed (upstream of the Montrose Road culvert) is mainly residential and employment land use with a total drainage area of 412 ha. The Warren Creek has been modelled in Visual OTTHYMO by extracting sub-watershed parameters and existing SWM facility characteristics from the existing MIDUSS hydrologic model. A schematic of the Warren Creek hydrologic model and the Visual OTTHYMO input parameters are shown in **Appendix C**. **Table 3** presents the peak flow generated by different storm events. As shown in the Table, the highest peak flow in the Warren Creek watershed is generated by the 24-hour SCS Type II Design Storm.

Table 3: Warren Creek Estimated Peak Flow (m^3/s)

Return Period	Design Storm		
	3-Hour Chicago	12-hour AES	24-hour SCS Type II
2-year	2.738	2.416	**5.253**
5-year	3.780	4.403	**6.881**
10-year	4.502	6.352	**8.409**
25-year	6.451	8.322	**11.671**
50-year	8.519	10.203	**15.336**
100-year	10.699	11.784	**18.460**

4.1.2 Welland River

The Welland River is approximately 135 kilometres in length and drains a watershed area of approximately 990 square kilometres in size. The Welland River flows in an easterly direction from its headwaters in Ancaster to its historical physical outlet at the Niagara River. Historically, the natural flow of the Welland River discharged into the Niagara River; however, since the completion of the Sir Adam Beck Generating Station No. 1 in 1920 and the Queenston-Chippawa Power Canal in 1921, the river flows into the Power Canal. This results in a flow reversal between the confluence of the Welland River and the Power Canal and the mouth of the Welland River at the Niagara River.

The Welland River watershed is known to be one of the most complicated watersheds in Southern Ontario as it involves a large number of hydraulic structures (siphons, weirs, dams, bridges, etc.) that impact the hydrologic responses under different storm events. A significant amount of data exists for the study area, which has been collected over many decades and from many studies dating back to the 1920s when the Queenston-Chippewa Power Canal was constructed. The latest hydrology study by MMM Group (May 2017) and Floodplain Mapping study by WSP (November 2018) summarize the previous studies. The Hydrology study (MMM Group, 2017) concluded that "due to the characteristics of the watershed, the corresponding flows from the hydrological model obtained by simulating a typical 100-year design rainfall are not necessarily the same as the peak 100-year return period flows observed for the Welland River. Therefore, the design storm approach is not appropriate for the study area" and determined the 100-year flow using a synthetic rainfall/snowmelt-runoff simulation. The study estimated the 100-year flow at Montrose Road bridge to be 308.2 m^3/s.

4.1.3 Grassy Brook

Grassy Brook subwatershed (upstream of Montrose Road) is primarily agricultural in nature with a total drainage area of 1274 ha. 82 ha of the subwatershed will develop as part of Grand Niagara Secondary Plan and the remaining 1192 ha is expected to remain agricultural. A previous study in 2016 simulated the subwatershed using VisualHYMO model. The subwatershed parameters have been extracted from the report to estimate peak flow at Montrose Road using Visual OTTHYMO model. A schematic of the Grassy Brook hydrologic model and the Visual OTTHYMO input parameters are shown in **Appendix C**. **Table 4** indicates that 24-hour SCS Type II storm generates the highest flow compared to other design storms.

Table 4: Grassy Brook Estimated Peak Flow (m^3/s)

Return Period	Design Storm		
	3-Hour Chicago	12-hour AES	24-hour SCS Type II
2-year	2.72	4.728	**5.400**
5-year	4.417	7.51	**7.862**
10-year	5.758	9.57	**10.077**
25-year	7.524	12.025	**12.417**
50-year	9.122	14.299	**14.855**
100-year	10.61	16.3	**16.742**

4.1.4 Lyons Creek Tributary

Lyons Creek Tributary subwatershed (upstream of Montrose Road) drains 717.5 ha of predominantely agricultural lands with sporadic pockets of woodlands and wetlands. In the future, the 150 ha in the catchment will be developed as hospital, commercial, mixed and residential land use as part of Grand Niagara Secondary Plan. The revised HEC-HMS model developed by NPCA was used to estimate peak flow at Montrose Road culvert. The model does not include proposed potential changes as part of Grand Niagara Secondary Plan (no SWM detail is available) assuming the future developments will control stormwater quantity on site. **Table 5** summarizes estimated peak flow for different storm events. Like other subwatersheds within the Project limit, the 24-hour SCS Type II Design Storm generates the highest peak flow at the Lyons Creek Tributary subwatershed. Refer to **Appendix C** for model schematic, input parameters and detail outputs.

Table 5: Lyons Creek Tributary Estimated Peak Flow (m^3/s)

Return Period	Design Storm		
	3-Hour Chicago	12-hour AES	24-hour SCS Type II
2-year	1.996	3.098	**3.961**
5-year	3.282	4.830	**6.068**
10-year	4.324	6.154	**7.634**
25-year	5.693	7.991	**9.773**
50-year	6.866	9.447	**11.448**
100-year	7.993	10.953	**13.199**

4.1.5 Minor Drainage Areas

Five (5) subwatersheds with drainage areas smaller than 100 ha cross Montrose Road and Biggar Road within the Project limit. The Rational Method was used to estimate the peak flow for these subwatersheds assuming the subwatersheds are developed to their ultimate condition based on proposed Secondary Plans. Peak flow rates for these subwatersheds presented in **Table 6.** Refer to **Appendix D** for detail parameter calculations for each subwatershed.

Table 6: Estimated Peak Flow Rate - Minor Drainage Areas

Culvert ID	Area (ha)	Peak Flow (m^3/s)					
		2-year	5-year	10-year	25-year	50-year	100-year
Tributary of Warren Creek	22.49	1.299	1.688	1.948	2.266	2.539	2.761
North of Chippawa Creek Rd	9.82	0.735	0.958	1.102	1.283	1.438	1.564
E.S. Fox Limited Culvert	3.09	0.192	0.247	0.283	0.328	0.368	0.398
Biggar Rd Culvert	13.4	0.283	0.368	0.425	0.495	0.553	0.605
Culvert 01	6.8	0.098	0.127	0.146	0.171	0.191	0.209

4.2 EXISTING CULVERT HYDRAULICS

Hydraulic analysis for the existing culverts on watercourses were performed to evaluate the road widening impact on floodplains. The analysis for Grassy Brook and Lyons Creek Tributary were performed using approved HEC-RAS models provided by NPCA. As there is no approved HEC-RAS model for Warren Creek, HY-8 model was developed to estimate the highwater level. Floodplain study for Welland River (WSP, 2018) was conducted using Mike 11 and the results from that study are reported in **Table 7**.

Table 7: Hydraulic Analysis Summary - Existing Condition

Culvert Name	Culvert ID	Dimension Span x Rise (mxm)	Length (m)	Design Flow (m^3/s)	Water Level
Warren Creek	98325	5.5 x 2.1	23.9	15.34	175.43
Welland River	-	68.58 x 10.6	11.9	308.2*	171.58
Grassy Brook	98340	3.0 x 2.1 2.4 x 1.8	18.8	14.86	172.61
Lyons Creek Tributary	98230	4.3 x 1.2	15.3	11.45	175.26

* Design Flow for Welland River is the 100-year peak flow reported in MMM Group report,2017.

5 Proposed Drainage Assessment

5.1 PROPOSED SITE CONDITIONS

The Project limit has been identified as part of Niagara's Region Transportation Master Plan which requires capacity improvement. Roadway widening, addition of through lanes, and intersection improvements impact drainage and requires design of storm sewer systems and SWM measures. In addition, crossing culverts need to be extended to accommodate the proposed road widening/urban cross section. This section summarizes the proposed drainage and stormwater management measures.

5.1.1 Storm Sewer System

The City's Engineering Design Guidelines Manual requires storm sewer systems to be designed using the approved Rainfall Intensity Duration Frequency Curve (IDF) for Niagara Falls. However, the Region of Niagara asked Parsons to consider climate change impacts in the design.

There are a couple of tools available that provide projected rainfall for different climate change scenarios for different time horizons. These tools include IDF-CC tool developed by University of Western Ontario and MTO's IDF Curve Look-up Tool. IDF-CC Tool provides projected rainfall for three climate change scenario (RCP 2.6, RCP 4.5, and RCP 8.5) using ensemble of Global Circulation Models (GCMs) and Bias Correction Method for downscaling; The tool has its own limitations but provides more reasonable projected rainfall compared to MTO'S IDF Curve Look-up Tool for short duration storms (less than 1-hour). Considering the capabilities and limitations of these two tools, it was decided to design the proposed storm sewers using IDF-CC Tool to estimate projected rainfall for the worst climate change scenario (RCP 8.5) for the year 2070 (Design Service Life of the Project). The tool projected 10% increase for 5-year rainfall at Niagara Falls station under RCP8.5 scenario by 2070. Refer to Appendix E for Niagara Falls IDF curves in the context of climate change.

The proposed drainage system will follow the existing drainage pattern and outlet to the existing watercourses. Storm sewers are designed based on the City of Niagara Falls and Region of Niagara design criteria to collect and convey 5-year storm without any surcharging considering climate change impact. Preliminary storm sewer design sheets are presented in Appendix F.

5.1.2 Culvert Design

Under post-development conditions, Montrose Road, Biggar Road and Lyons Creek Road will be widened to a 30 to 36 metres road with urban cross sections. Proposed road widening requires longer culverts to safely convey the flow.

As mentioned in Section 2.1.2, the effect of climate change shall be considered in designing drainage infrastructure. The rainfall intensity for the Design Service Life of culverts (Year 2070) is recommended to be obtained from MTO's Intensity Duration Frequency (IDF) Curve Look-up Tool. The tool projected 6.3% rainfall increase compared to the existing condition for the Project Limit. Using available hydrologic models, Design Flow for watercourses was estimated using 24-hour SCS Type II design storm. In addition, Design Flow for minor drainage areas (smaller than 100 ha) was calculated using Rational Method. Table 8 presents design flow for all subwatersheds in the context of climate change. Model outputs and Projected IDF curve details are provided in Appendix E.

Table 8: Projected Design Flow (50-year) Considering Climate Change Impact

Culvert ID	Drainage Area (ha)	Design Flow (m^3/s)
Tributary of Warren Creek	22.49	2.626
Warren Creek	412	17.460
North of Chippawa Creek Rd	9.82	1.438
E.S. Fox Limited Culvert	3.09	0.379
Grassy Brook	1274	16.106
Lyons Creek Tributary	717.5	12.671
Biggar Rd Culvert	13.4	0.575
Culvert 01	6.8	0.198

Existing culverts are proposed to be extended considering their existing condition and hydraulic capacity. All existing rigid frame box (RFB) culverts except the Lyons Creek Tributary culvert are in good condition (See **Table 1** and **Appendix A** for the field investigation summary) and meet the hydraulic requirements. Lyons Creek Tributary culvert is proposed to be replaced with twin 3000 x 1500mm box culverts. The culvert is designed with a low flow channel to address fish passage concerns as the watercourse is identified as an important fish habitat by NPCA.

In addition to RFB culverts, an existing 800 mm CSP pipe culvert in front of E.S. Fox Limited is corroded and proposed to be replaced with a same size culvert. Also, an existing 600mm at Biggar Road does not meet the minimum required highwater (HW/D) criteria and recommended to be replaced with an 800 mm culvert. The proposed culvert sizes are summarized in **Table 9**.

Table 9: Proposed Culverts Sizing Summary

Culvert ID	Type	Dimension Span x Rise mm	Proposed Length (m)	Embedment (mm)	Proposed Action
Tributary of Warren Creek	Open Footing-RFB	1200 x 1500	44.6	-	Extend
Warren Creek	Open Footing-RFB	5500 x 2100	43.6	-	Extend
North of Chippawa Creek Rd	Open Footing-RFB	1200 x 1200	42.8	-	Extend
E.S. Fox Limited Culvert	CSP/HDPE	Φ 800	39.9	-	Replace
Grassy Brook	Box	3000 x 2100 2400 x 1800	41.4	300	Extend
Lyons Creek Tributary	Box	3000 x 1500 3000 x 1500	45.1	300	Replace
Biggar Rd Culvert	CSP/HDPE	Φ 800	35.0	200	Replace
Culvert 01	HDPE	Φ 450	23.0	-	Extend

Hydraulic performance of proposed culverts was evaluated using HEC-RAS and HY-8 models. A summary of hydraulic analysis for proposed culvert provided in **Table 10**. All proposed culverts are designed to meet the maximum flood depth (HW/D <1.5) and freeboard criteria. Freeboard is estimated to be greater than 1.0 metre for culverts on watercourses and greater than 0.3 m for culverts not on a watercourse. Detailed hydraulic analysis outputs provided in **Appendix H**.

Table 10: Hydraulic Performance of Proposed Culverts

Culvert ID	Dimension Span x Rise mm	U/S Invert	D/S Invert	Road Elevation	High Water Elevation	Hw/D	Freeboard (m)	Meet Criteria (Y/N)
Tributary of Warren Creek	1200 x 1500	176.41*	176.35*	178.61	177.79	1.15	0.82	Y
Warren Creek	5500 x 2100	173.91	173.80	176.94	175.61	0.81	1.34	Y
North of Chippawa Creek Rd	1200 x 1200	176.05*	175.95*	177.86	176.96	0.76	0.90	Y
E.S. Fox Limited Culvert	Φ 800	174.15*	174.05*	175.74	174.82	0.84	0.92	Y
Grassy Brook	3000 x 2100 2400 x 1800	170.80 171.21	170.70 170.92	175.08	172.70 172.70	0.90 0.83	2.38	Y
Lyons Creek Tributary	3000 x 1500 3000 x 1500	173.54	173.53	176.29	175.16	0.88	1.13	Y
Biggar Rd Culvert	Φ 800	178.25	178.11	179.80	179.24	0.79	0.56	Y
Culvert 01	Φ 450	178.00	177.95	179.09	178.6	1.33	0.49	Y

* Cover was measured visually, and invert was estimated based on the existing road profile. Inverts shall be confirmed during detail design.

5.1.3 Floodplain Analysis

Hydraulic analysis has been carried out for Regulatory Flow to evaluate the road widening impact on existing floodplain. As discussed previously, culverts on Warren Creek and Grassy Brook are proposed to be extended and new twin culverts are proposed at Lyons Creek Tributary. The Regulatory Flow within NPCA jurisdiction is a 100-year storm and the flow was calculated using approved Visual OTTHYMO and HEC-HMS models. **Table 11** compares the highwater level resulted from the Regulatory Flow for the existing and proposed condition. Results of the analysis revealed that the water level slightly (0.02m) increases upstream of Warren Creek culvert and it decreases by 0.45 m upstream of the proposed Lyons Creek Tributary. The difference in water surface elevations between the existing and the proposed conditions are negligible, therefore no constraints are expected.

Table 11: Floodplain Analysis - Watercourse crossing the Project Limit

Culvert ID	Regulatory Flow (m^3/s)	High water Elevation Upstream of Montrose Road		
		Existing	Proposed	Change (m)
Warren Creek	18.460	175.63	175.61	0.02
Grassy Brook	16.742	172.74	172.74	0.00
Lyons Creek Tributary	13.199	175.65	175.20	-0.45

Montrose Road Bridge over the Welland River is a four span, 68.58 m long structure. The bridge was constructed in 1969 with soffit elevation of 174.94 and top of deck elevation of 177.42 m. The 100-year water level in the River is estimated at 171.58 m for the most conservative scenario (2.82 m below soffit). The bridge is proposed to be widened to the west with the same pier configuration therefore no change in Welland River floodplain is expected.

5.1.4 Impact on MTO

As the result of proposed road improvements at the QEW, segments of the QEW ramps within the MTO ROW are proposed to be reconfigured. These modification impacts the existing drainage system on Lyons Creek Road within the MTO ROW. To accommodate the new configuration, storm sewers are proposed to collect the pavement drainage and outlet to the existing ditches south and north of Lyons Creek Road. Overall drainage patterns and flow rates within this area will not be impacted by proposed changes.

As later presented in **Section 6.2.1,** the peak flow at receiving watercourse does not increase. Therefore, proposed road improvement has no impact on centreline culverts within MTO ROW. Generally, the peak flow from the roadway discharges to the receiving watercourses much earlier than the peak flow from upstream watersheds reach the Project limit and no change in peak flow is expected.

5.1.5 Warren Creek Realignment

Warren Creek runs on the west side of to Montrose Road for approximately 425 m before crossing the road and QEW. Considering the limited ROW east of Montrose Road, the road will be widened to the west. It is expected that the Warren Creek realignment will be required to accommodate the proposed road. In the event that creek realignment is required, a fluvial assessment shall be undertaken during detail design.

6 Stormwater Management Plan

Typical SWM alternatives for roadway construction projects should address the water quality impacts associated with the modified land use as well as any quantity control requirements as deemed necessary based on the receiving water bodies and local site constraints and considerations. The site-specific SWM requirements are based on the issues of concern associated with each watercourse and its natural and hydrologic features, as discussed in **Section 2.2** of this report.

SWM techniques that are consistent with transportation type construction projects are defined in **Table 12**, with notation of their typical effectiveness in addressing the various stormwater management issues.

Table 12: Stormwater Management Practices Effectiveness (Adapted form MOE, 2003)

SWMP	Water Balance	Water Quality	Erosion	Water Quantity
Pervious Pipes	1	1	2	3
Pervious Catch Basins	1	2	2	3
Wet Pond	3	1	1	1
Dry Pond	3	2	1	1
Wetland	3	1	1	1
Sand Filter	3	1	3	3
Infiltration Trench	1	1	2	3
Infiltration Basin	2	1	2	3
Vegetated Filter Strip	1	2	2	3
Buffer Strip	2	2	2	3
Grassed Swales	1	2	2	3
Oil/Grit Separator	3	2	3	3
Key:	1 High Sustainability 2 Medium Sustainability 3 Low Sustainability			

Alternative techniques must be consistent with the physical constraints including the property limits, topography, soil characteristics and flooding constraints, and should require minimal maintenance. It is also important to consider the existing system's capacity to provide SWM given the fully established vegetation. Physical constraints which limit the application of certain SWM facilities are summarized in **Table 13**.

Low Impact Development (LID) practices are sustainable SWM strategy that emphasizes conservation and use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns. LIDs are practical SWM strategy in residential, commercial, and industrial settings, but have significant limitations for transportation projects with high traffic. In addition, clay soil usually implies high water level and low infiltration rate that further challenges the application of LID practices.

Table 13: Physical Constraints for SWM Types (Adapted from MOE, 2003)

SWMP	Topography	Soils	Bedrock	Groundwater	Area
Pervious Pipes	None	Loam (min inf. Rate ≥ 15 mm/hr)	> 1.0 m below bottom	> 1.0 m below bottom	None
Pervious Catch Basins	N/A	N/A	N/A	N/A	N/A
Wet Pond	None	None	None	None	> 5 ha
Dry Pond	None	None	None	None	> 5 ha
Wetland	None	None	None	None	> 5 ha
Sand Filter	None	None	None	> 0.5 m below bottom	> 5 ha
Infiltration Trench	None	Loam (min inf. Rate ≥ 15 mm/hr)	> 1.0 m below bottom	> 1.0 m below bottom	> 2 ha
Infiltration Basin	None	Loam (min inf. Rate ≥ 60 mm/hr)	> 1.0 m below bottom	> 1.0 m below bottom	> 5 ha
Vegetated Filter Strip	< 10%	None	None	> 0.5 m below bottom	> 2 ha
Buffer Strip	N/A	N/A	N/A	N/A	N/A
Grassed Swales	<5%	None	None	None	> 2 ha
Oil/Grit Separator	None	None	None	None	> 2 ha

Road salt and TSS was identified as a pollutant of concern at the outset of this study. There is no particular guideline with regard to the management of road salt within the roadway drainage system, except to reduce its application where possible, prevent excessive infiltration of salt water from snow disposal areas and maximize the potential for dilution of stormwater discharges prior to discharge to the receiving water body.

6.1 SCREENING OF ALTERNATIVE STORMWATER MANAGEMENT FACILITIES

As indicated in **Table 12** and **Table 13**, larger catchments, where there is a significant portion of impervious area contributing to a ROW outlet, or where there is an unacceptable increase in flows, are better served by end-of-pipe storage facilities. Therefore, those sites where the new contributing roadway pavement area is in excess of 0.5 ha, or where there is an unacceptable increase in ROW discharge, are identified.

Factors considered in the evaluation of stormwater management needs included:

- Sensitivity of receiving watercourse to increased flows,
- Sensitivity of receiving watercourse to typical stormwater pollutants,
- Distance from ROW outlet to receiving watercourse,
- Physical constraints (grading, etc.), and
- Potential to isolate/consolidate roadway drainage.

On the basis of these factors, the feasibility (and necessity) of end-of-pipe stormwater management facilities was assessed for each ROW outlet location where the contributing roadway pavement surface is greater than 0.5 ha. A common physical constraint to the development of wet pond facilities within the study area is that the local roadway drainage typically enters the receiving watercourse and there is limited ROW close to the outlets. In most cases it is not feasible to isolate a sufficient local catchment area (at least 5.0 ha) before outleting to the receiving watercourse for treatment in a wet pond. In these cases, it has been considered beneficial to maintain the dispersed outlet conditions and provide Oil/Grit Separator or typical grassed ditch if possible. In areas where the receiving watercourse is particularly sensitive to stormwater discharge, Oil/Grit Separators (OGS) are proposed to provide treatment before outleting to the watercourse.

6.2 PROPOSED SWM STRATEGY

6.2.1 Stormwater Quantity Control

The proposed work increases the impervious area which is considered negligible compared to the total subwatershed area (**Table 14**). The VO and HEC-HMS models were revised for Warren Creek, Grassy Brook and Lyons Creek Tributary to reflect the future road widening conditions in these watersheds. The model results are shown in **Table 15**. Although the increase in the proposed impervious land surface will increase the runoff volume, the peak flow rate in the receiving watercourses will not increase. This is primarily due to the time of concentration effect. In fact, majority of the watershed is located upstream of the study area with longer time of concentration. Thus, the peak flow at the Montrose Road crossings occurs well after the peak intensity of the storm. Following road improvements, the increase in impervious area results in local increase in peak flow which are discharged to the watercourses earlier compared to the pre-development condition, considerably ahead of the time of peak flows in the receiving watercourses. As such, the peak flow will not increase compared to existing condition and stormwater quantity control is not considered necessary for the Project.

Table 14: Summary of Existing and Proposed Impervious Area

Watershed ID	Subwatershed ID	Subwatershed Area (ha)	Subwatershed Impervious Area (%)	
			Existing	Proposed
Warren Creek	1400	26.51	85	90
Grassy Brook	407	16.7	13.65	22.0
Lyons Creek Tributary	Tri1_10	172.68	6.85	9.28

Table 15: Comparison of Flow Rates (m^3/s)

Watershed ID	Condition	Estimated Peak flow (24-Hour SCS Type II Design Storm)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Warren Creek	Existing	5.253	6.881	8.409	11.671	15.336	18.460
	Proposed	5.464	7.170	8.596	11.638	15.300	18.418
Grassy Brook	Existing	5.4	7.862	10.077	12.417	14.855	16.742
	Proposed	5.402	7.864	10.079	12.420	14.858	16.746
Lyons Creek Tributary	Existing	3.961	6.068	7.634	9.773	11.448	13.199
	Proposed	3.966	6.074	7.639	9.779	11.454	13.205

6.2.2 Stormwater Quality Control

"Enhanced" level (Level I) of water quality treatment (80% TSS reduction) will be required within the Project limit for all developments draining to Warren Creek, Grassy Brook, Lyons Creek Tributary and associated section of Welland River and "Normal" level (Level II) of water quality treatment (70% TSS reduction) will be required for all other outlets.

The proposed option involves application of OGS system and roadside ditches to provide the required quality control. The surface runoff from the proposed ROW will be captured by catchbasins and directed toward the OGS to achieve the required TSS removal. From the OGS the flow will be directed toward a roadside ditch where feasible before draining to a watercourse. Runoff from a section of the Montrose Road north of Welland River proposed to outlet to the roadside ditches to achieve required quality control.

PCSWM Stormceptor EF tool developed by Forterra was utilized to size proposed OGSs based on treating a minimum of 90 percent of the average annual runoff volume. Sizing was determined using historical rainfall data from St. Catherine Station. **Table 16** presents selected stormwater quality control results. Refer to **Appendix I** for detail OGS sizing reports.

Table 16: Proposed Stormwater Quality Controls

Outlet Location		Area (ha)	Percent Impervious (%)	Proposed quality control	Required TSS Removal (%)	Provided TSS Removal (%)
Road	Station					
Biggar Road	4+440	0.585	77	Stormceptor EF4	70	79
Biggar Road	4+450	0.71	77	Stormceptor EF4	70	77
Lyons Creek Road	5+370	0.66	67	Enhanced Swale	70	-
Montrose Road	13+380	0.59	87	Stormceptor EF6	80	84
Montrose Road	13+415	0.45	87	Stormceptor EF4	80	80
Montrose Road	13+825	0.8	87	Stormceptor EF6	80	82
Montrose Road	13+925	3.65	85	Stormceptor EF12	80	82

6.2.3 Water Balance

Pervious pipes, pervious catch basins, infiltration trenches, vegetated filter strip and grassed swales are the best means of achieving water balance objectives; however, the proposed urban cross section and local soil type provides limited water balance options. Grassed swales with rock check dams where feasible, are proposed to provide a temporary storage and enhance infiltration. These measures are proposed at the east limit of project and north of Welland River, where catch basins outlet directly to ditches.

6.2.4 Erosion Protection

The watercourses within the Project limit except Welland River flow in a shallow channel. No steep banks or sign of significant erosion could be observed in the Project area. The gentle topography and clayey soils restrict the amount of erosion. Erosion is not considered to be significant constraint within the Project limit; however, the following erosion and sediment control measures are recommended:

- Riprap protections are proposed at all storm sewer outlets as well as culverts' inlet and outlet,
- Silt fences will be installed along the Project limit during construction to collect sediment in the overland flows, and

- Disturbed areas are recommended to be re-vegetated as soon as possible after the construction works have been completed.

7 Conclusions

This report has provided an overview of drainage and SWM plan for the proposed Montrose Road and Lyons Creek Road/Biggar Road within the Project limit. The key points discussed in the report are:

- Storm sewers designed in conformance with the City of Niagara Falls and Region of Niagara design criteria,
- Climate change impact has been considered in the sewers design through application of projected rainfall for design service life of the Project (Year 2070),
- Culverts designed in conformance with MTO design criteria to safely convey external flow draining toward the site,
- Floodplain analysis conducted in conformance with the NPCA guidelines and no significant change in floodplain is expected,
- Impact of proposed road improvement evaluated on MTO ROW and no negative impact on MTO ROW is expected,
- SWM plan provided in conformance with NPCA guidelines,
- Impact of proposed road improvement on peak flow was evaluated and stormwater quantity control is not considered necessary for the Project limit, and
- Stormwater quality control alternatives screened and the best options considering the site characteristic areprovided.

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APPENDIX A

CULVERT INSPECTION – SITE VISIT PHOTOS

Structure ID:	Warren Creek Tributary		**Major Watercourse**	--
Nearest Road:	Montrose Road		**Minor Watercourse**	Tributary of Warren Creek
Road Classification:	Arterial Road		**Watershed Name**	Warren Creek
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°03' 29.26" N	
Longitude	79°07' 22.90" W	
Image Date	2018	

						Elevation(m)
Characteristics					Road Elevation	178.61
Shape	Rectangular				Soffit	-
Material	Concrete				Upstream Invert	176.41*
Footing	Open Footing				Downstream Invert	176.35*
Barrel No	1					
Length (m)	26.9					
Span (m)	1.2					
Rise (m)	1.5					

* Inverts are estimated based on existing road profile. Inverts shall be confirmed during detail design.

Upstream Photo

Downstream Photo

Structure ID:	Warren Creek	**Major Watercourse**	--
Nearest Road:	Montrose Road	**Minor Watercourse**	Warren Creek
Road Classification:	Arterial Road	**Watershed Name**	Warren Creek
Nearest City/Town:	Niagara Falls	**Tertiary Watershed**	
Inspection Date:	22-Sep-20		

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°03' 15.95" N	
Longitude	79°07' 22.60" W	
Image Date	2018	

Characteristics			
Shape	Rectangular		
Material	Concrete		
Footing	Open Footing		
Barrel No	1		
Length (m)	23.9		
Span (m)	5.5		
Rise (m)	2.1		

	Elevation(m)
Road Elevation	176.94
Soffit	-
Upstream Invert	173.86
Downstream Invert	173.8

Upstream Photo

Downstream Photo

Structure ID:	North of Chippawa Creek Rd		**Major Watercourse**	Chippawa Canal
Nearest Road:	Montrose Road		**Minor Watercourse**	no name
Road Classification:	Arterial Road		**Watershed Name**	-
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°03' 07.95" N	
Longitude	79°07' 22.79" W	
Image Date	2018	

Characteristics			
Shape	Rectangular		
Material	Concrete		
Footing	Open Footing		
Barrel No	1		
Length (m)	25.4		
Span (m)	1.2		
Rise (m)	1.2		

	Elevation(m)
Road Elevation	177.86
Soffit	-
Upstream Invert	176.05*
Downstream Invert	175.95*

* Inverts are estimated based on existing road profile. Inverts shall be confirmed during detail design.

Upstream Photo

Downstream Photo

Structure ID:	Welland River		**Major Watercourse**	Welland River
Nearest Road:	Montrose Road		**Minor Watercourse**	-
Road Classification:	Arterial Road		**Watershed Name**	Welland River
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Bridge

Location	**Key Map**
Latitude	43°02' 46.37" N
Longitude	79°07' 23.61" W
Image Date	2018

Characteristics					Elevation(m)
Shape	Flat Soffit			Road Elevation	177.42
Material	Concrete			Soffit	174.94
Footing	Open Footing			Upstream Invert	165.3
Barrel No	1			Downstream Invert	165.09
Length (m)	11.9				
Span (m)	68.0				
Rise (m)	9.64				

Upstream Photo

Downstream Photo

Structure ID:	Fox Limited Culvert		**Major Watercourse**	-
Nearest Road:	Montrose Road		**Minor Watercourse**	-
Road Classification:	Arterial Road		**Watershed Name**	Welland River
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°02' 41.98" N	
Longitude	79°07' 22.96" W	
Image Date	2018	

Characteristics						Elevation(m)
Shape	Circular				Road Elevation	175.74
Material	CSP				Soffit	-
Footing	Open Footing				Upstream Invert	174.15*
Barrel No	1				Downstream Invert	174.05*
Length (m)	17.9					
Span (m)	-					
Diameter (mm)	800					

* Inverts are estimated based on existing road profile. Inverts shall be confirmed during detail design.

Upstream Photo

Downstream Photo

Structure ID:	Grassy Brook		**Major Watercourse**	Grassy Brook
Nearest Road:	Montrose Road		**Minor Watercourse**	-
Road Classification:	Arterial Road		**Watershed Name**	Grassy Brook
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°02' 29.17" N	
Longitude	79°07' 23.36" W	
Image Date	2018	

Characteristics				Elevation(m)
Shape	Rectangular		Road Elevation	175.08
Material	Concrete		Soffit	-
Footing	Box		Upstream Invert	170.78, 171.11
Barrel No	1	2	Downstream Invert	170.74, 170.98
Length (m)	18.8	18.8		
Span (m)	3.0	2.4		
Rise (m)	2.1	1.8		


Upstream Photo


Downstream Photo

Structure ID:	Lyons Creek Tributary	**Major Watercourse**	-
Nearest Road:	Montrose Road	**Minor Watercourse**	Lyons Creek Tributary
Road Classification:	Arterial Road	**Watershed Name**	Lyons Creek
Nearest City/Town:	Niagara Falls	**Tertiary Watershed**	
Inspection Date:	22-Sep-20		

Crossing Type:	Culvert

Location	
Latitude	43°02' 14.73" N
Longitude	79°07' 22.54" W
Image Date	2018

Key Map

Characteristics			
Shape	Rectangular		
Material	Concrete		
Footing	Open Footing		
Barrel No	1	2	
Length (m)	15.3		
Span (m)	4.3		
Rise (m)	1.4		

	Elevation(m)
Road Elevation	176.29
Soffit	-
Upstream Invert	173.845
Downstream Invert	173.838

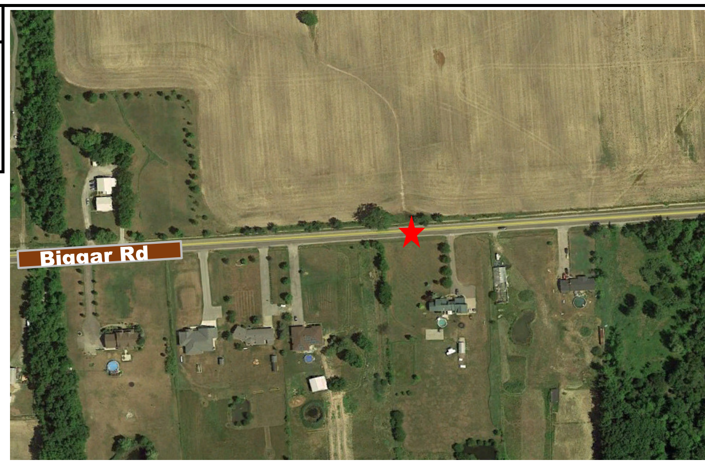

Upstream Photo


Downstream Photo

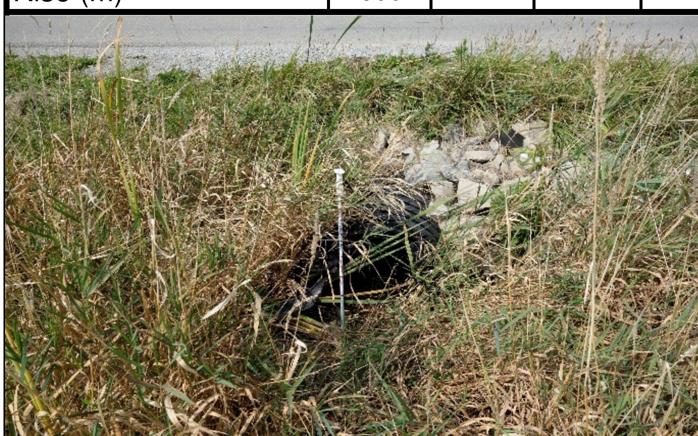
Structure ID:	Biggar Road Culvert		**Major Watercourse**	-
Nearest Road:	Biggar Road		**Minor Watercourse**	-
Road Classification:	Arterial Road		**Watershed Name**	Lyons Creek
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	22-Sep-20			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°01' 54.09" N	
Longitude	79°07' 46.67" W	
Image Date	2018	



Characteristics					Elevation(m)
Shape	Circular			Road Elevation	176.29
Material	HDPE			Soffit	-
Footing	-			Upstream Invert	173.845
Barrel No	1			Downstream Invert	173.838
Length (m)	13.9				
Span (m)	-				
Rise (m)	600				



Upstream Photo

Downstream Photo

Structure ID:	Culvert 01		**Major Watercourse**	-
Nearest Road:	Montrose Rd		**Minor Watercourse**	-
Road Classification:	Arterial Road		**Watershed Name**	Lyons Creek
Nearest City/Town:	Niagara Falls		**Tertiary Watershed**	
Inspection Date:	21-Apr-21			

Crossing Type:	Culvert

Location		**Key Map**
Latitude	43°01' 43.77" N	
Longitude	79°07' 21.91" W	
Image Date	2018	

Characteristics					Elevation(m)
Shape	Circular			Road Elevation	179.09
Material	HDPE			Soffit	-
Footing	-			Upstream Invert	177.97
Barrel No	1			Downstream Invert	177.96
Length (m)	15.4				
Span (m)	-				
Rise (m)	450				

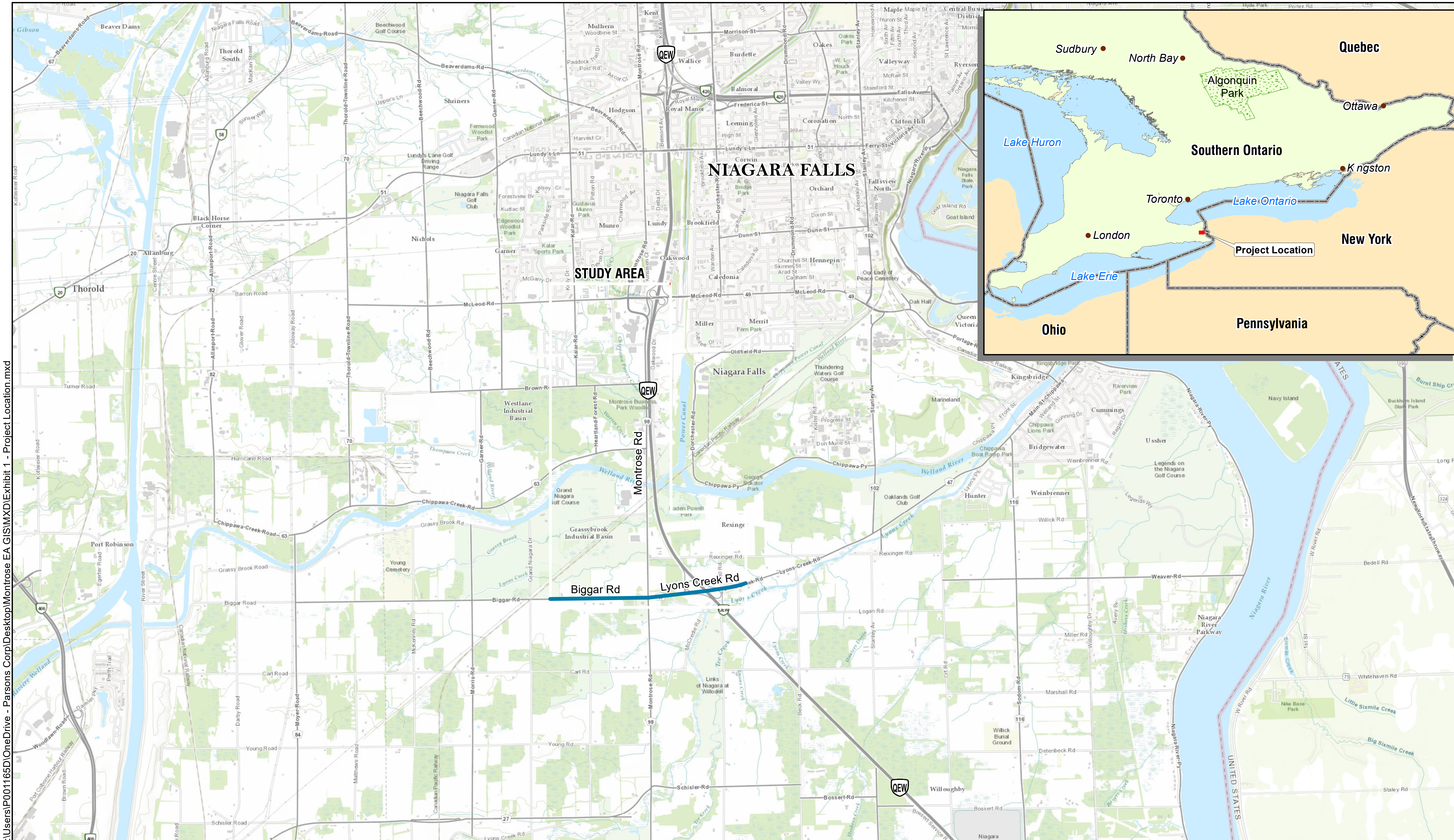
Upstream Photo

Downstream Photo

PARSONS

APPENDIX B

EXHIBITS



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DATE
AUGUST 2021

PROJECT NO.
477511

0 1 2 3 Kilometers

1:50 000

Niagara Region

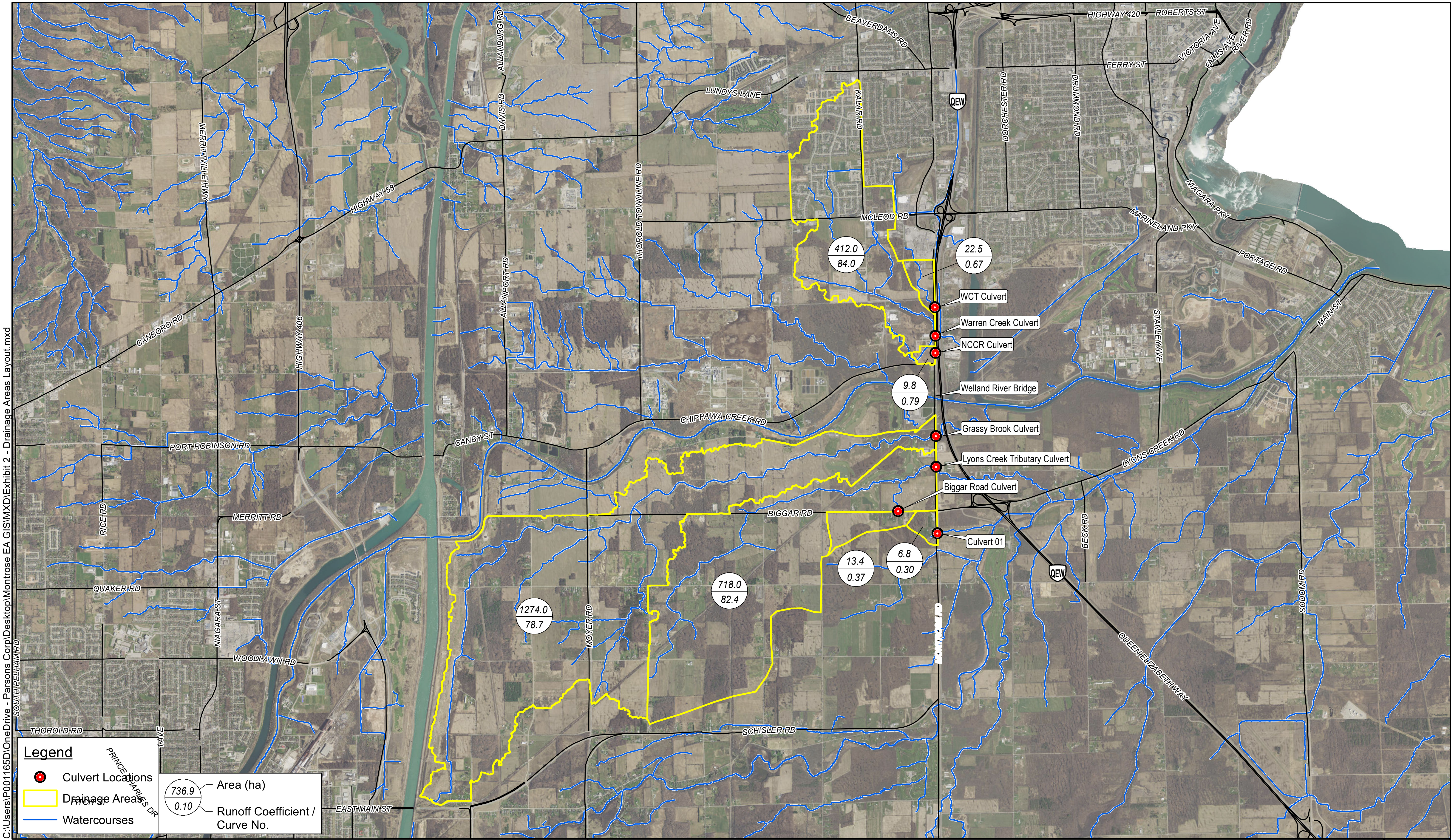
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

STUDY AREA LOCATION

EXHIBIT 1



DATE
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PROJECT NO.
477511

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Niagara Region

PARSONS

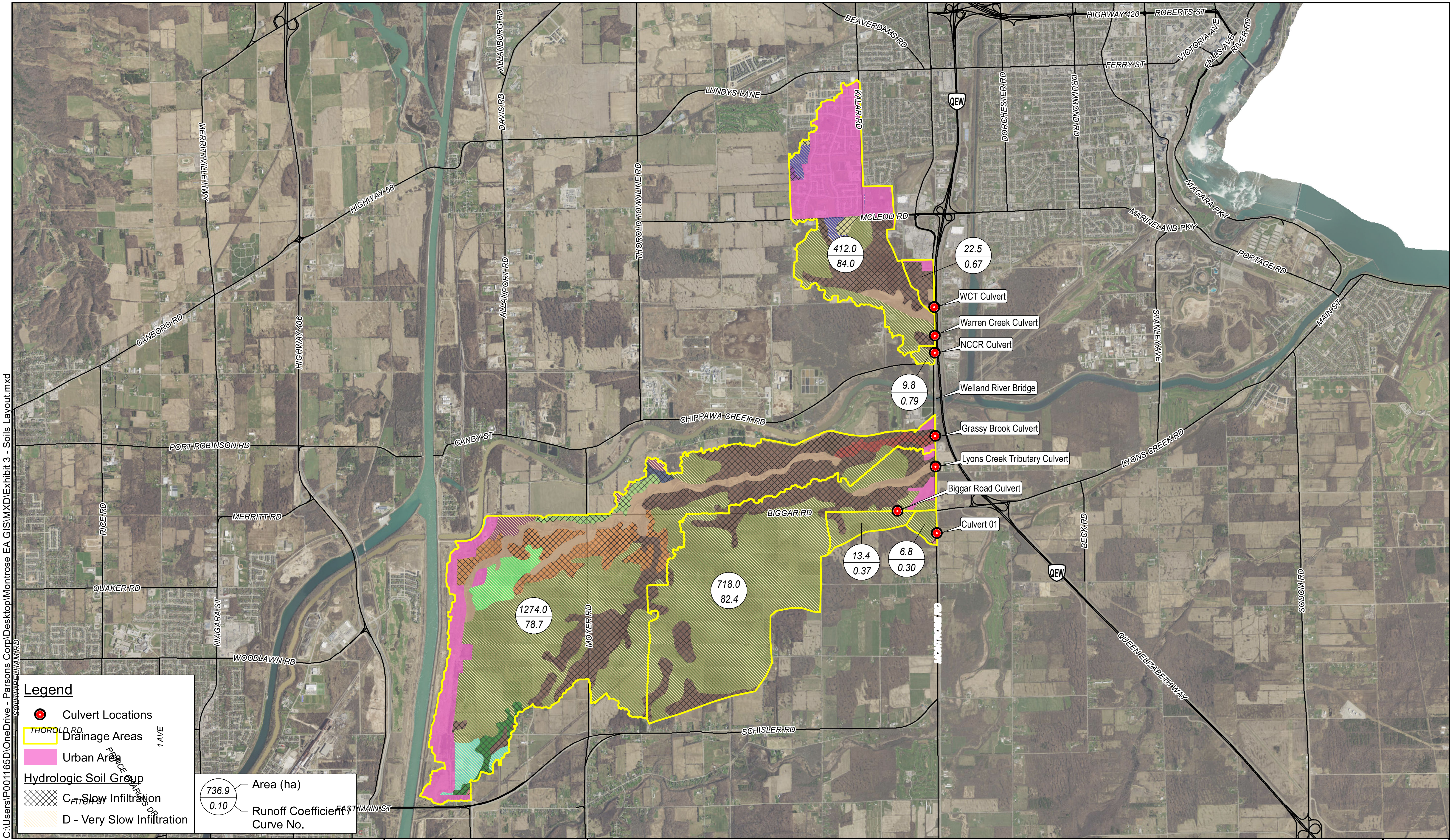
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

DRAINAGE AREAS LAYOUT

EXHIBIT

2



DATE
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PROJECT NO.
477511

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Niagara Region

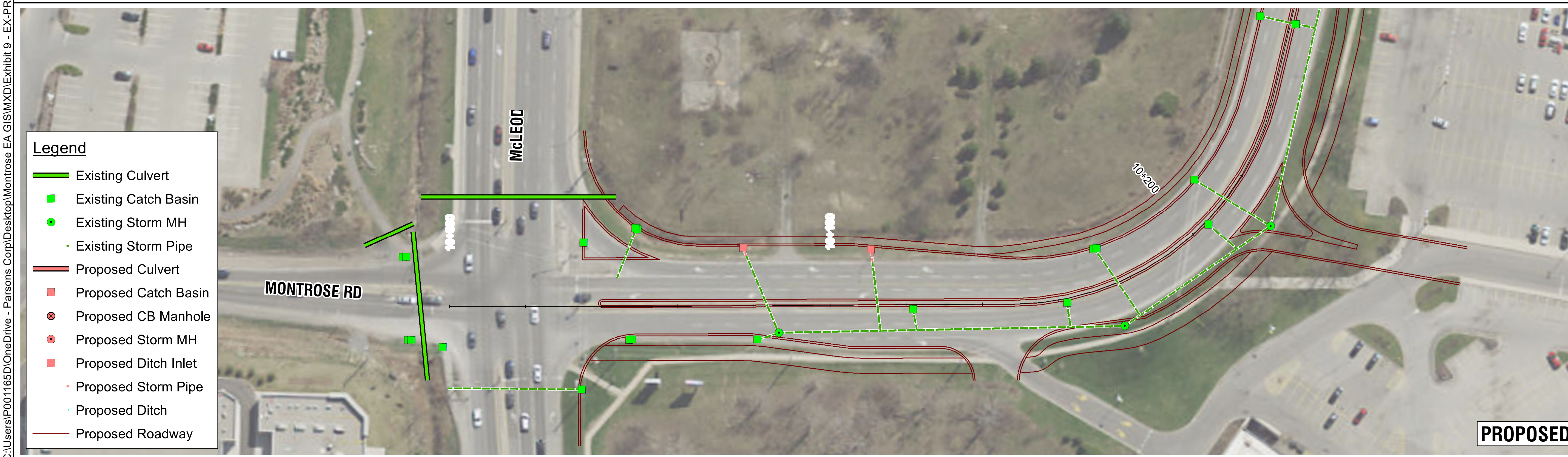
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

SOILS LAYOUT

EXHIBIT
3



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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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Niagara Region

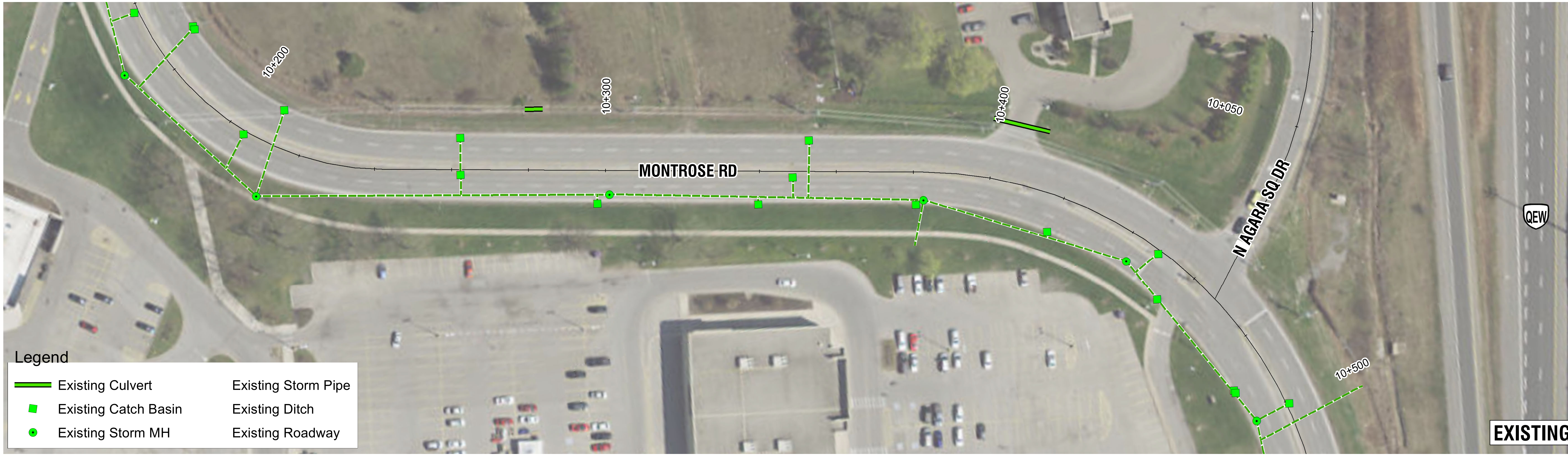
PARSONS

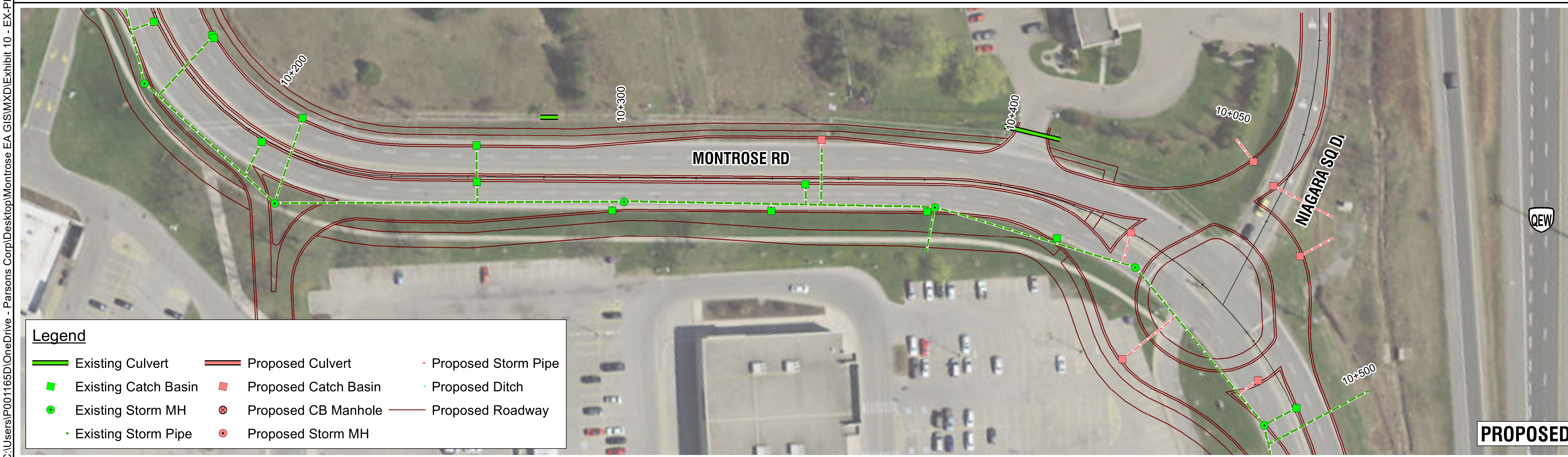
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 1 of 19)

EXHIBIT
9





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SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

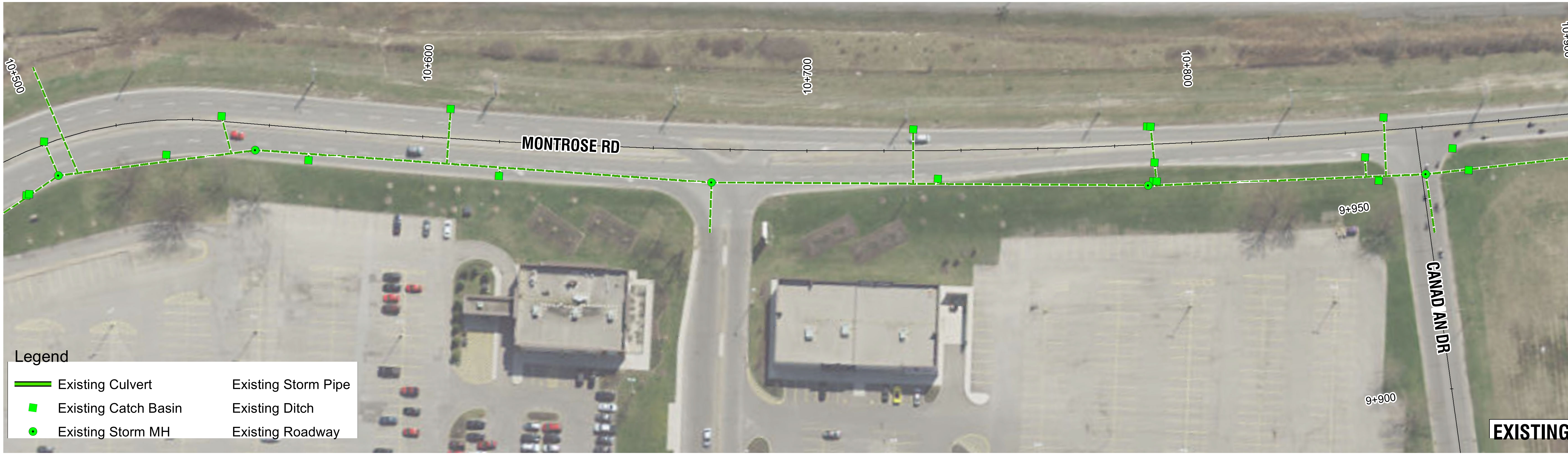
PARSONS

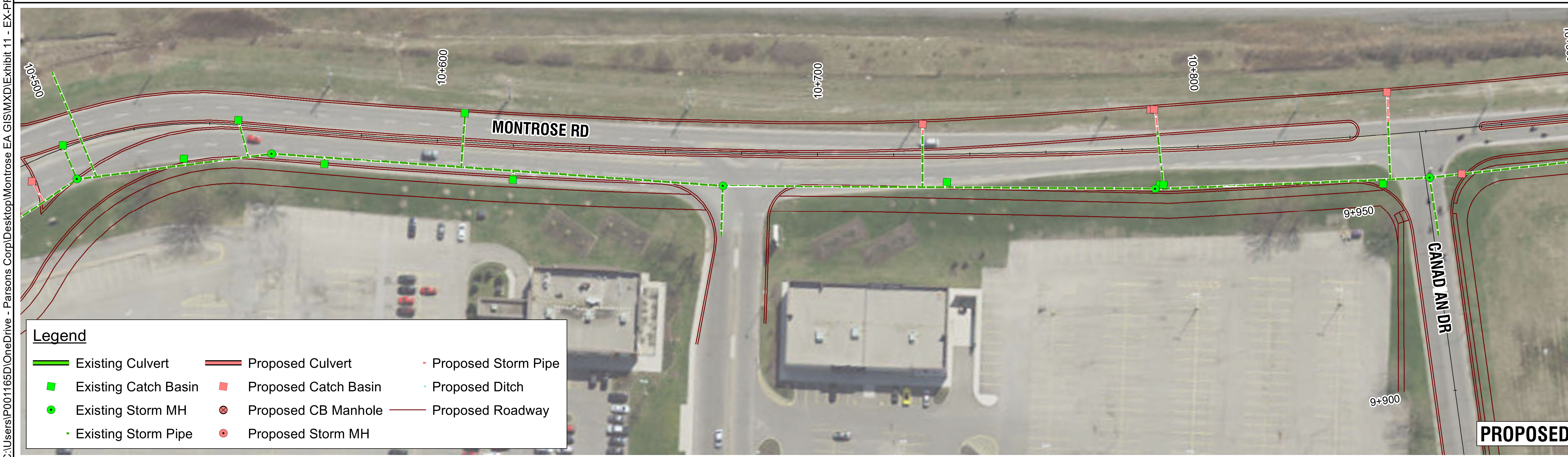
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 2 of 19)

EXHIBIT
10





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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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Niagara Region

PARSONS

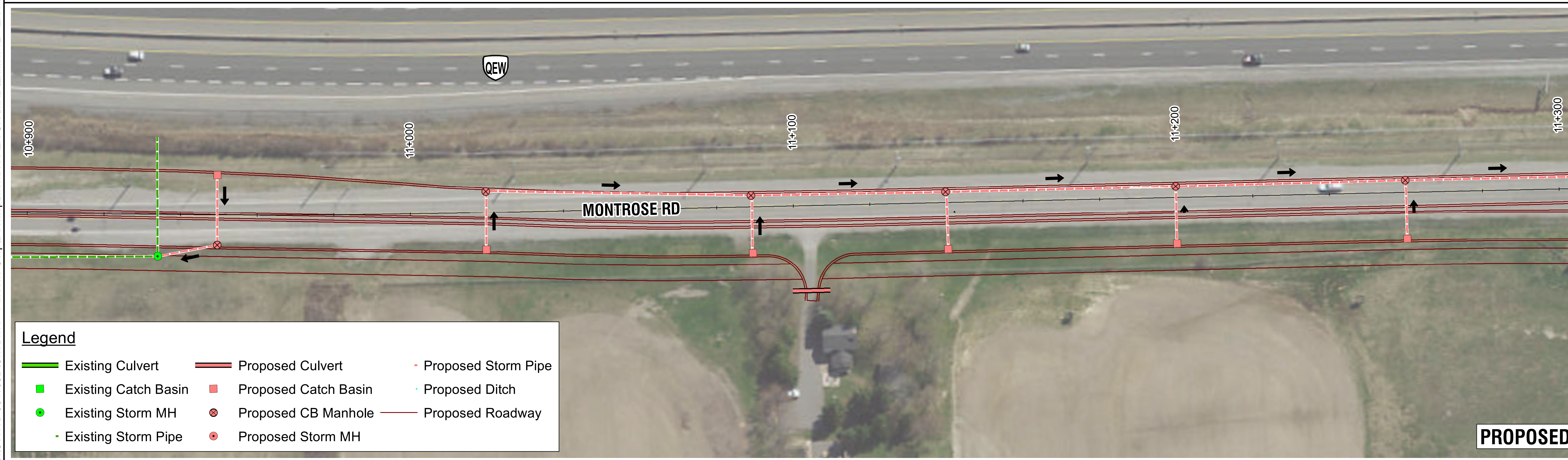
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 3 of 19)

EXHIBIT

11



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PROJECT NO.
477511

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Niagara Region

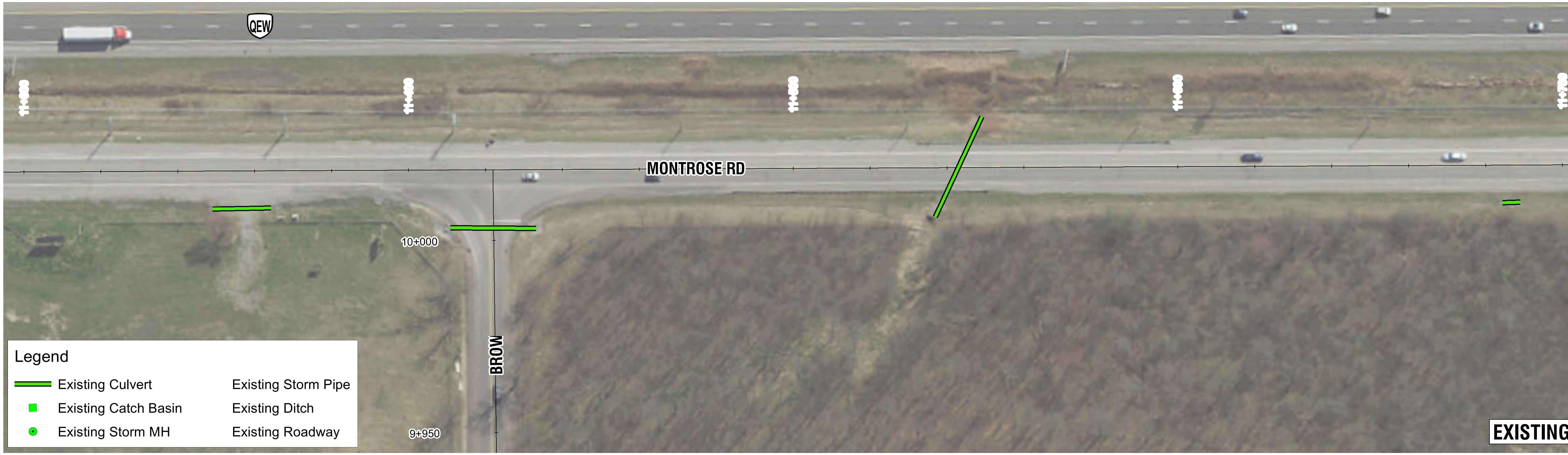
PARSONS

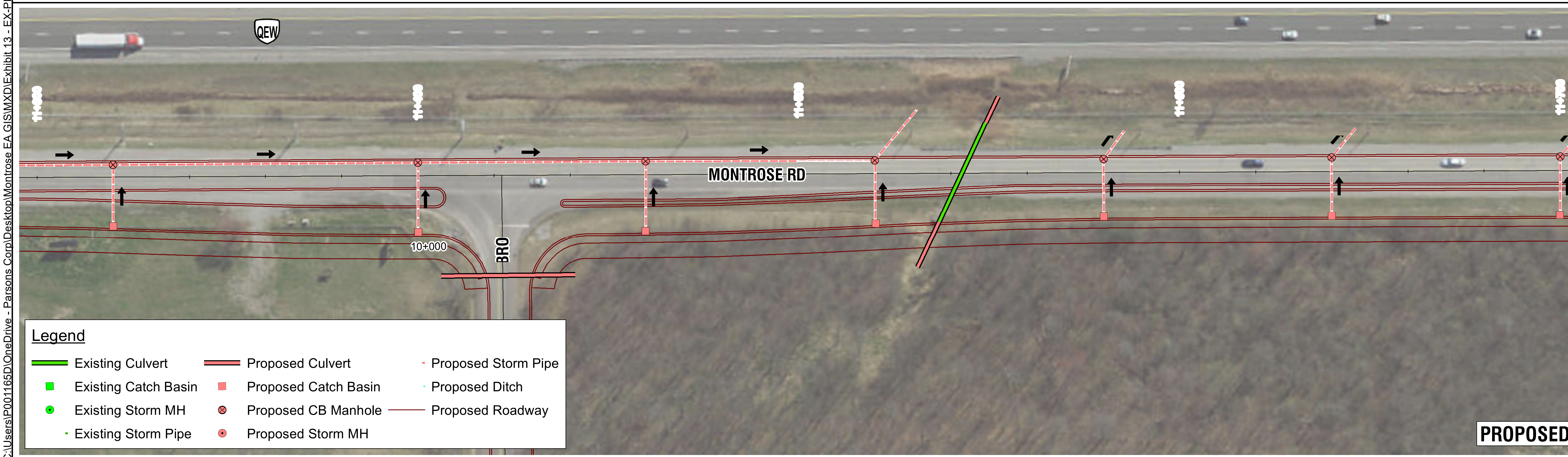
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 4 of 19)

EXHIBIT
12





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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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Niagara Region

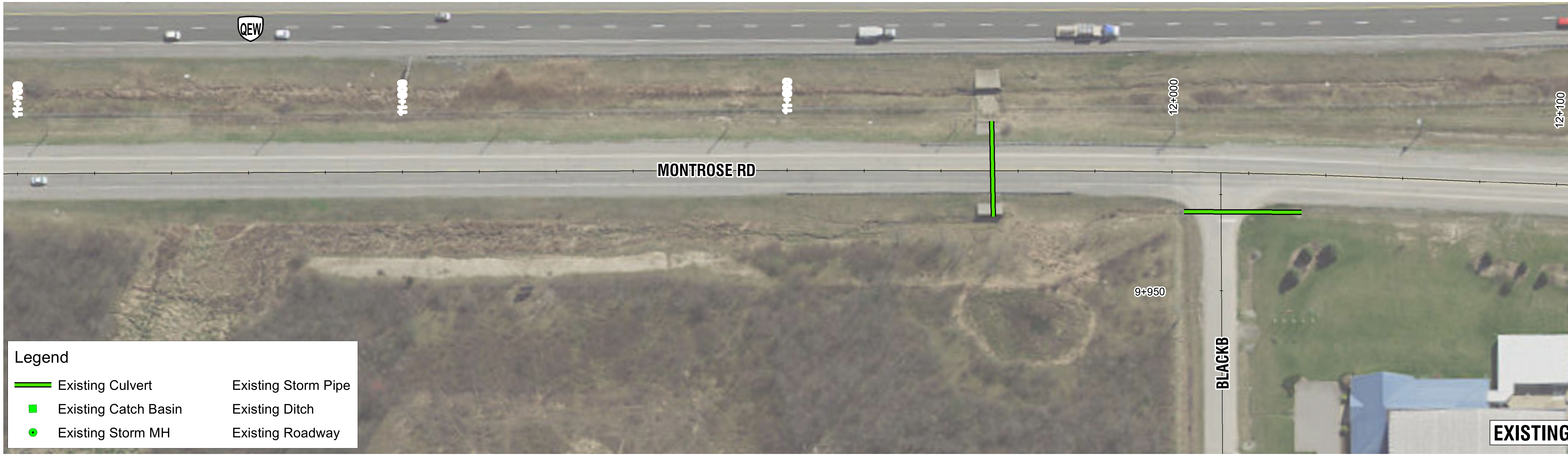
PARSONS

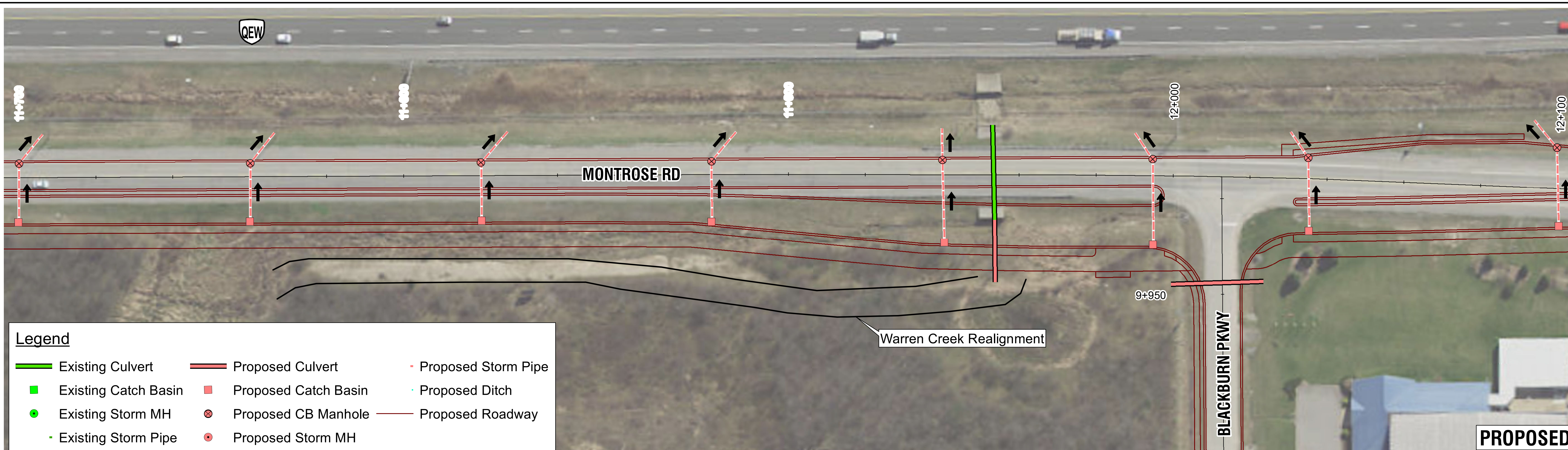
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 5 of 19)

EXHIBIT
13





DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

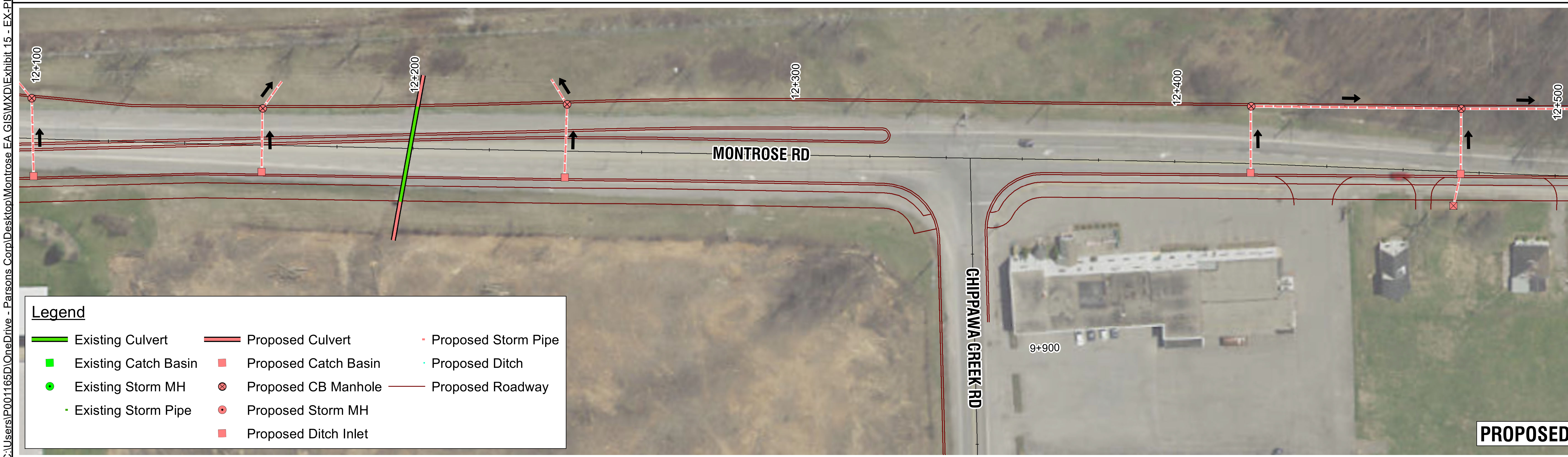
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 6 of 19)

EXHIBIT
14



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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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Niagara Region — PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511 — EXISTING AND PROPOSED LAYOUT (Sheet 7 of 19)

EXHIBIT **15**

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DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

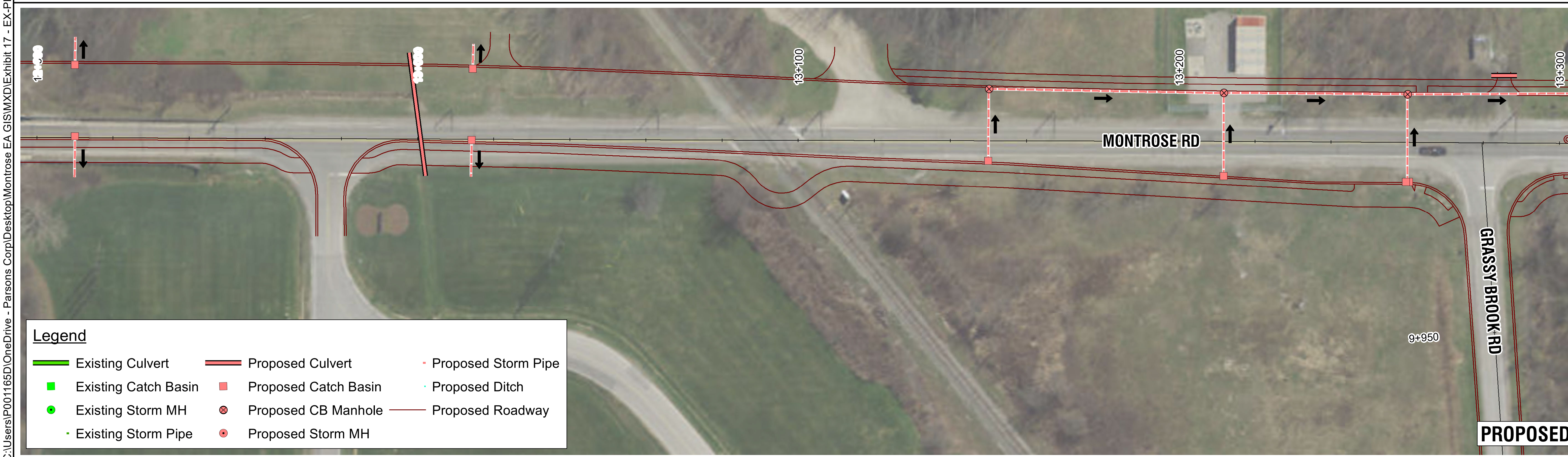
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 8 of 19)

EXHIBIT
16



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SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

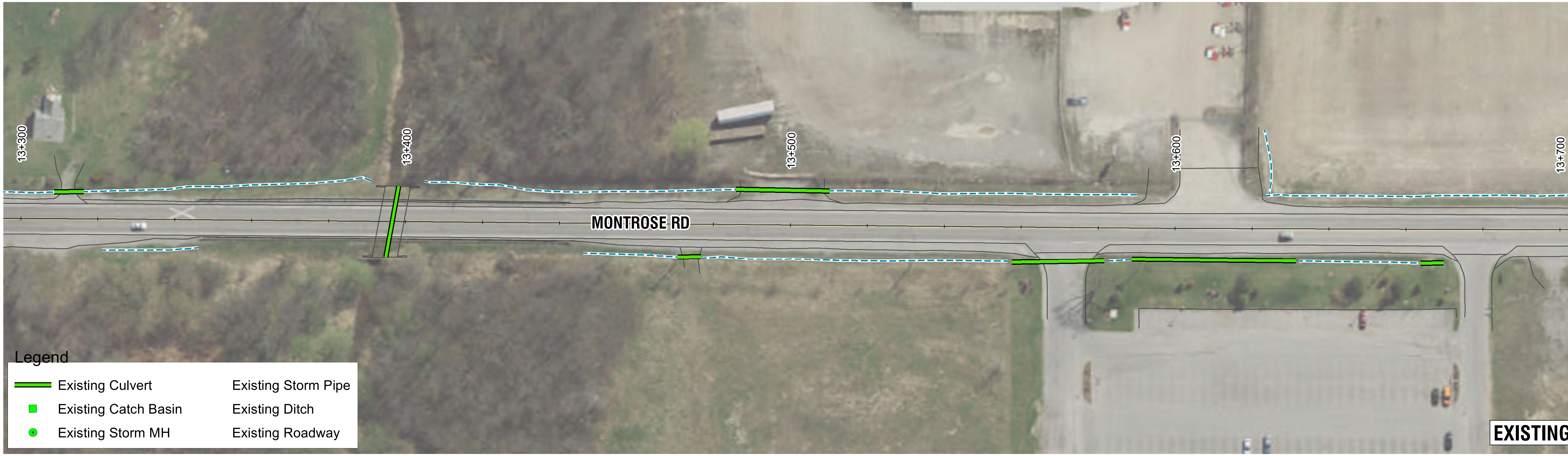
PARSONS

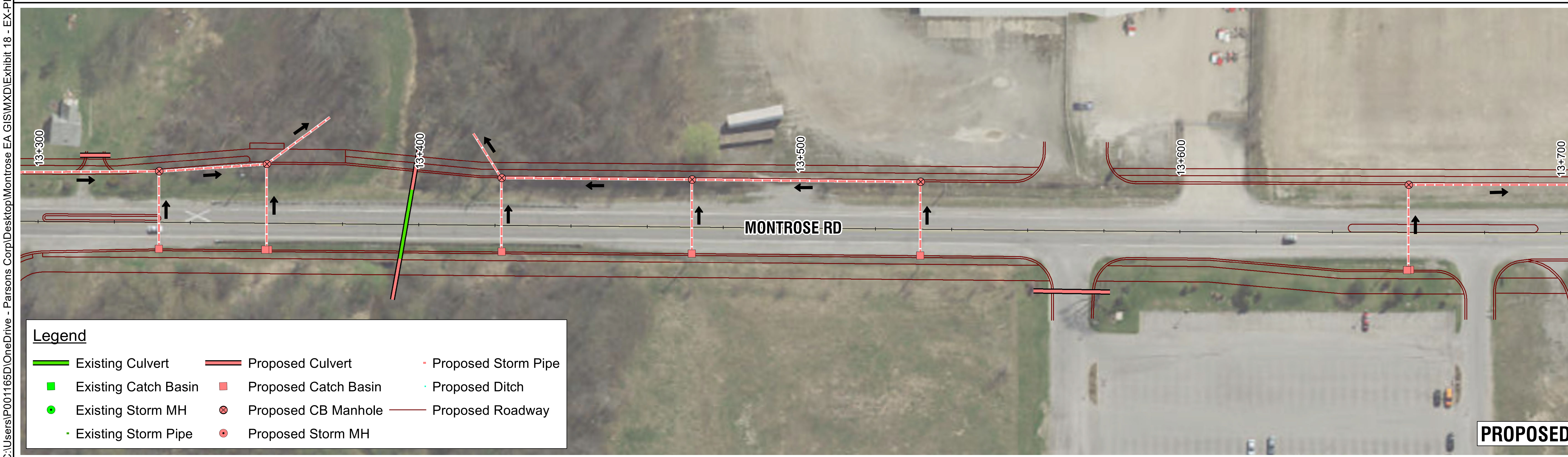
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 9 of 19)

EXHIBIT
17





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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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Niagara Region

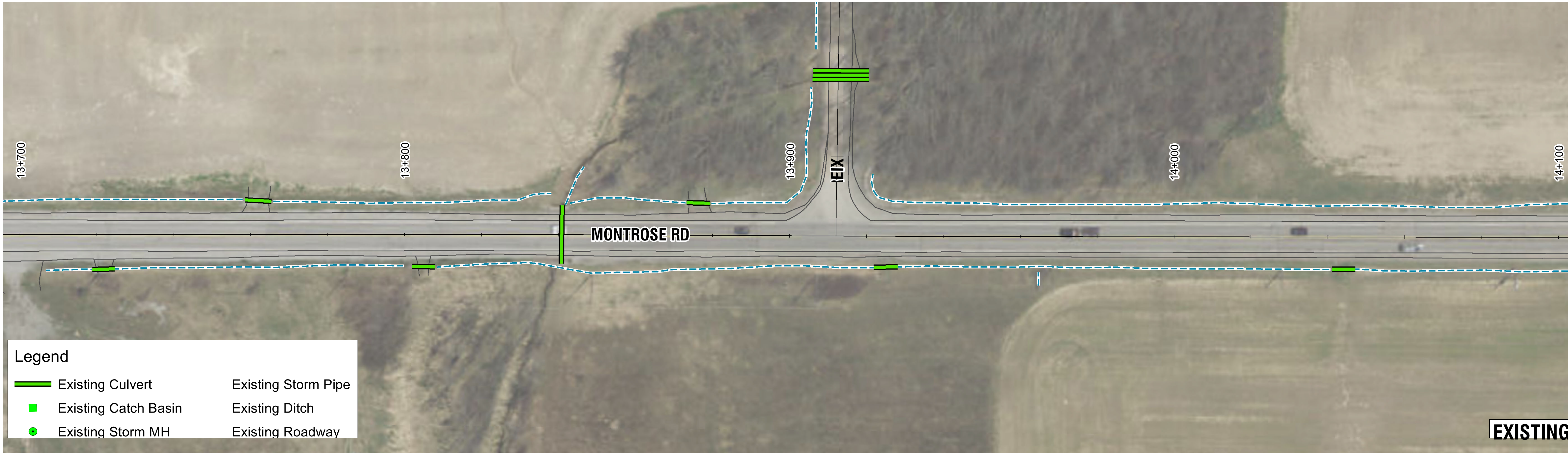
PARSONS

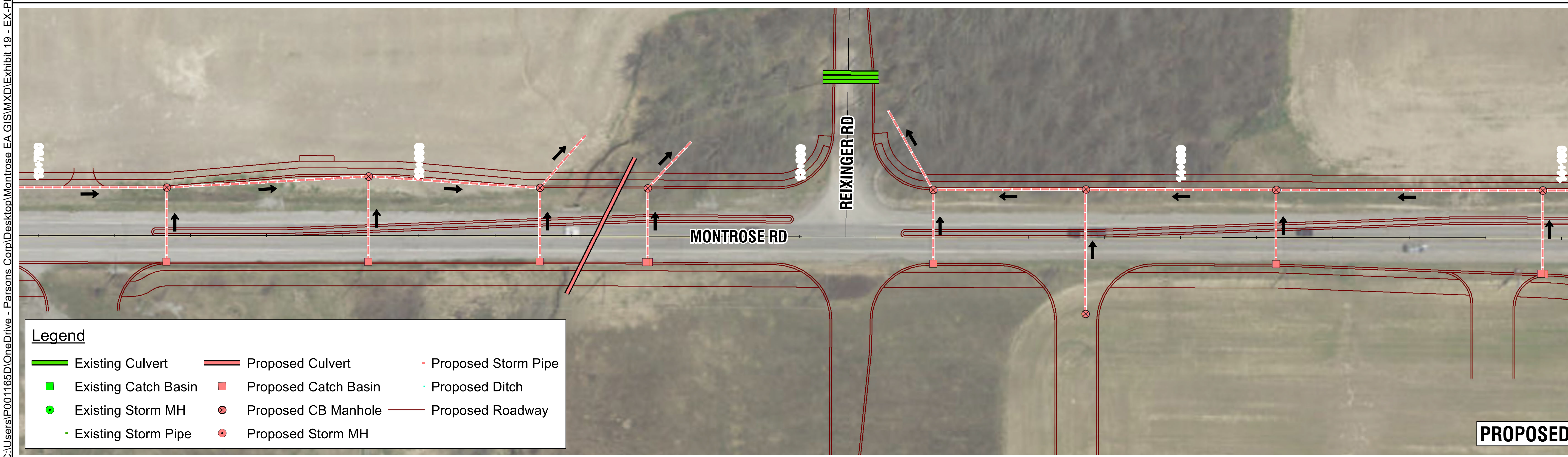
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 10 of 19)

EXHIBIT
18





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SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

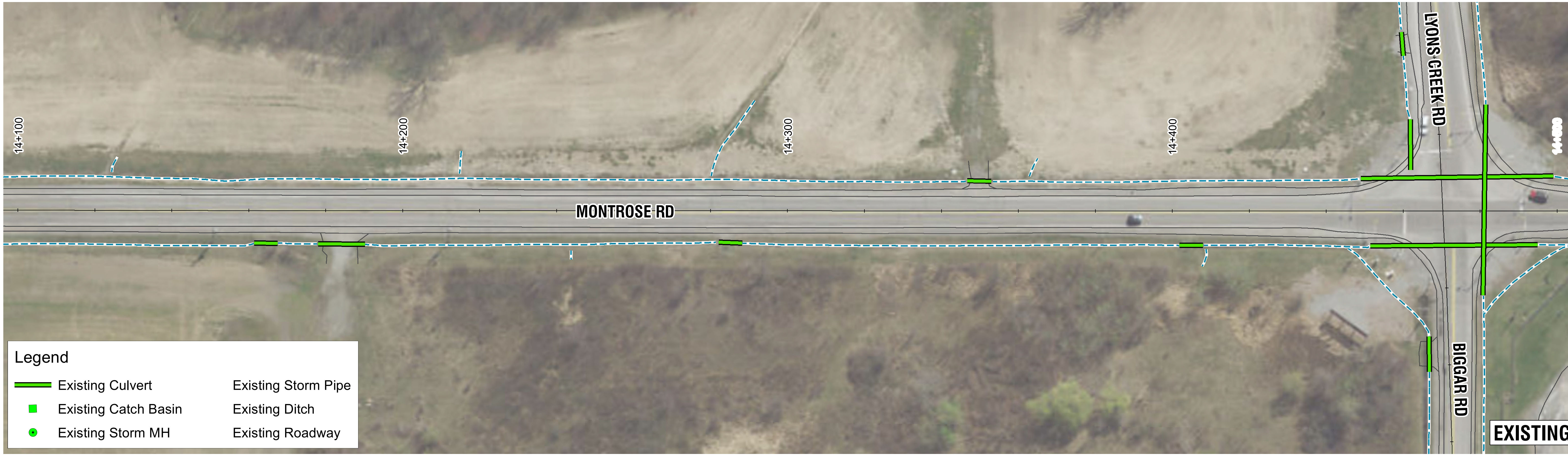
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 11 of 19)

EXHIBIT
19



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DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

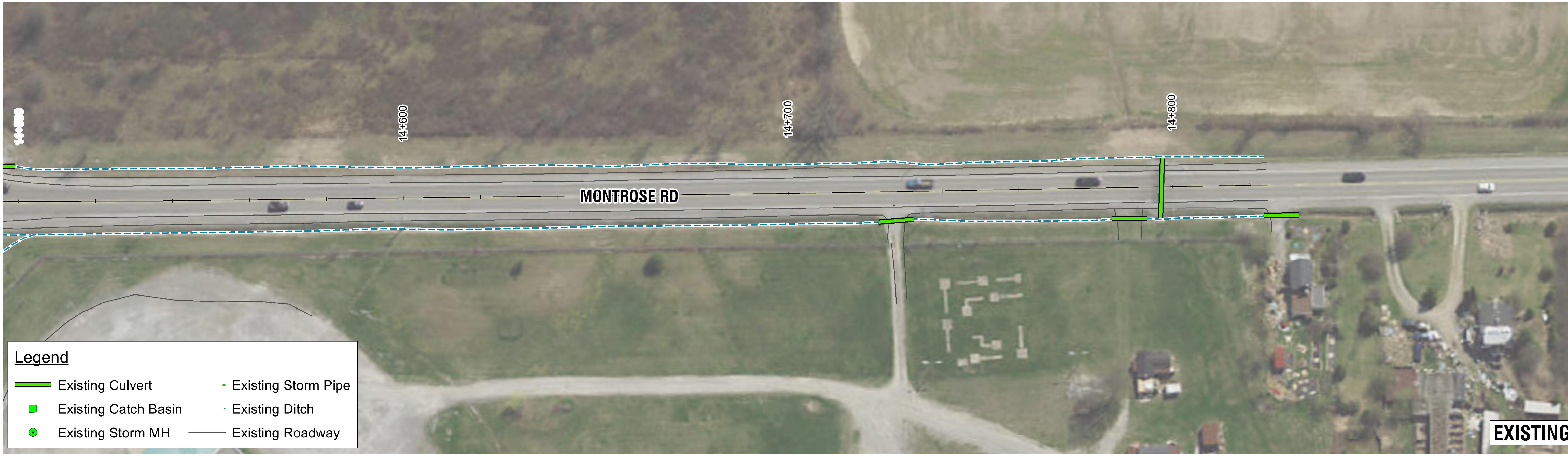
PARSONS

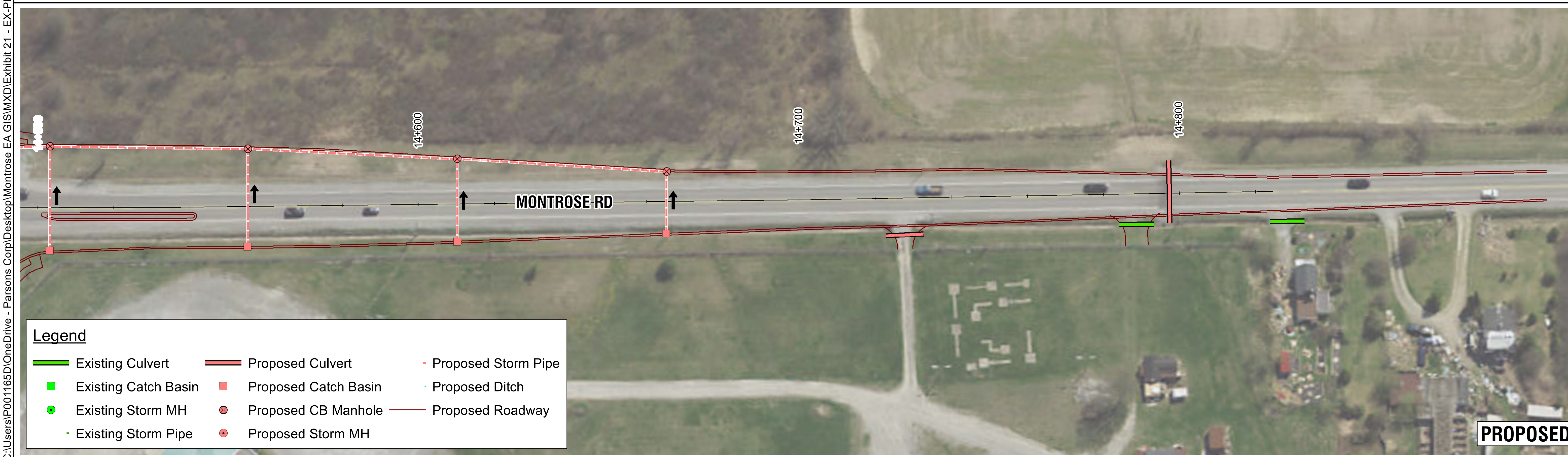
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 12 of 19)

EXHIBIT
20





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DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

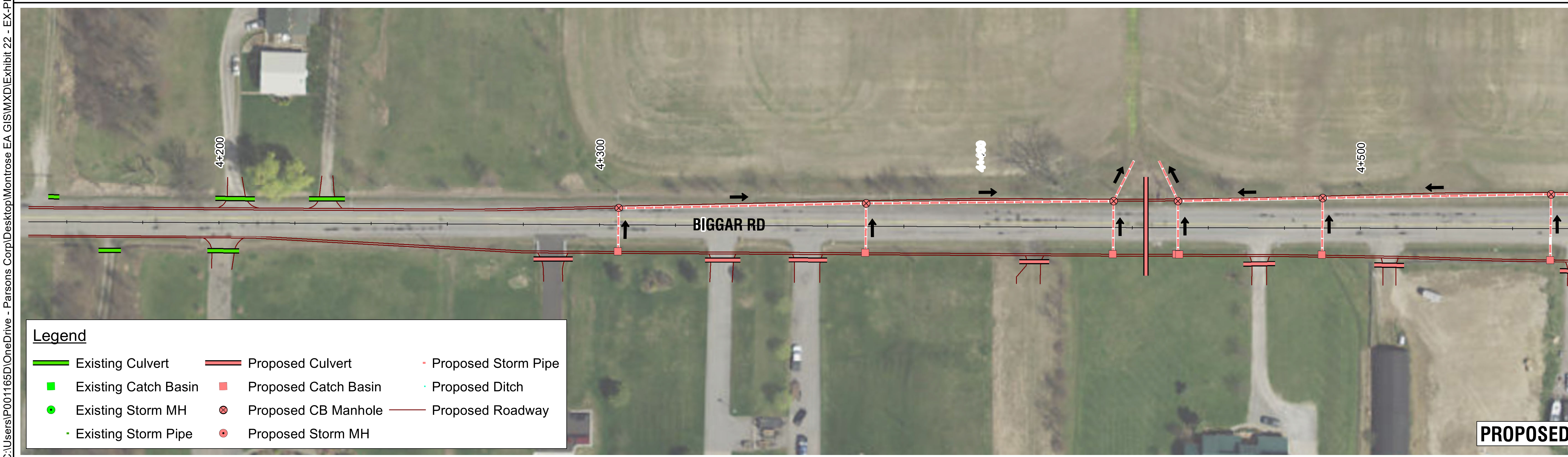
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 13 of 19)

EXHIBIT
21



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DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

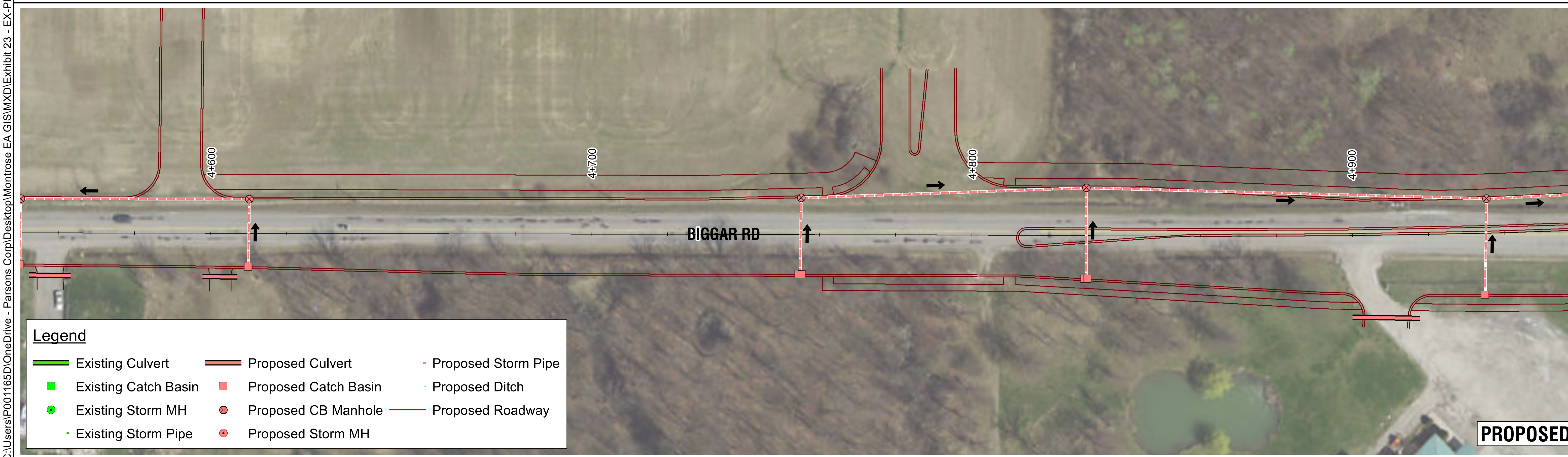
PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 14 of 19)

EXHIBIT
22



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SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

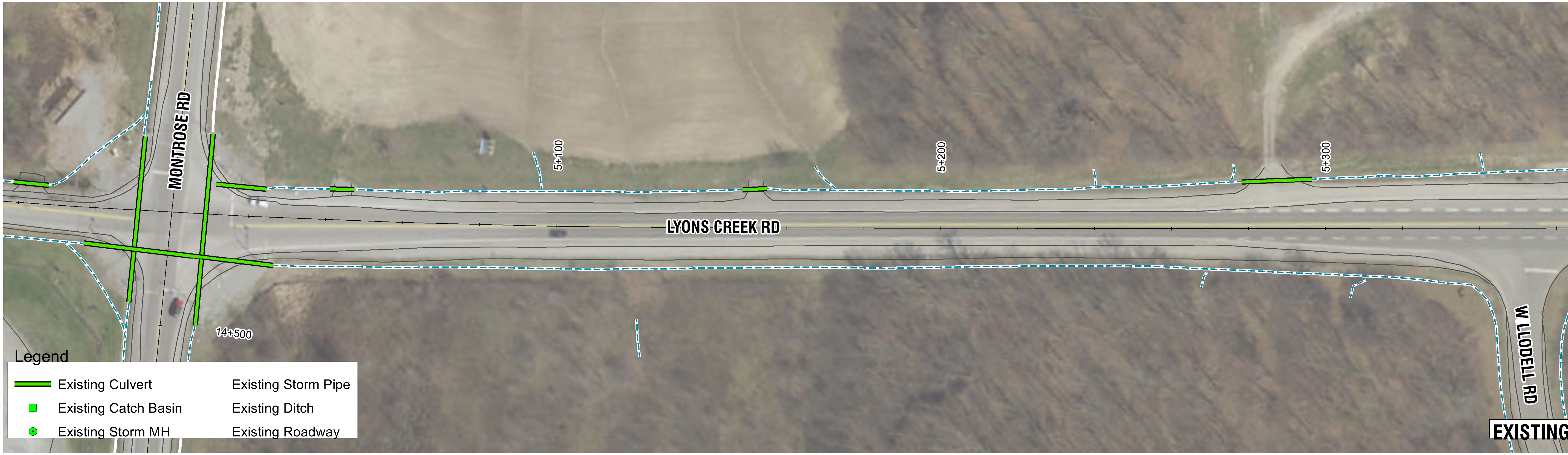
PARSONS

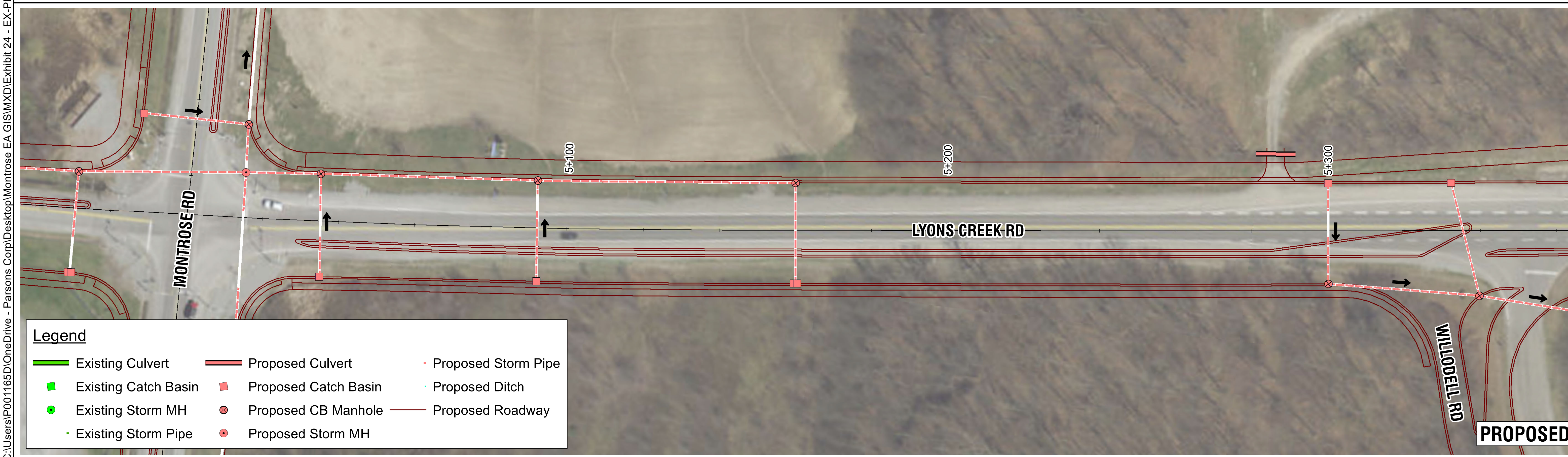
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 15 of 19)

EXHIBIT
23





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DATE	PROJECT NO.
SEPTEMBER 2021	477511

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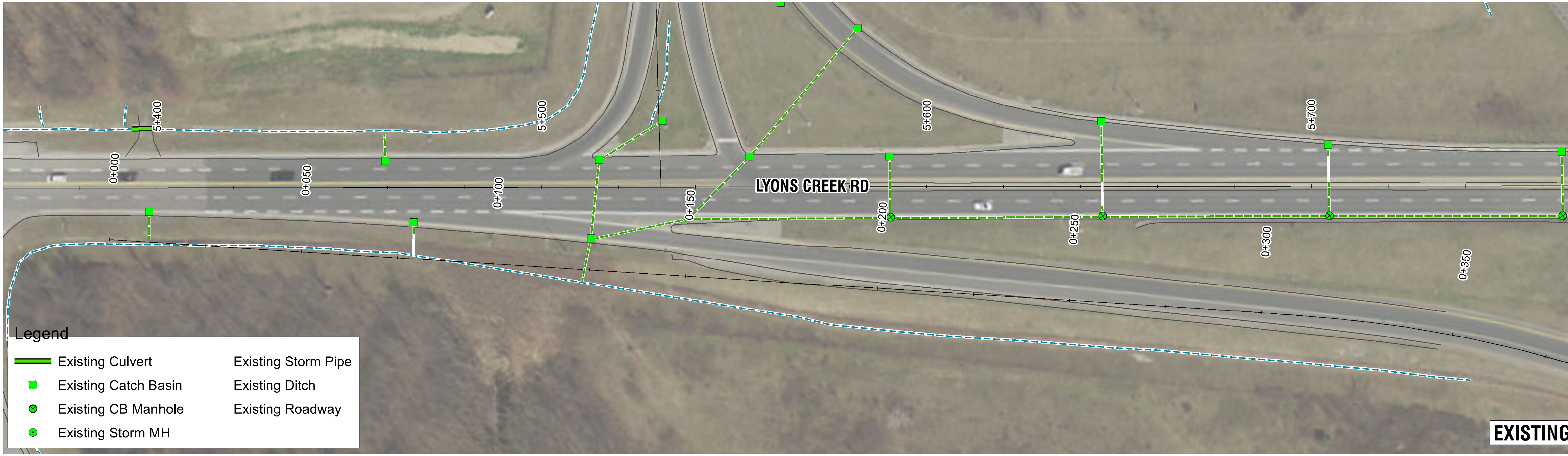
Niagara Region
PARSONS

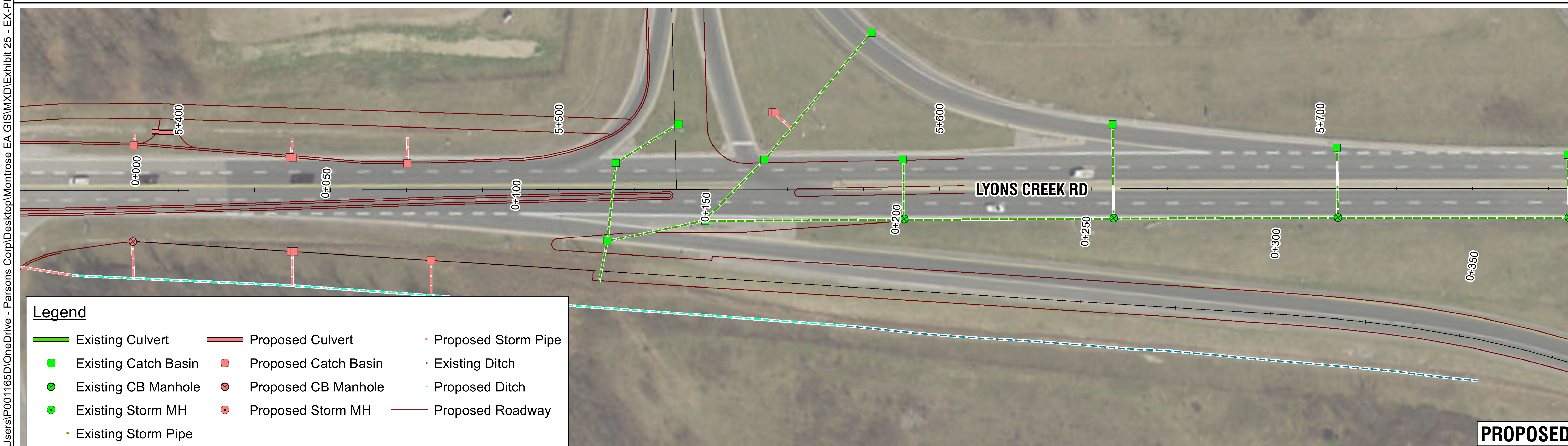
MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 16 of 19)

EXHIBIT
24





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DATE
SEPTEMBER 2021

PROJECT NO.
477511

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Niagara Region

PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

EXISTING AND PROPOSED LAYOUT (Sheet 17 of 19)

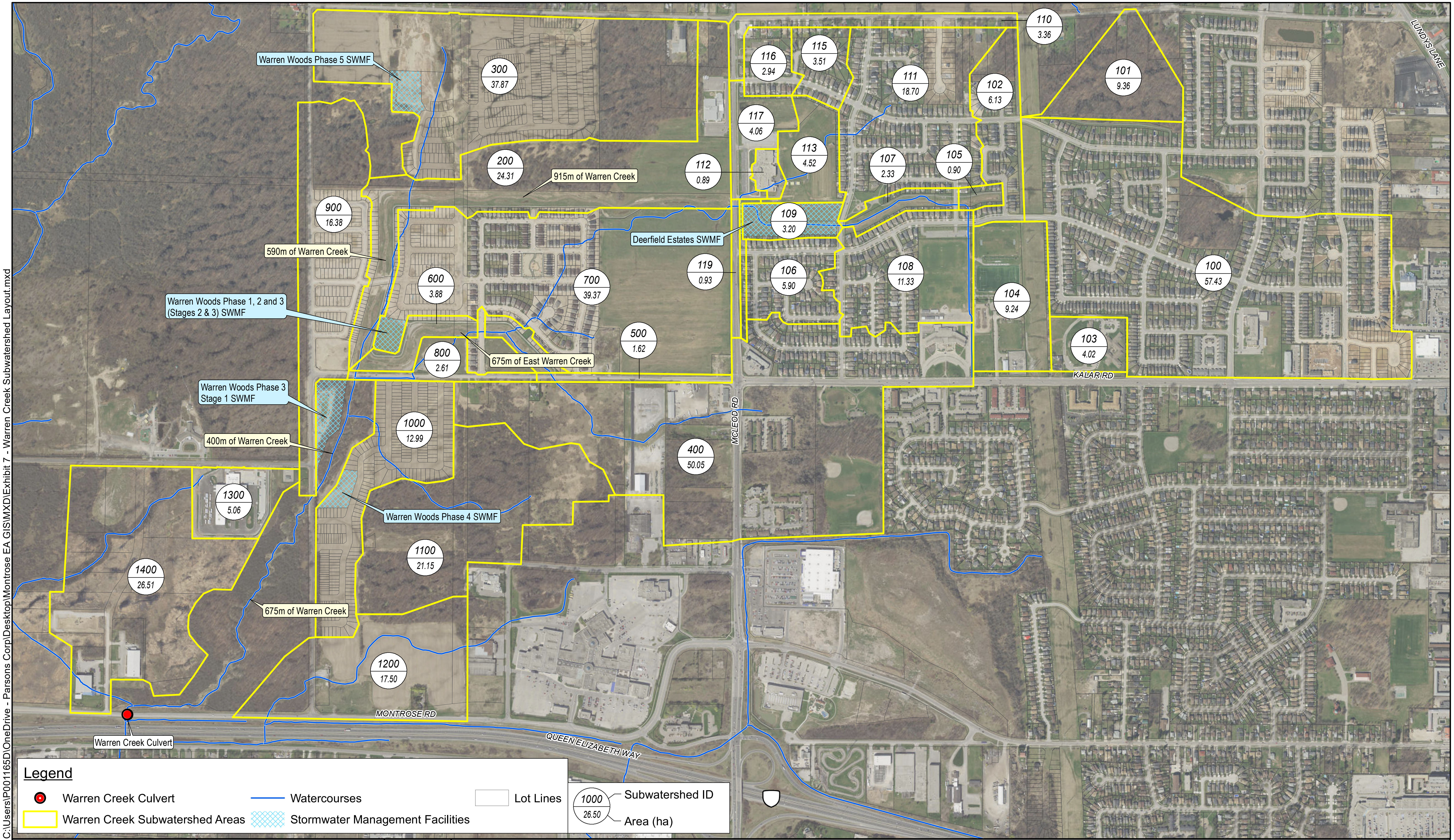
EXHIBIT
25

PARSONS

APPENDIX C

EXISTING CONDITION HYDROLOGIC MODELS

- Schematic
- Input Parameters
- Outputs



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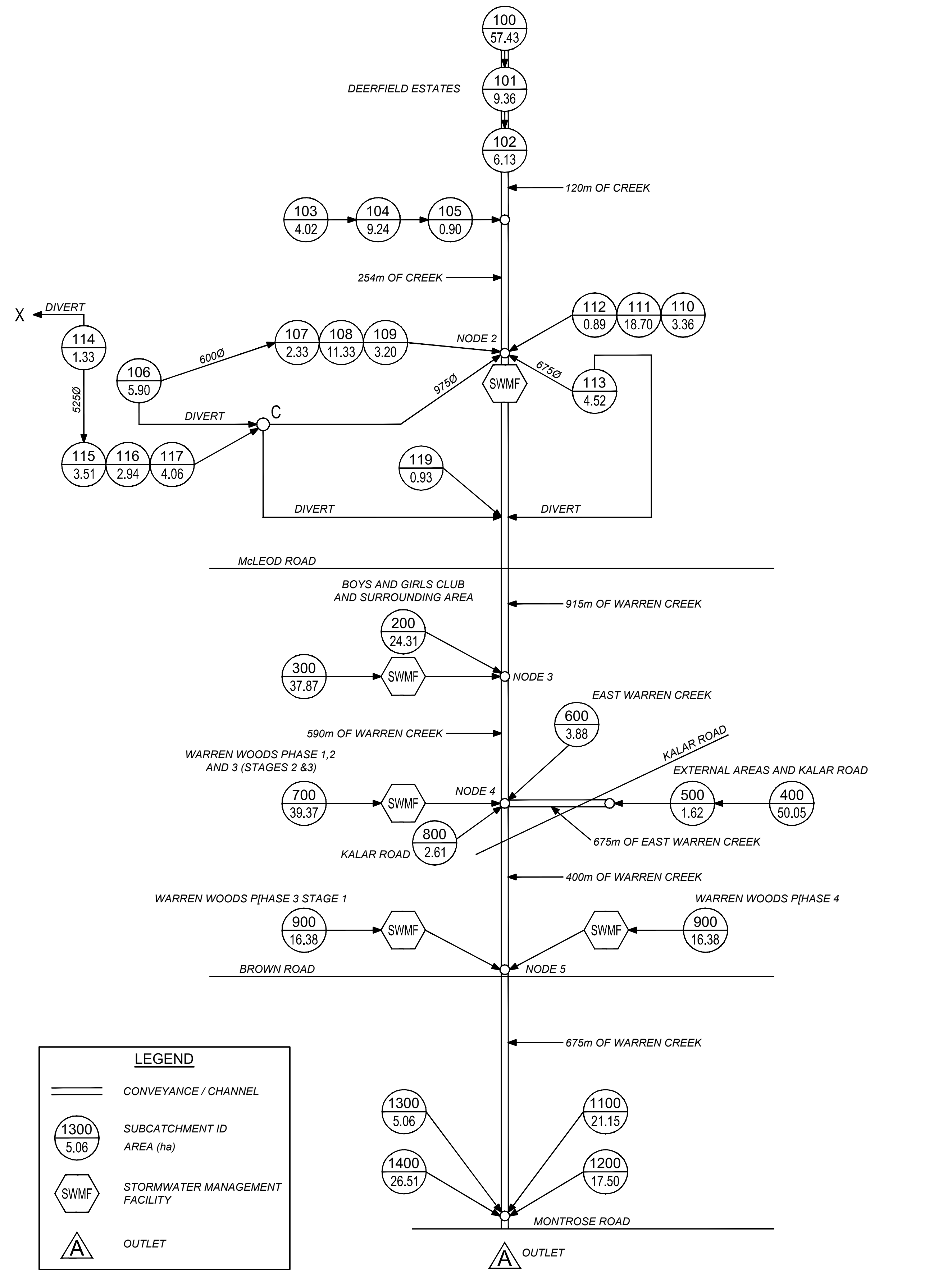
DATE	PROJECT NO.			MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN	EXHIBIT
AUGUST 2021	477511		Niagara Region		
0 0.1 0.2 0.3 0.4 Kilometers	1:10 000		PARSONS	PROJECT NO. 477511 — WARREN CREEK SUBWATERSHED LAYOUT	7



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DATE AUGUST 2021	Niagara Region	**MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD** **MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN**	**EXHIBIT** **8**
PROJECT NO. 477511	PARSONS	**WARREN CREEK SUBWATERSHEDS SCHEMATIC**	

Warren Creek Watershed - Input Parameters

Subcatchment ID	Area (ha)	Length (m)	Slope (%)	Impervious (%)	SCS CN
Deerfield Estates					
100	57.43	220	1	35	84
101	9.36	180	0.5	0.1	84
102	6.13	35	1	35	84
103	4.02	75	1	85	84
104	9.24	120	1	3	84
105	0.9	25	10	0	84
106	5.9	35	1.5	35	84
107	2.33	25	10	0.1	84
108	11.33	45	1.5	35	84
109	3.2	20	10	75	84
110	3.36	25	1.5	35	84
111	18.7	25	1.5	35	84
112	0.89	10	1	95	84
113	4.52	25	1.5	5	84
114	1.33	10	1.5	85	84
115	3.51	20	1	15	84
116	2.94	35	1.5	46	84
117	4.06	25	1	55	84
118	0.93	30	1	35	84
Boy’s and Girl’s Club and surrounding area (Including Warren Creek)					
200	24.31	402.6	1	20	84
Warren Woods Phase 5					
300	10.5	265	2	2	84
301	14.39	310	2	43	84
302	12.97	295	2	93	84
External Area to East Warren Creek					
400	52.66	577.6	2	45	84
500	1.62	103.9	2	90	84
East Warren Creek					
600	3.88	160.8	0.2	0.2	84
Warren woods phase 1, 2 and 3 (Stage 2&3) and additional Badger Land					
700	39.37	515	21	55	84
Kalar Road					
800	2.61	131.9	1	90	84
Warren Wood Phase 3 Stage 1					
900	4.09	165	2	16	84
910	6.07	201	2	45	84
920	0.87	76	2	70	84
930	5.4	190	2	45	84
Warren Wood Phase 4					
1000	12.99	295	2	50	84
External Areas					
1100	21.15	375	2	25	84
1200	17.5	342	2	20	84
Niagara Falls Bus Depot					
1300	5.06	184	2	85	84
Niagara Falls Industrial Park					
1400	26.51	375	2	25	84

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================================================================================
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      V    V   I    SSSSS  U   U    A    L             (v 5.2.2003)
      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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                   ***** S U M M A R Y   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\e47
ebfa5-c16c-4b91-8a6f-104728c61813\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\e47
ebfa5-c16c-4b91-8a6f-104728c61813\sce

DATE: 10/04/2021                          TIME: 07:22:41

USER:
         Warren Creek - Existing Condition
COMMENTS: 100-yr 24-Hour SCS Type II

  ************************************************
  ** SIMULATION : 100 yr SCS                    **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]
```

```
    remark: 100yr 24hr 15min SCS

 *
 ** CALIB NASHYD        0104  1 15.0    9.24    0.73 12.50  61.51 0.63   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.55]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0103  1 15.0    4.02    1.14 12.25  88.80 0.90   0.000
    [I%=45.0:S%= 1.00]
 *
    ADD [  0103+  0104] 0012  3 15.0   13.26    1.64 12.25  69.78  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB NASHYD        0105  1 15.0    0.90    0.12 12.25  36.80 0.37   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.12]
 *
    ADD [  0105+  0012] 0013  3 15.0   14.16    1.77 12.25  67.68  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB NASHYD        0101  1 15.0    9.36    0.76 12.50  61.48 0.62   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.53]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0100  1 15.0   57.43    6.03 12.25  73.24 0.74   0.000
    [I%=25.0:S%= 1.00]
 *
    ADD [  0100+  0101] 0001  3 15.0   66.79    6.57 12.25  71.59  n/a   0.000
 *
    READ STORM                 15.0
```

```
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0102  1 15.0    6.13    1.35 12.25  72.85 0.74   0.000
    [I%=20.0:S%= 1.00]
 *
    ADD [  0001+  0102] 0005  3 15.0   72.92    7.92 12.25  71.70  n/a   0.000
 *
    CHANNEL[ 2:  0005]  0007  1 15.0   72.92    6.89 12.25  71.70  n/a   0.000
 *
    ADD [  0013+  0007] 0014  3 15.0   87.08    8.66 12.25  71.05  n/a   0.000
 *
    CHANNEL[ 2:  0014]  0015  1 15.0   87.08    9.29 12.50  71.05  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB NASHYD        0107  1 15.0    2.33    0.28 12.25  32.08 0.33   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.11]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0106  1 15.0    5.90    1.31 12.25  73.24 0.74   0.000
    [I%=25.0:S%= 1.50]
 *
    DIVERT HYD          0017  1 15.0    5.90    1.31 12.25  73.24  n/a   0.000
       Outflow          0002  2 15.0    5.90    1.31 12.25  73.24  n/a   0.000
       Outflow          0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
 *
    ADD [  0107+  0017] 0020  3 15.0    8.23    1.59 12.25  61.59  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0108  1 15.0   11.33    1.69 12.25  73.24 0.74   0.000
    [I%=25.0:S%= 1.50]
```

```
 *
    ADD [  0108+  0020] 0021  3 15.0   19.56    3.29 12.25  68.34  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0109  1 15.0    3.20    0.96 12.25  85.85 0.87   0.000
    [I%=60.0:S%= 1.00]
 *
    ADD [  0109+  0021] 0022  3 15.0   22.76    4.25 12.25  70.80  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB NASHYD        0113  1 15.0    4.52    0.74 12.25  56.25 0.57   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.21]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB NASHYD        0115  1 15.0    3.51    0.58 12.25  55.33 0.56   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.20]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  * CALIB STANDHYD      0114  1 15.0    1.33    0.43 12.25  91.36 0.93   0.000
    [I%=75.0:S%= 1.50]
 *
    DIVERT HYD          0077  1 15.0    1.33    0.43 12.25  91.36  n/a   0.000
       Outflow          0001  2 15.0    1.33    0.43 12.25  91.36  n/a   0.000
       Outflow          0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow          0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]
```

```
    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0116  1 15.0    2.94    0.69 12.25  76.75 0.78   0.000
    [I%=30.0:S%= 1.50]
 *
    ADD [  0115+  0116]  0033  3 15.0    6.45    1.28 12.25  65.09  n/a   0.000
 *
    ADD [  0033+  0077]  0033  1 15.0    7.78    1.70 12.25  69.58  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0117  1 15.0    4.06    0.99 12.25  79.77 0.81   0.000
    [I%=35.0:S%= 1.00]
 *
    ADD [  0117+  0017]  0078  3 15.0    4.06    0.99 12.25  79.77  n/a   0.000
 *
    ADD [  0078+  0033]  0078  1 15.0   11.84    2.70 12.25  73.08  n/a   0.000
 *
    DIVERT HYD           0079  1 15.0   11.84    2.70 12.25  73.08  n/a   0.000
       Outflow           0002  2 15.0   11.84    2.70 12.25  73.08  n/a   0.000
       Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0110  1 15.0    3.36    0.74 12.25  72.85 0.74   0.000
    [I%=20.0:S%= 1.50]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0111  1 15.0   18.70    4.02 12.25  72.85 0.74   0.000
    [I%=20.0:S%= 1.50]
 *
    ADD [  0110+  0111]  0025  3 15.0   22.06    4.76 12.25  72.85  n/a   0.000
 *
    READ STORM                 15.0
```

```
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0112  1 15.0    0.89    0.29 12.25  95.23 0.97   0.000
    [I%=85.0:S%= 1.00]
 *
    ADD [  0112+  0025]  0028  3 15.0   22.95    5.06 12.25  73.72  n/a   0.000
 *
    ADD [  0113+  0015]  0036  3 15.0   91.60    9.65 12.50  70.32  n/a   0.000
 *
    ADD [  0036+  0022]  0036  1 15.0  114.36   11.59 12.50  70.41  n/a   0.000
 *
    ADD [  0036+  0028]  0036  3 15.0  137.31   16.49 12.25  70.96  n/a   0.000
 *
    ADD [  0036+  0079]  0036  1 15.0  149.15   19.19 12.25  71.13  n/a   0.000
 *
 ** Reservoir
    OUTFLOW:             0035  1 15.0  149.15    9.16 12.75  71.12  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0119  1 15.0    0.93    0.21 12.25  72.84 0.74   0.000
    [I%=20.0:S%= 1.00]
 *
    ADD [  0119+  0035]  0038  3 15.0  150.08    9.20 12.75  71.13  n/a   0.000
 *
    ADD [  0038+  0079]  0038  1 15.0  150.08    9.20 12.75  71.13  n/a   0.000
 *
    CHANNEL[ 2:  0038]   0039  1 15.0  150.08    8.21 13.00  71.13  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB NASHYD         0200  1 15.0   24.31    1.85 12.50  61.53 0.63   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.57]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
```

```
  *  CALIB NASHYD         0300  1 15.0   10.50    0.79 12.75  61.54 0.63   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.58]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0310  1 15.0   14.39    2.12 12.25  75.88 0.77   0.000
    [I%=30.0:S%= 2.00]
 *
    ADD [  0300+  0310]  0045  3 15.0   24.89    2.65 12.25  69.83  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0320  1 15.0   12.97    3.46 12.25  94.33 0.96   0.000
    [I%=70.0:S%= 2.00]
 *
    ADD [  0320+  0045]  0046  3 15.0   37.86    6.11 12.25  78.22  n/a   0.000
 *
 ** Reservoir
    OUTFLOW:             0047  1 15.0   37.86    1.06 13.50  78.19  n/a   0.000
 *
    ADD [  0200+  0039]  0040  3 15.0  174.39    9.73 13.00  69.79  n/a   0.000
 *
    ADD [  0040+  0047]  0040  1 15.0  212.25   10.76 13.00  71.29  n/a   0.000
 *
    CHANNEL[ 2:  0040]   0048  1 15.0  212.25   10.73 13.25  71.29  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB NASHYD         0600  1 15.0    3.88    0.22 13.00  61.64 0.63   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.86]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0400  1 15.0   52.66    7.68 12.25  76.46 0.78   0.000
```

```
    [I%=30.0:S%= 2.00]
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0500  1 15.0    1.62    0.51 12.25  93.06 0.95   0.000
    [I%=70.0:S%= 2.00]
 *
    ADD [  0400+  0500]  0051  3 15.0   54.28    8.18 12.25  76.95  n/a   0.000
 *
    CHANNEL[ 2:  0051]   0053  1 15.0   54.28    6.17 12.50  76.95  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0700  1 15.0   39.37    5.90 12.25  77.95 0.79   0.000
    [I%=30.0:S%= 2.00]
 *
 ** Reservoir
    OUTFLOW:             0056  1 15.0   39.37    1.88 13.00  77.92  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
  *  CALIB STANDHYD       0800  1 15.0    2.61    0.64 12.25  89.82 0.91   0.000
    [I%=60.0:S%= 1.00]
 *
    ADD [  0048+  0053]  0052  3 15.0  266.53   13.21 13.25  72.44  n/a   0.000
 *
    ADD [  0052+  0056]  0052  1 15.0  305.90   15.00 13.25  73.15  n/a   0.000
 *
    ADD [  0052+  0600]  0052  3 15.0  309.78   15.21 13.25  73.00  n/a   0.000
 *
    ADD [  0052+  0800]  0052  1 15.0  312.39   15.27 13.25  73.14  n/a   0.000
 *
    CHANNEL[ 2:  0052]   0058  1 15.0  312.39   15.49 13.25  73.14  n/a   0.000
 *
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

 *
```

```
 * CALIB NASHYD         0900  1 15.0    4.09    0.31 12.50  61.53 0.63   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       0910  1 15.0    6.07    0.91 12.25  76.46 0.78   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0900+  0910]  0061  3 15.0   10.16    1.13 12.25  70.45  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       0920  1 15.0    0.87    0.23 12.25  81.89 0.83   0.000
   [I%=45.0:S%= 1.50]
*
   ADD [  0061+  0920]  0062  3 15.0   11.03    1.36 12.25  71.35  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       0930  1 15.0    5.40    0.82 12.25  76.45 0.78   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0062+  0930]  0065  3 15.0   16.43    2.17 12.25  73.03  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0066  1 15.0   16.43    0.71 13.00  72.99  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       1000  1 15.0   12.99    1.66 12.25  76.46 0.78   0.000
   [I%=30.0:S%= 1.50]
*
 ** Reservoir
   OUTFLOW:             0069  1 15.0   12.99    0.50 13.25  76.38  n/a   0.000
*
```

```
   ADD [  0058+  0066]  0067  3 15.0  328.82   16.20 13.25  73.13  n/a   0.000
*
   ADD [  0067+  0069]  0067  1 15.0  341.81   16.70 13.25  73.26  n/a   0.000
*
   CHANNEL[ 2:  0067]   0070  1 15.0  341.81   16.06 13.25  73.26  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB NASHYD         1100  1 15.0   21.15    2.04 12.50  61.21 0.62   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.42]
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB NASHYD         1200  1 15.0   17.50    1.48 12.50  61.45 0.62   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.51]
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       1300  1 15.0    5.06    1.27 12.25  91.05 0.93   0.000
   [I%=65.0:S%= 2.00]
*
   READ STORM                 15.0
   [ Ptot= 98.40 mm ]

   remark: 100yr 24hr 15min SCS

*
 * CALIB STANDHYD       1400  1 15.0   26.51    6.77 12.25  91.36 0.93   0.000
   [I%=75.0:S%= 2.00]
*
   ADD [  1100+  1200]  0071  3 15.0   38.65    3.52 12.50  61.32  n/a   0.000
*
   ADD [  0071+  1300]  0071  1 15.0   43.71    4.09 12.25  64.76  n/a   0.000
*
   ADD [  0071+  1400]  0071  3 15.0   70.22   10.86 12.25  74.80  n/a   0.000
*
   ADD [  0071+  0070]  0071  1 15.0  412.03   18.46 13.25  73.52  n/a   0.000
*
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 FINISH

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===================================================================================
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       V    V   I    SSSSS  U    U    A     L              (v 5.2.2003)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\af0
b5a94-51a5-4fa5-9ceb-3a4badc7b7ed\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\af0
b5a94-51a5-4fa5-9ceb-3a4badc7b7ed\sce


DATE: 10/04/2021                           TIME: 07:22:39

USER:       Warren Creek - Existing Condition
            10-yr 24-Hour SCS Type II
COMMENTS: ________________________________________________


  ************************************************
  ** SIMULATION : 10yr SCS                      **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
```

```
     START @  0.00 hrs
     -------------------
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
** CALIB NASHYD         0104  1 15.0    9.24    0.46 12.50  38.94 0.54   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.55]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0103  1 15.0    4.02    0.79 12.25  62.84 0.87   0.000
   [I%=45.0:S%= 1.00]
*
   ADD [  0103+  0104]  0012  3 15.0   13.26    1.10 12.25  46.18  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0105  1 15.0    0.90    0.08 12.25  23.30 0.32   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.12]
*
   ADD [  0105+  0012]  0013  3 15.0   14.16    1.18 12.25  44.73  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0101  1 15.0    9.36    0.48 12.50  38.92 0.54   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.53]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0100  1 15.0   57.43    3.77 12.25  49.17 0.68   0.000
```

```
   [I%=25.0:S%= 1.00]
*
   ADD [  0100+  0101]  0001  3 15.0   66.79    4.10 12.25  47.74  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0102  1 15.0    6.13    0.58 12.25  48.72 0.68   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0001+  0102]  0005  3 15.0   72.92    4.69 12.25  47.82  n/a   0.000
*
   CHANNEL[ 2:  0005]   0007  1 15.0   72.92    3.96 12.25  47.82  n/a   0.000
*
   ADD [  0013+  0007]  0014  3 15.0   87.08    5.14 12.25  47.32  n/a   0.000
*
   CHANNEL[ 2:  0014]   0015  1 15.0   87.08    5.64 12.50  47.32  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0107  1 15.0    2.33    0.18 12.25  20.31 0.28   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.11]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0106  1 15.0    5.90    0.60 12.25  49.17 0.68   0.000
   [I%=25.0:S%= 1.50]
*
   DIVERT HYD           0017  1 15.0    5.90    0.60 12.25  49.17  n/a   0.000
      Outflow           0002  2 15.0    5.90    0.60 12.25  49.17  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   ADD [  0107+  0017]  0020  3 15.0    8.23    0.78 12.25  41.00  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]
```

```
   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0108  1 15.0   11.33    1.13 12.25  49.17 0.68   0.000
   [I%=25.0:S%= 1.50]
*
   ADD [  0108+  0020]  0021  3 15.0   19.56    1.91 12.25  45.73  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0109  1 15.0    3.20    0.67 12.25  60.47 0.84   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0109+  0021]  0022  3 15.0   22.76    2.58 12.25  47.80  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0113  1 15.0    4.52    0.47 12.25  35.60 0.49   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.21]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0115  1 15.0    3.51    0.37 12.25  35.03 0.49   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.20]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0114  1 15.0    1.33    0.31 12.25  65.41 0.91   0.000
   [I%=75.0:S%= 1.50]
*
   DIVERT HYD           0077  1 15.0    1.33    0.31 12.25  65.41  n/a   0.000
      Outflow           0001  2 15.0    1.33    0.31 12.25  65.41  n/a   0.000
      Outflow           0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
      Outflow           0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0116  1 15.0    2.94    0.34 12.25  52.19 0.72   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0115+  0116]  0033  3 15.0    6.45    0.71 12.25  42.85  n/a   0.000
*
   ADD [  0033+  0077]  0033  1 15.0    7.78    1.01 12.25  46.71  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0117  1 15.0    4.06    0.51 12.25  54.84 0.76   0.000
   [I%=35.0:S%= 1.00]
*
   ADD [  0117+  0017]  0078  3 15.0    4.06    0.51 12.25  54.84  n/a   0.000
*
   ADD [  0078+  0033]  0078  1 15.0   11.84    1.52 12.25  49.50  n/a   0.000
*
   DIVERT HYD           0079  1 15.0   11.84    1.52 12.25  49.50  n/a   0.000
      Outflow           0002  2 15.0   11.84    1.52 12.25  49.50  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0110  1 15.0    3.36    0.32 12.25  48.72 0.68   0.000
   [I%=20.0:S%= 1.50]
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0111  1 15.0   18.70    1.74 12.25  48.72 0.68   0.000
```

```
   [I%=20.0:S%= 1.50]
*
   ADD [  0110+  0111]  0025  3 15.0   22.06    2.06 12.25  48.72  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0112  1 15.0    0.89    0.21 12.25  68.94 0.96   0.000
   [I%=85.0:S%= 1.00]
*
   ADD [  0112+  0025]  0028  3 15.0   22.95    2.27 12.25  49.50  n/a   0.000
*
   ADD [  0113+  0015]  0036  3 15.0   91.60    5.87 12.50  46.74  n/a   0.000
*
   ADD [  0036+  0022]  0036  1 15.0  114.36    7.27 12.50  46.95  n/a   0.000
*
   ADD [  0036+  0028]  0036  3 15.0  137.31    9.08 12.50  47.38  n/a   0.000
*
   ADD [  0036+  0079]  0036  1 15.0  149.15   10.48 12.25  47.55  n/a   0.000
*
** Reservoir
   OUTFLOW:             0035  1 15.0  149.15    3.87 13.25  47.53  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB STANDHYD       0119  1 15.0    0.93    0.14 12.25  48.71 0.68   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0119+  0035]  0038  3 15.0  150.08    3.89 13.25  47.54  n/a   0.000
*
   ADD [  0038+  0079]  0038  1 15.0  150.08    3.89 13.25  47.54  n/a   0.000
*
   CHANNEL[ 2:  0038]   0039  1 15.0  150.08    3.47 13.75  47.54  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 72.00 mm ]

   remark: 10yr 24hr 15min SCS

*
 * CALIB NASHYD         0200  1 15.0   24.31    1.16 12.75  38.95 0.54   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                 15.0
```

```
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB NASHYD         0300  1 15.0   10.50    0.50 12.75  38.95 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.58]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0310  1 15.0   14.39    1.28 12.25  51.47 0.71   0.000
    [I%=30.0:S%= 2.00]
*
    ADD [  0300+  0310]  0045  3 15.0   24.89    1.61 12.25  46.19  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0320  1 15.0   12.97    2.49 12.25  68.04 0.94   0.000
    [I%=70.0:S%= 2.00]
*
    ADD [  0320+  0045]  0046  3 15.0   37.86    4.09 12.25  53.68  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0047  1 15.0   37.86    0.74 13.50  53.65  n/a   0.000
*
    ADD [  0200+  0039]  0040  3 15.0  174.39    3.98 13.50  46.34  n/a   0.000
*
    ADD [  0040+  0047]  0040  1 15.0  212.25    4.72 13.50  47.64  n/a   0.000
*
    CHANNEL[ 2:  0040]   0048  1 15.0  212.25    4.65 13.75  47.64  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB NASHYD         0600  1 15.0    3.88    0.14 13.00  39.02 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.86]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]
```

```
    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0400  1 15.0   52.66    4.60 12.25  51.95 0.72   0.000
    [I%=30.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0500  1 15.0    1.62    0.36 12.25  66.87 0.93   0.000
    [I%=70.0:S%= 2.00]
*
    ADD [  0400+  0500]  0051  3 15.0   54.28    4.97 12.25  52.40  n/a   0.000
*
    CHANNEL[ 2:  0051]   0053  1 15.0   54.28    3.02 12.50  52.40  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0700  1 15.0   39.37    3.98 12.25  53.20 0.74   0.000
    [I%=30.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0056  1 15.0   39.37    0.83 13.50  53.18  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0800  1 15.0    2.61    0.45 12.25  63.89 0.89   0.000
    [I%=60.0:S%= 1.00]
*
    ADD [  0048+  0053]  0052  3 15.0  266.53    5.93 13.50  48.61  n/a   0.000
*
    ADD [  0052+  0056]  0052  1 15.0  305.90    6.76 13.50  49.20  n/a   0.000
*
    ADD [  0052+  0600]  0052  3 15.0  309.78    6.87 13.50  49.07  n/a   0.000
*
    ADD [  0052+  0800]  0052  1 15.0  312.39    6.91 13.50  49.19  n/a   0.000
*
    CHANNEL[ 2:  0052]   0058  1 15.0  312.39    6.90 13.75  49.19  n/a   0.000
*
    READ STORM                 15.0
```

```
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB NASHYD         0900  1 15.0    4.09    0.19 12.75  38.95 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.57]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0910  1 15.0    6.07    0.56 12.25  51.95 0.72   0.000
    [I%=30.0:S%= 1.50]
*
    ADD [  0900+  0910]  0061  3 15.0   10.16    0.69 12.25  46.72  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0920  1 15.0    0.87    0.16 12.25  56.82 0.79   0.000
    [I%=45.0:S%= 1.50]
*
    ADD [  0061+  0920]  0062  3 15.0   11.03    0.84 12.25  47.51  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0930  1 15.0    5.40    0.56 12.25  51.95 0.72   0.000
    [I%=30.0:S%= 1.50]
*
    ADD [  0062+  0930]  0065  3 15.0   16.43    1.40 12.25  48.97  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0066  1 15.0   16.43    0.40 13.25  48.93  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1000  1 15.0   12.99    1.14 12.25  51.95 0.72   0.000
```

```
    [I%=30.0:S%= 1.50]
*
 ** Reservoir
    OUTFLOW:             0069  1 15.0   12.99    0.27 13.75  51.88  n/a   0.000
*
    ADD [  0058+  0066]  0067  3 15.0  328.82    7.28 13.75  49.18  n/a   0.000
*
    ADD [  0067+  0069]  0067  1 15.0  341.81    7.54 13.75  49.28  n/a   0.000
*
    CHANNEL[ 2:  0067]   0070  1 15.0  341.81    7.46 13.75  49.28  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB NASHYD         1100  1 15.0   21.15    1.29 12.50  38.75 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.42]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB NASHYD         1200  1 15.0   17.50    0.93 12.50  38.90 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.51]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1300  1 15.0    5.06    0.90 12.25  65.03 0.90   0.000
    [I%=65.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1400  1 15.0   26.51    4.84 12.25  65.41 0.91   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  1100+  1200]  0071  3 15.0   38.65    2.22 12.50  38.82  n/a   0.000
*
    ADD [  0071+  1300]  0071  1 15.0   43.71    2.65 12.25  41.85  n/a   0.000
```

```
*
    ADD [  0071+  1400]  0071  3 15.0   70.22    7.49 12.25  50.75  n/a   0.000
*
    ADD [  0071+  0070]  0071  1 15.0  412.03    8.41 13.75  49.53  n/a   0.000
*
===============================================================================
======================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 5.2.2003)
       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
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\024
ee5dc-a423-4f74-a016-8cf3ea2c58ce\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\024
ee5dc-a423-4f74-a016-8cf3ea2c58ce\sce

DATE: 10/04/2021                           TIME: 07:22:31

USER:
```

Warren Creek - Existing Condition
25-yr 24-Hour SCS Type II

```
COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : 25 yr SCS                     **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms
```

```
      START @  0.00 hrs
      -------------------
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0104  1 15.0    9.24    0.55 12.50  46.96 0.58   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.55]
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0103  1 15.0    4.02    0.92 12.25  72.25 0.89   0.000
    [I%=45.0:S%= 1.00]
*
    ADD [  0103+  0104]  0012  3 15.0   13.26    1.30 12.25  54.63  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD         0105  1 15.0    0.90    0.09 12.25  28.10 0.34   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.12]
*
    ADD [  0105+  0012]  0013  3 15.0   14.16    1.39 12.25  52.94  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD         0101  1 15.0    9.36    0.58 12.50  46.94 0.58   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.53]
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0100  1 15.0   57.43    4.69 12.25  57.81 0.71   0.000
```

```
    [I%=25.0:S%= 1.00]
*
    ADD [  0100+  0101]  0001  3 15.0   66.79    5.10 12.25  56.28  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0102  1 15.0    6.13    1.03 12.25  57.37 0.70   0.000
    [I%=20.0:S%= 1.00]
*
    ADD [  0001+  0102]  0005  3 15.0   72.92    6.13 12.25  56.38  n/a   0.000
*
    CHANNEL[ 2:  0005]   0007  1 15.0   72.92    5.26 12.25  56.38  n/a   0.000
*
    ADD [  0013+  0007]  0014  3 15.0   87.08    6.65 12.25  55.82  n/a   0.000
*
    CHANNEL[ 2:  0014]   0015  1 15.0   87.08    7.21 12.50  55.82  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD         0107  1 15.0    2.33    0.22 12.25  24.49 0.30   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.11]
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0106  1 15.0    5.90    1.01 12.25  57.81 0.71   0.000
    [I%=25.0:S%= 1.50]
*
    DIVERT HYD           0017  1 15.0    5.90    1.01 12.25  57.81  n/a   0.000
       Outflow           0002  2 15.0    5.90    1.01 12.25  57.81  n/a   0.000
       Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
    ADD [  0107+  0017]  0020  3 15.0    8.23    1.23 12.25  48.37  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]
```

```
    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0108  1 15.0   11.33    1.33 12.25  57.81 0.71   0.000
    [I%=25.0:S%= 1.50]
*
    ADD [  0108+  0020]  0021  3 15.0   19.56    2.55 12.25  53.84  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0109  1 15.0    3.20    0.78 12.25  69.64 0.85   0.000
    [I%=60.0:S%= 1.00]
*
    ADD [  0109+  0021]  0022  3 15.0   22.76    3.33 12.25  56.06  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD         0113  1 15.0    4.52    0.56 12.25  42.94 0.53   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.21]
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD         0115  1 15.0    3.51    0.45 12.25  42.25 0.52   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.20]
*
    READ STORM                15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0114  1 15.0    1.33    0.35 12.25  74.82 0.92   0.000
    [I%=75.0:S%= 1.50]
*
    DIVERT HYD           0077  1 15.0    1.33    0.35 12.25  74.82  n/a   0.000
       Outflow           0001  2 15.0    1.33    0.35 12.25  74.82  n/a   0.000
       Outflow           0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
      Outflow           0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0116  1 15.0    2.94    0.54 12.25  61.02 0.75   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0115+  0116]  0033  3 15.0    6.45    0.99 12.25  50.81  n/a   0.000
*
   ADD [  0033+  0077]  0033  1 15.0    7.78    1.34 12.25  54.91  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0117  1 15.0    4.06    0.59 12.25  63.82 0.78   0.000
   [I%=35.0:S%= 1.00]
*
   ADD [  0117+  0017]  0078  3 15.0    4.06    0.59 12.25  63.82  n/a   0.000
*
   ADD [  0078+  0033]  0078  1 15.0   11.84    1.93 12.25  57.97  n/a   0.000
*
   DIVERT HYD           0079  1 15.0   11.84    1.93 12.25  57.97  n/a   0.000
      Outflow           0002  2 15.0   11.84    1.93 12.25  57.97  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0110  1 15.0    3.36    0.57 12.25  57.37 0.70   0.000
   [I%=20.0:S%= 1.50]
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0111  1 15.0   18.70    2.06 12.25  57.37 0.70   0.000
   [I%=20.0:S%= 1.50]
*
   ADD [  0110+  0111]  0025  3 15.0   22.06    2.63 12.25  57.37  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0112  1 15.0    0.89    0.24 12.25  78.49 0.96   0.000
   [I%=85.0:S%= 1.00]
*
   ADD [  0112+  0025]  0028  3 15.0   22.95    2.87 12.25  58.19  n/a   0.000
*
   ADD [  0113+  0015]  0036  3 15.0   91.60    7.49 12.50  55.18  n/a   0.000
*
   ADD [  0036+  0022]  0036  1 15.0  114.36    8.99 12.50  55.36  n/a   0.000
*
   ADD [  0036+  0028]  0036  3 15.0  137.31   11.59 12.25  55.83  n/a   0.000
*
   ADD [  0036+  0079]  0036  1 15.0  149.15   13.52 12.25  56.00  n/a   0.000
*
** Reservoir
   OUTFLOW:             0035  1 15.0  149.15    5.66 13.00  55.98  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0119  1 15.0    0.93    0.16 12.25  57.37 0.70   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0119+  0035]  0038  3 15.0  150.08    5.68 13.00  55.99  n/a   0.000
*
   ADD [  0038+  0079]  0038  1 15.0  150.08    5.68 13.00  55.99  n/a   0.000
*
   CHANNEL[ 2:  0038]   0039  1 15.0  150.08    5.04 13.25  55.99  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB NASHYD         0200  1 15.0   24.31    1.40 12.50  46.98 0.58   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB NASHYD         0300  1 15.0   10.50    0.60 12.75  46.98 0.58   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.58]
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0310  1 15.0   14.39    1.68 12.25  60.25 0.74   0.000
   [I%=30.0:S%= 2.00]
*
   ADD [  0300+  0310]  0045  3 15.0   24.89    2.07 12.25  54.65  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0320  1 15.0   12.97    2.84 12.25  77.59 0.95   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0320+  0045]  0046  3 15.0   37.86    4.91 12.25  62.51  n/a   0.000
*
** Reservoir
   OUTFLOW:             0047  1 15.0   37.86    0.84 13.50  62.48  n/a   0.000
*
   ADD [  0200+  0039]  0040  3 15.0  174.39    5.94 13.25  54.73  n/a   0.000
*
   ADD [  0040+  0047]  0040  1 15.0  212.25    6.77 13.25  56.12  n/a   0.000
*
   CHANNEL[ 2:  0040]   0048  1 15.0  212.25    6.68 13.50  56.12  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB NASHYD         0600  1 15.0    3.88    0.17 13.00  47.06 0.58   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.86]
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0400  1 15.0   52.66    6.05 12.25  60.76 0.74   0.000
   [I%=30.0:S%= 2.00]
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0500  1 15.0    1.62    0.41 12.25  76.38 0.94   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0400+  0500]  0051  3 15.0   54.28    6.46 12.25  61.23  n/a   0.000
*
   CHANNEL[ 2:  0051]   0053  1 15.0   54.28    4.49 12.50  61.23  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0700  1 15.0   39.37    4.66 12.25  62.11 0.76   0.000
   [I%=30.0:S%= 2.00]
*
** Reservoir
   OUTFLOW:             0056  1 15.0   39.37    1.18 13.25  62.09  n/a   0.000
*
   READ STORM                   15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 * CALIB STANDHYD       0800  1 15.0    2.61    0.52 12.25  73.29 0.90   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0048+  0053]  0052  3 15.0  266.53    8.25 13.25  57.16  n/a   0.000
*
   ADD [  0052+  0056]  0052  1 15.0  305.90    9.43 13.25  57.79  n/a   0.000
*
   ADD [  0052+  0600]  0052  3 15.0  309.78    9.59 13.25  57.66  n/a   0.000
*
   ADD [  0052+  0800]  0052  1 15.0  312.39    9.64 13.25  57.79  n/a   0.000
*
   CHANNEL[ 2:  0052]   0058  1 15.0  312.39    9.66 13.50  57.79  n/a   0.000
*
   READ STORM                   15.0
```

```
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD        0900  1 15.0    4.09    0.24 12.50  46.98 0.58   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      0910  1 15.0    6.07    0.73 12.25  60.76 0.74   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0900+  0910]  0061  3 15.0   10.16    0.88 12.25  55.21  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      0920  1 15.0    0.87    0.18 12.25  65.87 0.81   0.000
   [I%=45.0:S%= 1.50]
*
   ADD [  0061+  0920]  0062  3 15.0   11.03    1.07 12.25  56.05  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      0930  1 15.0    5.40    0.65 12.25  60.76 0.74   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0062+  0930]  0065  3 15.0   16.43    1.72 12.25  57.60  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0066  1 15.0   16.43    0.52 13.25  57.56  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      1000  1 15.0   12.99    1.32 12.25  60.76 0.74   0.000
```

```
   [I%=30.0:S%= 1.50]
*
 ** Reservoir
   OUTFLOW:             0069  1 15.0   12.99    0.35 13.50  60.69  n/a   0.000
*
   ADD [  0058+  0066]  0067  3 15.0  328.82   10.16 13.50  57.78  n/a   0.000
*
   ADD [  0067+  0069]  0067  1 15.0  341.81   10.51 13.50  57.89  n/a   0.000
*
   CHANNEL[ 2:  0067]   0070  1 15.0  341.81   10.30 13.50  57.89  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD        1100  1 15.0   21.15    1.56 12.50  46.73 0.57   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.42]
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB NASHYD        1200  1 15.0   17.50    1.12 12.50  46.92 0.57   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.51]
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      1300  1 15.0    5.06    1.03 12.25  74.47 0.91   0.000
   [I%=65.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 *  CALIB STANDHYD      1400  1 15.0   26.51    5.54 12.25  74.82 0.92   0.000
   [I%=75.0:S%= 2.00]
*
   ADD [  1100+  1200]  0071  3 15.0   38.65    2.68 12.50  46.82  n/a   0.000
*
   ADD [  0071+  1300]  0071  1 15.0   43.71    3.16 12.25  50.02  n/a   0.000
```

```
*
   ADD [  0071+  1400]  0071  3 15.0   70.22    8.70 12.25  59.38  n/a   0.000
*
   ADD [  0071+  0070]  0071  1 15.0  412.03   11.67 13.50  58.14  n/a   0.000
*
==================================================================================
=======================

       V    V   I    SSSSS  U    U    A    L              (v 5.2.2003)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\04b
76d56-031d-4615-bf60-dc59dadb681a\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\04b
76d56-031d-4615-bf60-dc59dadb681a\sce

DATE: 10/04/2021                          TIME: 07:22:33

USER:     Warren Creek - Existing Condition
          2-yr 24-Hour SCS Type II
COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : 2yr SCS                       **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms
```

```
     START @  0.00 hrs
     --------------------
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0104  1 15.0    9.24    0.25 12.50  22.04 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.55]
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD      0103  1 15.0    4.02    0.41 12.25  41.87 0.83   0.000
   [I%=45.0:S%= 1.00]
*
   ADD [  0103+  0104]  0012  3 15.0   13.26    0.58 12.25  28.05  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD        0105  1 15.0    0.90    0.04 12.25  13.19 0.26   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.12]
*
   ADD [  0105+  0012]  0013  3 15.0   14.16    0.63 12.25  27.11  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD        0101  1 15.0    9.36    0.27 12.50  22.03 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.53]
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD      0100  1 15.0   57.43    2.32 12.25  30.52 0.61   0.000
```

```
    [I%=25.0:S%= 1.00]
*
    ADD [  0100+  0101]  0001  3 15.0   66.79    2.51 12.25  29.33  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0102  1 15.0    6.13    0.35 12.25  30.02 0.60   0.000
    [I%=20.0:S%= 1.00]
*
    ADD [  0001+  0102]  0005  3 15.0   72.92    2.86 12.25  29.39  n/a   0.000
*
    CHANNEL[ 2:  0005]   0007  1 15.0   72.92    2.38 12.50  29.39  n/a   0.000
*
    ADD [  0013+  0007]  0014  3 15.0   87.08    2.91 12.25  29.02  n/a   0.000
*
    CHANNEL[ 2:  0014]   0015  1 15.0   87.08    3.37 12.50  29.02  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0107  1 15.0    2.33    0.10 12.25  11.49 0.23   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.11]
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0106  1 15.0    5.90    0.36 12.25  30.52 0.61   0.000
    [I%=25.0:S%= 1.50]
*
    DIVERT HYD           0017  1 15.0    5.90    0.36 12.25  30.52  n/a   0.000
       Outflow           0002  2 15.0    5.90    0.36 12.25  30.52  n/a   0.000
       Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
    ADD [  0107+  0017]  0020  3 15.0    8.23    0.47 12.25  25.13  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]
```

```
    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0108  1 15.0   11.33    0.68 12.25  30.52 0.61   0.000
    [I%=25.0:S%= 1.50]
*
    ADD [  0108+  0020]  0021  3 15.0   19.56    1.14 12.25  28.25  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0109  1 15.0    3.20    0.44 12.25  40.17 0.80   0.000
    [I%=60.0:S%= 1.00]
*
    ADD [  0109+  0021]  0022  3 15.0   22.76    1.58 12.25  29.93  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0113  1 15.0    4.52    0.26 12.25  20.15 0.40   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.21]
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0115  1 15.0    3.51    0.21 12.25  19.83 0.39   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.20]
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0114  1 15.0    1.33    0.21 12.25  44.42 0.88   0.000
    [I%=75.0:S%= 1.50]
*
    DIVERT HYD           0077  1 15.0    1.33    0.21 12.25  44.42  n/a   0.000
       Outflow           0001  2 15.0    1.33    0.21 12.25  44.42  n/a   0.000
       Outflow           0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
       Outflow           0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0116  1 15.0    2.94    0.21 12.25  32.97 0.65   0.000
    [I%=30.0:S%= 1.50]
*
    ADD [  0115+  0116]  0033  3 15.0    6.45    0.41 12.25  25.82  n/a   0.000
*
    ADD [  0033+  0077]  0033  1 15.0    7.78    0.62 12.25  29.00  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0117  1 15.0    4.06    0.32 12.25  35.15 0.70   0.000
    [I%=35.0:S%= 1.00]
*
    ADD [  0117+  0017]  0078  3 15.0    4.06    0.32 12.25  35.15  n/a   0.000
*
    ADD [  0078+  0033]  0078  1 15.0   11.84    0.94 12.25  31.11  n/a   0.000
*
    DIVERT HYD           0079  1 15.0   11.84    0.94 12.25  31.11  n/a   0.000
       Outflow           0002  2 15.0   11.84    0.94 12.25  31.11  n/a   0.000
       Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0110  1 15.0    3.36    0.19 12.25  30.01 0.60   0.000
    [I%=20.0:S%= 1.50]
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0111  1 15.0   18.70    1.05 12.25  30.02 0.60   0.000
```

```
    [I%=20.0:S%= 1.50]
*
    ADD [  0110+  0111]  0025  3 15.0   22.06    1.24 12.25  30.02  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0112  1 15.0    0.89    0.15 12.25  47.49 0.94   0.000
    [I%=85.0:S%= 1.00]
*
    ADD [  0112+  0025]  0028  3 15.0   22.95    1.39 12.25  30.70  n/a   0.000
*
    ADD [  0113+  0015]  0036  3 15.0   91.60    3.50 12.50  28.58  n/a   0.000
*
    ADD [  0036+  0022]  0036  1 15.0  114.36    4.24 12.50  28.85  n/a   0.000
*
    ADD [  0036+  0028]  0036  3 15.0  137.31    5.25 12.50  29.16  n/a   0.000
*
    ADD [  0036+  0079]  0036  1 15.0  149.15    6.02 12.25  29.31  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0035  1 15.0  149.15    1.05 14.50  29.29  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0119  1 15.0    0.93    0.06 12.25  30.01 0.60   0.000
    [I%=20.0:S%= 1.00]
*
    ADD [  0119+  0035]  0038  3 15.0  150.08    1.05 14.50  29.30  n/a   0.000
*
    ADD [  0038+  0079]  0038  1 15.0  150.08    1.05 14.50  29.30  n/a   0.000
*
    CHANNEL[ 2:  0038]   0039  1 15.0  150.08    0.96 15.25  29.30  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0200  1 15.0   24.31    0.65 12.75  22.05 0.44   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.57]
*
    READ STORM                 15.0
```

```
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0300  1 15.0   10.50    0.28 12.75  22.05 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.58]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0310  1 15.0   14.39    0.82 12.25  32.42 0.64   0.000
   [I%=30.0:S%= 2.00]
*
   ADD [  0300+  0310]  0045  3 15.0   24.89    1.00 12.25  28.04  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0320  1 15.0   12.97    1.68 12.25  46.61 0.92   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0320+  0045]  0046  3 15.0   37.86    2.68 12.25  34.40  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0047  1 15.0   37.86    0.53 13.50  34.37  n/a   0.000
*
   ADD [  0200+  0039]  0040  3 15.0  174.39    1.05 15.25  28.29  n/a   0.000
*
   ADD [  0040+  0047]  0040  1 15.0  212.25    1.41 14.50  29.37  n/a   0.000
*
   CHANNEL[ 2:  0040]   0048  1 15.0  212.25    1.40 14.75  29.37  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0600  1 15.0    3.88    0.08 13.00  22.09 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.86]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]
```

```
   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0400  1 15.0   52.66    2.93 12.25  32.78 0.65   0.000
   [I%=30.0:S%= 2.00]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0500  1 15.0    1.62    0.24 12.25  45.57 0.90   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0400+  0500]  0051  3 15.0   54.28    3.17 12.25  33.17  n/a   0.000
*
   CHANNEL[ 2:  0051]   0053  1 15.0   54.28    1.61 12.50  33.16  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0700  1 15.0   39.37    2.27 12.25  33.75 0.67   0.000
   [I%=30.0:S%= 2.00]
*
 ** Reservoir
   OUTFLOW:             0056  1 15.0   39.37    0.27 14.50  33.73  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0800  1 15.0    2.61    0.30 12.25  42.92 0.85   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0048+  0053]  0052  3 15.0  266.53    2.37 13.00  30.14  n/a   0.000
*
   ADD [  0052+  0056]  0052  1 15.0  305.90    2.56 13.25  30.61  n/a   0.000
*
   ADD [  0052+  0600]  0052  3 15.0  309.78    2.64 13.25  30.50  n/a   0.000
*
   ADD [  0052+  0800]  0052  1 15.0  312.39    2.67 13.25  30.60  n/a   0.000
*
   CHANNEL[ 2:  0052]   0058  1 15.0  312.39    2.73 13.25  30.60  n/a   0.000
*
   READ STORM                 15.0
```

```
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         0900  1 15.0    4.09    0.11 12.75  22.05 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0910  1 15.0    6.07    0.36 12.25  32.78 0.65   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0900+  0910]  0061  3 15.0   10.16    0.43 12.25  28.46  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0920  1 15.0    0.87    0.08 12.25  36.94 0.73   0.000
   [I%=45.0:S%= 1.50]
*
   ADD [  0061+  0920]  0062  3 15.0   11.03    0.51 12.25  29.13  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0930  1 15.0    5.40    0.32 12.25  32.78 0.65   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0062+  0930]  0065  3 15.0   16.43    0.84 12.25  30.33  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0066  1 15.0   16.43    0.17 13.75  30.29  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1000  1 15.0   12.99    0.71 12.25  32.78 0.65   0.000
```

```
   [I%=30.0:S%= 1.50]
*
 ** Reservoir
   OUTFLOW:             0069  1 15.0   12.99    0.11 14.50  32.71  n/a   0.000
*
   ADD [  0058+  0066]  0067  3 15.0  328.82    2.87 13.25  30.59  n/a   0.000
*
   ADD [  0067+  0069]  0067  1 15.0  341.81    2.95 13.25  30.67  n/a   0.000
*
   CHANNEL[ 2:  0067]   0070  1 15.0  341.81    2.83 13.75  30.67  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         1100  1 15.0   21.15    0.72 12.50  21.93 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.42]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB NASHYD         1200  1 15.0   17.50    0.51 12.50  22.02 0.44   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.51]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1300  1 15.0    5.06    0.60 12.25  43.94 0.87   0.000
   [I%=65.0:S%= 2.00]
*
   READ STORM                 15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1400  1 15.0   26.51    3.26 12.25  44.42 0.88   0.000
   [I%=75.0:S%= 2.00]
*
   ADD [  1100+  1200]  0071  3 15.0   38.65    1.23 12.50  21.97  n/a   0.000
*
   ADD [  0071+  1300]  0071  1 15.0   43.71    1.56 12.25  24.51  n/a   0.000
```

```
*
    ADD [  0071+  1400]  0071  3 15.0   70.22    4.82 12.25  32.03  n/a   0.000
*
    ADD [  0071+  0070]  0071  1 15.0  412.03    5.25 12.25  30.90  n/a   0.000
*
===============================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 5.2.2003)
       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
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\190
be41d-b7ec-4a53-8604-e60eafe7ab79\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\190
be41d-b7ec-4a53-8604-e60eafe7ab79\sce


DATE: 10/04/2021                           TIME: 07:22:35

USER:

COMMENTS:
```

Warren Creek - Existing Condition
50-yr 24-Hour SCS Type II

```
  ************************************************
  ** SIMULATION : 50 yr SCS                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms
```

```
      START @  0.00 hrs
      -------------------
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0104  1 15.0    9.24    0.65 12.50  55.20 0.61   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.55]
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0103  1 15.0    4.02    1.04 12.25  81.70 0.90   0.000
    [I%=45.0:S%= 1.00]
*
    ADD [  0103+  0104]  0012  3 15.0   13.26    1.50 12.25  63.24  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0105  1 15.0    0.90    0.11 12.25  33.03 0.36   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.12]
*
    ADD [  0105+  0012]  0013  3 15.0   14.16    1.61 12.25  61.32  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0101  1 15.0    9.36    0.68 12.50  55.18 0.61   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.53]
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0100  1 15.0   57.43    5.40 12.25  66.58 0.73   0.000
```

```
    [I%=25.0:S%= 1.00]
*
    ADD [  0100+  0101]  0001  3 15.0   66.79    5.89 12.25  64.99  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0102  1 15.0    6.13    1.21 12.25  66.17 0.73   0.000
    [I%=20.0:S%= 1.00]
*
    ADD [  0001+  0102]  0005  3 15.0   72.92    7.10 12.25  65.09  n/a   0.000
*
    CHANNEL[ 2:  0005]   0007  1 15.0   72.92    6.14 12.25  65.09  n/a   0.000
*
    ADD [  0013+  0007]  0014  3 15.0   87.08    7.75 12.25  64.47  n/a   0.000
*
    CHANNEL[ 2:  0014]   0015  1 15.0   87.08    8.33 12.50  64.47  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0107  1 15.0    2.33    0.26 12.25  28.79 0.32   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.11]
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0106  1 15.0    5.90    1.18 12.25  66.58 0.73   0.000
    [I%=25.0:S%= 1.50]
*
    DIVERT HYD           0017  1 15.0    5.90    1.18 12.25  66.58  n/a   0.000
       Outflow           0002  2 15.0    5.90    1.18 12.25  66.58  n/a   0.000
       Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
    ADD [  0107+  0017]  0020  3 15.0    8.23    1.43 12.25  55.88  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]
```

```
    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0108  1 15.0   11.33    1.54 12.25  66.58 0.73   0.000
    [I%=25.0:S%= 1.50]
*
    ADD [  0108+  0020]  0021  3 15.0   19.56    2.97 12.25  62.08  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0109  1 15.0    3.20    0.88 12.25  78.89 0.86   0.000
    [I%=60.0:S%= 1.00]
*
    ADD [  0109+  0021]  0022  3 15.0   22.76    3.85 12.25  64.44  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0113  1 15.0    4.52    0.66 12.25  50.48 0.55   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.21]
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0115  1 15.0    3.51    0.52 12.25  49.66 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.20]
*
    READ STORM                 15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0114  1 15.0    1.33    0.39 12.25  84.26 0.92   0.000
    [I%=75.0:S%= 1.50]
*
    DIVERT HYD           0077  1 15.0    1.33    0.39 12.25  84.26  n/a   0.000
       Outflow           0001  2 15.0    1.33    0.39 12.25  84.26  n/a   0.000
       Outflow           0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
       Outflow           0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
      Outflow           0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0116  1 15.0    2.94    0.63 12.25  69.97 0.77   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0115+  0116]  0033  3 15.0    6.45    1.15 12.25  58.92  n/a   0.000
*
   ADD [  0033+  0077]  0033  1 15.0    7.78    1.55 12.25  63.25  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0117  1 15.0    4.06    0.90 12.25  72.91 0.80   0.000
   [I%=35.0:S%= 1.00]
*
   ADD [  0117+  0017]  0078  3 15.0    4.06    0.90 12.25  72.91  n/a   0.000
*
   ADD [  0078+  0033]  0078  1 15.0   11.84    2.45 12.25  66.56  n/a   0.000
*
   DIVERT HYD           0079  1 15.0   11.84    2.45 12.25  66.56  n/a   0.000
      Outflow           0002  2 15.0   11.84    2.45 12.25  66.56  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0110  1 15.0    3.36    0.67 12.25  66.17 0.73   0.000
   [I%=20.0:S%= 1.50]
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0111  1 15.0   18.70    3.61 12.25  66.17 0.73   0.000
```

```
   [I%=20.0:S%= 1.50]
*
   ADD [  0110+  0111]  0025  3 15.0   22.06    4.28 12.25  66.17  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0112  1 15.0    0.89    0.27 12.25  88.06 0.97   0.000
   [I%=85.0:S%= 1.00]
*
   ADD [  0112+  0025]  0028  3 15.0   22.95    4.55 12.25  67.02  n/a   0.000
*
   ADD [  0113+  0015]  0036  3 15.0   91.60    8.65 12.50  63.78  n/a   0.000
*
   ADD [  0036+  0022]  0036  1 15.0  114.36   10.40 12.50  63.91  n/a   0.000
*
   ADD [  0036+  0028]  0036  3 15.0  137.31   14.77 12.25  64.43  n/a   0.000
*
   ADD [  0036+  0079]  0036  1 15.0  149.15   17.22 12.25  64.60  n/a   0.000
*
** Reservoir
   OUTFLOW:             0035  1 15.0  149.15    7.48 12.75  64.59  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0119  1 15.0    0.93    0.19 12.25  66.17 0.73   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0119+  0035]  0038  3 15.0  150.08    7.52 12.75  64.60  n/a   0.000
*
   ADD [  0038+  0079]  0038  1 15.0  150.08    7.52 12.75  64.60  n/a   0.000
*
   CHANNEL[ 2:  0038]   0039  1 15.0  150.08    6.74 13.25  64.60  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0200  1 15.0   24.31    1.66 12.50  55.22 0.61   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                  15.0
```

```
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0300  1 15.0   10.50    0.71 12.75  55.23 0.61   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.58]
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0310  1 15.0   14.39    1.93 12.25  69.14 0.76   0.000
   [I%=30.0:S%= 2.00]
*
   ADD [  0300+  0310]  0045  3 15.0   24.89    2.40 12.25  63.27  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0320  1 15.0   12.97    3.19 12.25  87.15 0.96   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0320+  0045]  0046  3 15.0   37.86    5.60 12.25  71.45  n/a   0.000
*
** Reservoir
   OUTFLOW:             0047  1 15.0   37.86    0.97 13.50  71.42  n/a   0.000
*
   ADD [  0200+  0039]  0040  3 15.0  174.39    7.79 13.25  63.29  n/a   0.000
*
   ADD [  0040+  0047]  0040  1 15.0  212.25    8.76 13.25  64.74  n/a   0.000
*
   CHANNEL[ 2:  0040]   0048  1 15.0  212.25    8.85 13.25  64.74  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB NASHYD         0600  1 15.0    3.88    0.20 13.00  55.33 0.61   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.86]
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]
```

```
   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0400  1 15.0   52.66    6.97 12.25  69.69 0.76   0.000
   [I%=30.0:S%= 2.00]
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0500  1 15.0    1.62    0.47 12.25  85.91 0.94   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0400+  0500]  0051  3 15.0   54.28    7.44 12.25  70.18  n/a   0.000
*
   CHANNEL[ 2:  0051]   0053  1 15.0   54.28    5.47 12.50  70.18  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0700  1 15.0   39.37    5.37 12.25  71.13 0.78   0.000
   [I%=30.0:S%= 2.00]
*
** Reservoir
   OUTFLOW:             0056  1 15.0   39.37    1.52 13.00  71.10  n/a   0.000
*
   READ STORM                  15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0800  1 15.0    2.61    0.59 12.25  82.73 0.91   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0048+  0053]  0052  3 15.0  266.53   11.13 13.25  65.85  n/a   0.000
*
   ADD [  0052+  0056]  0052  1 15.0  305.90   12.63 13.25  66.52  n/a   0.000
*
   ADD [  0052+  0600]  0052  3 15.0  309.78   12.82 13.25  66.38  n/a   0.000
*
   ADD [  0052+  0800]  0052  1 15.0  312.39   12.88 13.25  66.52  n/a   0.000
*
   CHANNEL[ 2:  0052]   0058  1 15.0  312.39   12.84 13.25  66.52  n/a   0.000
*
   READ STORM                  15.0
```

```
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB NASHYD        0900  1 15.0    4.09    0.28 12.50  55.22 0.61   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      0910  1 15.0    6.07    0.83 12.25  69.69 0.76   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0900+  0910] 0061  3 15.0   10.16    1.02 12.25  63.87  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      0920  1 15.0    0.87    0.21 12.25  75.00 0.82   0.000
   [I%=45.0:S%= 1.50]
*
   ADD [  0061+  0920] 0062  3 15.0   11.03    1.23 12.25  64.75  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      0930  1 15.0    5.40    0.75 12.25  69.69 0.76   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0062+  0930] 0065  3 15.0   16.43    1.98 12.25  66.37  n/a   0.000
*
 ** Reservoir
   OUTFLOW:            0066  1 15.0   16.43    0.64 13.25  66.33  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      1000  1 15.0   12.99    1.50 12.25  69.69 0.76   0.000
```

```
   [I%=30.0:S%= 1.50]
*
 ** Reservoir
   OUTFLOW:            0069  1 15.0   12.99    0.43 13.50  69.62  n/a   0.000
*
   ADD [  0058+  0066] 0067  3 15.0  328.82   13.48 13.25  66.51  n/a   0.000
*
   ADD [  0067+  0069] 0067  1 15.0  341.81   13.90 13.25  66.63  n/a   0.000
*
   CHANNEL[ 2:  0067]  0070  1 15.0  341.81   13.55 13.50  66.63  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB NASHYD        1100  1 15.0   21.15    1.83 12.50  54.94 0.60   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.42]
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB NASHYD        1200  1 15.0   17.50    1.33 12.50  55.16 0.60   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.51]
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      1300  1 15.0    5.06    1.17 12.25  83.94 0.92   0.000
   [I%=65.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 91.20 mm ]

   remark: 50yr 24hr 15min SCS

*
 * CALIB STANDHYD      1400  1 15.0   26.51    6.25 12.25  84.26 0.92   0.000
   [I%=75.0:S%= 2.00]
*
   ADD [  1100+  1200] 0071  3 15.0   38.65    3.16 12.50  55.04  n/a   0.000
*
   ADD [  0071+  1300] 0071  1 15.0   43.71    3.69 12.25  58.38  n/a   0.000
```

```
*
   ADD [  0071+  1400] 0071  3 15.0   70.22    9.94 12.25  68.15  n/a   0.000
*
   ADD [  0071+  0070] 0071  1 15.0  412.03   15.34 13.25  66.89  n/a   0.000
*
==================================================================================
========================


       V    V   I    SSSSS  U    U    A    L              (v 5.2.2003)
       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
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\a24
bda69-5c17-4ae5-9b9c-0ae407b2c91a\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\a24
bda69-5c17-4ae5-9b9c-0ae407b2c91a\sce


DATE: 10/04/2021                           TIME: 07:22:37

USER:      Warren Creek - Existing Condition
           5-yr 24-Hour SCS Type II
COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : 5yr SCS                       **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
```

```
     START @  0.00 hrs
     --------------------
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD       0104  1 15.0    9.24    0.36 12.50  31.19 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.55]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD      0103  1 15.0    4.02    0.67 12.25  53.48 0.86   0.000
   [I%=45.0:S%= 1.00]
*
   ADD [  0103+  0104] 0012  3 15.0   13.26    0.91 12.25  37.95  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD        0105  1 15.0    0.90    0.06 12.25  18.66 0.30   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.12]
*
   ADD [  0105+  0012] 0013  3 15.0   14.16    0.98 12.25  36.72  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD        0101  1 15.0    9.36    0.38 12.50  31.18 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.53]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD      0100  1 15.0   57.43    3.15 12.25  40.73 0.65   0.000
```

```
   [I%=25.0:S%= 1.00]
*
   ADD [  0100+  0101]  0001  3 15.0   66.79    3.41 12.25  39.39  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0102  1 15.0    6.13    0.48 12.25  40.25 0.65   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0001+  0102]  0005  3 15.0   72.92    3.89 12.25  39.46  n/a   0.000
*
   CHANNEL[ 2:  0005]   0007  1 15.0   72.92    3.28 12.50  39.46  n/a   0.000
*
   ADD [  0013+  0007]  0014  3 15.0   87.08    4.20 12.25  39.01  n/a   0.000
*
   CHANNEL[ 2:  0014]   0015  1 15.0   87.08    4.69 12.50  39.01  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD         0107  1 15.0    2.33    0.14 12.25  16.27 0.26   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.11]
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0106  1 15.0    5.90    0.50 12.25  40.72 0.65   0.000
   [I%=25.0:S%= 1.50]
*
   DIVERT HYD           0017  1 15.0    5.90    0.50 12.25  40.72  n/a   0.000
      Outflow           0002  2 15.0    5.90    0.50 12.25  40.72  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   ADD [  0107+  0017]  0020  3 15.0    8.23    0.64 12.25  33.80  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]
```

```
   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0108  1 15.0   11.33    0.93 12.25  40.72 0.65   0.000
   [I%=25.0:S%= 1.50]
*
   ADD [  0108+  0020]  0021  3 15.0   19.56    1.57 12.25  37.81  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0109  1 15.0    3.20    0.57 12.25  51.37 0.82   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0109+  0021]  0022  3 15.0   22.76    2.14 12.25  39.72  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD         0113  1 15.0    4.52    0.37 12.25  28.52 0.46   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.21]
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD         0115  1 15.0    3.51    0.29 12.25  28.06 0.45   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.20]
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0114  1 15.0    1.33    0.26 12.25  56.05 0.90   0.000
   [I%=75.0:S%= 1.50]
*
   DIVERT HYD           0077  1 15.0    1.33    0.26 12.25  56.05  n/a   0.000
      Outflow           0001  2 15.0    1.33    0.26 12.25  56.05  n/a   0.000
      Outflow           0001  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
      Outflow           0001  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0001  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0116  1 15.0    2.94    0.28 12.25  43.52 0.70   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0115+  0116]  0033  3 15.0    6.45    0.58 12.25  35.11  n/a   0.000
*
   ADD [  0033+  0077]  0033  1 15.0    7.78    0.84 12.25  38.69  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0117  1 15.0    4.06    0.42 12.25  45.98 0.74   0.000
   [I%=35.0:S%= 1.00]
*
   ADD [  0117+  0017]  0078  3 15.0    4.06    0.42 12.25  45.98  n/a   0.000
*
   ADD [  0078+  0033]  0078  1 15.0   11.84    1.26 12.25  41.19  n/a   0.000
*
   DIVERT HYD           0079  1 15.0   11.84    1.26 12.25  41.19  n/a   0.000
      Outflow           0002  2 15.0   11.84    1.26 12.25  41.19  n/a   0.000
      Outflow           0002  3 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  4 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  5 15.0    0.00    0.00  0.00   0.00  n/a   0.000
      Outflow           0002  6 15.0    0.00    0.00  0.00   0.00  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0110  1 15.0    3.36    0.26 12.25  40.25 0.64   0.000
   [I%=20.0:S%= 1.50]
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0111  1 15.0   18.70    1.42 12.25  40.25 0.65   0.000
```

```
   [I%=20.0:S%= 1.50]
*
   ADD [  0110+  0111]  0025  3 15.0   22.06    1.69 12.25  40.25  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0112  1 15.0    0.89    0.18 12.25  59.40 0.95   0.000
   [I%=85.0:S%= 1.00]
*
   ADD [  0112+  0025]  0028  3 15.0   22.95    1.87 12.25  40.99  n/a   0.000
*
   ADD [  0113+  0015]  0036  3 15.0   91.60    4.87 12.50  38.50  n/a   0.000
*
   ADD [  0036+  0022]  0036  1 15.0  114.36    5.99 12.50  38.74  n/a   0.000
*
   ADD [  0036+  0028]  0036  3 15.0  137.31    7.44 12.50  39.12  n/a   0.000
*
   ADD [  0036+  0079]  0036  1 15.0  149.15    8.52 12.25  39.28  n/a   0.000
*
** Reservoir
   OUTFLOW:             0035  1 15.0  149.15    2.57 13.50  39.26  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB STANDHYD       0119  1 15.0    0.93    0.11 12.25  40.24 0.64   0.000
   [I%=20.0:S%= 1.00]
*
   ADD [  0119+  0035]  0038  3 15.0  150.08    2.58 13.50  39.27  n/a   0.000
*
   ADD [  0038+  0079]  0038  1 15.0  150.08    2.58 13.50  39.27  n/a   0.000
*
   CHANNEL[ 2:  0038]   0039  1 15.0  150.08    2.18 14.00  39.27  n/a   0.000
*
   READ STORM                 15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 * CALIB NASHYD         0200  1 15.0   24.31    0.92 12.75  31.20 0.50   0.000
   [CN=84.0         ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                 15.0
```

```
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB NASHYD         0300  1 15.0   10.50    0.40 12.75  31.21 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.58]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0310  1 15.0   14.39    1.08 12.25  42.87 0.69   0.000
   [I%=30.0:S%= 2.00]
*
   ADD [  0300+  0310]  0045  3 15.0   24.89    1.33 12.25  37.95  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0320  1 15.0   12.97    2.13 12.25  58.50 0.94   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0320+  0045]  0046  3 15.0   37.86    3.47 12.25  44.99  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0047  1 15.0   37.86    0.67 13.50  44.96  n/a   0.000
*
   ADD [  0200+  0039]  0040  3 15.0  174.39    2.44 14.00  38.15  n/a   0.000
*
   ADD [  0040+  0047]  0040  1 15.0  212.25    3.10 14.00  39.36  n/a   0.000
*
   CHANNEL[ 2:  0040]   0048  1 15.0  212.25    3.09 14.00  39.36  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB NASHYD         0600  1 15.0    3.88    0.11 13.00  31.26 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.86]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]
```

```
   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0400  1 15.0   52.66    3.86 12.25  43.30 0.69   0.000
   [I%=30.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0500  1 15.0    1.62    0.31 12.25  57.39 0.92   0.000
   [I%=70.0:S%= 2.00]
*
   ADD [  0400+  0500]  0051  3 15.0   54.28    4.17 12.25  43.72  n/a   0.000
*
   CHANNEL[ 2:  0051]   0053  1 15.0   54.28    2.34 12.50  43.72  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0700  1 15.0   39.37    2.97 12.25  44.43 0.71   0.000
   [I%=30.0:S%= 2.00]
*
 ** Reservoir
   OUTFLOW:             0056  1 15.0   39.37    0.50 14.00  44.41  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0800  1 15.0    2.61    0.38 12.25  54.53 0.87   0.000
   [I%=60.0:S%= 1.00]
*
   ADD [  0048+  0053]  0052  3 15.0  266.53    4.08 13.75  40.25  n/a   0.000
*
   ADD [  0052+  0056]  0052  1 15.0  305.90    4.57 13.75  40.78  n/a   0.000
*
   ADD [  0052+  0600]  0052  3 15.0  309.78    4.65 13.75  40.66  n/a   0.000
*
   ADD [  0052+  0800]  0052  1 15.0  312.39    4.68 13.75  40.78  n/a   0.000
*
   CHANNEL[ 2:  0052]   0058  1 15.0  312.39    4.67 14.00  40.78  n/a   0.000
*
   READ STORM                15.0
```

```
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB NASHYD         0900  1 15.0    4.09    0.16 12.75  31.20 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.57]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0910  1 15.0    6.07    0.47 12.25  43.30 0.69   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0900+  0910]  0061  3 15.0   10.16    0.57 12.25  38.43  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0920  1 15.0    0.87    0.11 12.25  47.89 0.77   0.000
   [I%=45.0:S%= 1.50]
*
   ADD [  0061+  0920]  0062  3 15.0   11.03    0.68 12.25  39.17  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       0930  1 15.0    5.40    0.42 12.25  43.30 0.69   0.000
   [I%=30.0:S%= 1.50]
*
   ADD [  0062+  0930]  0065  3 15.0   16.43    1.10 12.25  40.53  n/a   0.000
*
 ** Reservoir
   OUTFLOW:             0066  1 15.0   16.43    0.30 13.50  40.49  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1000  1 15.0   12.99    0.92 12.25  43.30 0.69   0.000
```

```
   [I%=30.0:S%= 1.50]
*
 ** Reservoir
   OUTFLOW:             0069  1 15.0   12.99    0.19 14.00  43.22  n/a   0.000
*
   ADD [  0058+  0066]  0067  3 15.0  328.82    4.95 14.00  40.76  n/a   0.000
*
   ADD [  0067+  0069]  0067  1 15.0  341.81    5.14 14.00  40.86  n/a   0.000
*
   CHANNEL[ 2:  0067]   0070  1 15.0  341.81    5.04 14.00  40.86  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB NASHYD         1100  1 15.0   21.15    1.03 12.50  31.04 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.42]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB NASHYD         1200  1 15.0   17.50    0.74 12.50  31.16 0.50   0.000
   [CN=84.0        ]
   [ N = 3.0:Tp 0.51]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

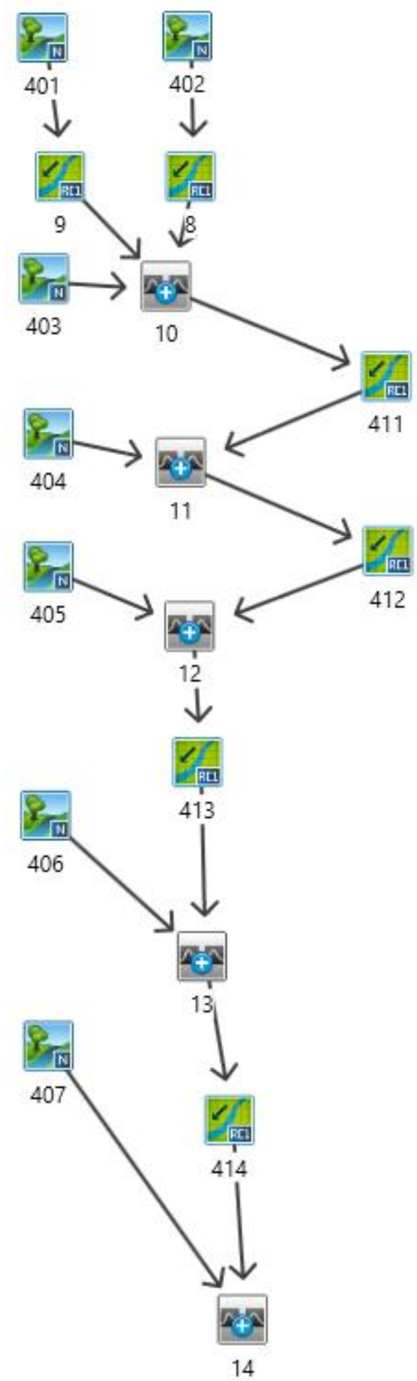
*
 *  CALIB STANDHYD       1300  1 15.0    5.06    0.76 12.25  55.62 0.89   0.000
   [I%=65.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 62.40 mm ]

   remark: 5yr 24hr 15min SCS

*
 *  CALIB STANDHYD       1400  1 15.0   26.51    4.12 12.25  56.05 0.90   0.000
   [I%=75.0:S%= 2.00]
*
   ADD [  1100+  1200]  0071  3 15.0   38.65    1.76 12.50  31.10  n/a   0.000
*
   ADD [  0071+  1300]  0071  1 15.0   43.71    2.15 12.25  33.94  n/a   0.000
```

```
*
    ADD [  0071+  1400]  0071  3 15.0   70.22    6.26 12.25  42.28  n/a   0.000
*
    ADD [  0071+  0070]  0071  1 15.0  412.03    6.88 12.25  41.10  n/a   0.000
*
```

Grassy Brook Layout



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

       V    V   I   SSSSS  U   U    A    L             (v 5.2.2003)
       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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                  *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\0c2
8f0db-0250-4abe-a579-e4b53825565a\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\0c2
8f0db-0250-4abe-a579-e4b53825565a\sce

DATE: 10/04/2021

USER:

COMMENTS: ____________________________________________________________
```

Lyons Creek - Existing Condition
100-yr 24-Hour SCS Type II

```
  ***********************************************
  ** SIMULATION : 100yr 24hr 15min SCS          **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0401  1 15.0  288.80    6.67 14.50  52.74 0.54   0.000
    [CN=77.0         ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]  0009  1 15.0  288.80    5.50 15.75  52.73  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0402  1 15.0  500.20    7.36 16.75  54.08 0.55   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]  0008  1 15.0  500.20    5.84 19.50  54.07  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0403  1 15.0  149.40    3.49 14.75  55.04 0.56   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    7.26 17.75  54.29  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40   12.33 16.50  53.81  n/a   0.000
*
    CHANNEL[ 2:  0010]  0411  1 15.0  938.40   11.93 17.25  53.81  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0404  1 15.0  197.30    4.58 14.75  57.87 0.59   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.52]
*
    ADD [  0404+  0411]  0011  3 15.0 1135.70   15.31 16.50  54.52  n/a   0.000
*
    CHANNEL[ 2:  0011]  0412  1 15.0 1135.70   15.24 17.00  54.52  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0405  1 15.0   56.10    1.82 13.75  57.87 0.59   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.64]
*
    ADD [  0405+  0412]  0012  3 15.0 1191.80   15.93 16.75  54.68  n/a   0.000
*
    CHANNEL[ 2:  0012]  0413  1 15.0 1191.80   15.63 17.25  54.67  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0406  1 15.0   65.30    1.55 14.75  57.87 0.59   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.45]
*
    ADD [  0406+  0413]  0013  3 15.0 1257.10   16.65 17.25  54.84  n/a   0.000
*
    CHANNEL[ 2:  0013]  0414  1 15.0 1257.10   16.62 17.25  54.84  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.40 mm ]

    remark: 100yr 24hr 15min SCS

*
 ** CALIB NASHYD        0407  1 15.0   16.70    0.66 13.50  57.87 0.59   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.27]
*
    ADD [  0407+  0414]  0014  3 15.0 1273.80   16.74 17.25  54.88  n/a   0.000
*
 FINISH

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

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

       V    V   I   SSSSS  U   U    A    L             (v 5.2.2003)
       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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                  *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\134
7eadf-3735-4915-b8d1-e4c40b0da700\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\134
7eadf-3735-4915-b8d1-e4c40b0da700\sce

DATE: 10/04/2021                              TIME: 08:51:32

USER:

COMMENTS: ____________________________________________________________
```

Lyons Creek - Existing Condition
10-yr 24-Hour SCS Type II

```
  ***********************************************
  ** SIMULATION : 10yr 24hr 15min SCS           **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD        0401  1 15.0  288.80    4.06 14.50  32.50 0.45   0.000
    [CN=77.0         ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]  0009  1 15.0  288.80    3.34 16.00  32.50  n/a   0.000
```

```
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0402  1 15.0  500.20    4.52 16.75  33.48 0.47   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]   0008  1 15.0  500.20    3.55 19.75  33.48  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0403  1 15.0  149.40    2.14 14.75  34.12 0.47   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    4.40 18.00  33.63  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40    7.48 16.50  33.28  n/a   0.000
*
    CHANNEL[ 2:  0010]   0411  1 15.0  938.40    7.21 17.50  33.28  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0404  1 15.0  197.30    2.84 15.00  36.24 0.50   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.52]
*
    ADD [  0404+  0411]  0011  3 15.0 1135.70    9.24 16.75  33.79  n/a   0.000
*
    CHANNEL[ 2:  0011]   0412  1 15.0 1135.70    9.19 17.00  33.79  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0405  1 15.0   56.10    1.13 13.75  36.24 0.50   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.64]
```

```
*
    ADD [  0405+  0412]  0012  3 15.0 1191.80    9.61 17.00  33.91  n/a   0.000
*
    CHANNEL[ 2:  0012]   0413  1 15.0 1191.80    9.40 17.50  33.91  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0406  1 15.0   65.30    0.96 14.75  36.24 0.50   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.45]
*
    ADD [  0406+  0413]  0013  3 15.0 1257.10   10.01 17.50  34.03  n/a   0.000
*
    CHANNEL[ 2:  0013]   0414  1 15.0 1257.10   10.00 17.50  34.03  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 72.00 mm ]

    remark: 10yr 24hr 15min SCS

*
 ** CALIB NASHYD         0407  1 15.0   16.70    0.41 13.50  36.24 0.50   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.27]
*
    ADD [  0407+  0414]  0014  3 15.0 1273.80   10.08 17.50  34.06  n/a   0.000
*
=================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L               (v 5.2.2003)
       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
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\619
ad9e8-abe7-4a5d-b0d1-ab661cff9fca\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\619
ad9e8-abe7-4a5d-b0d1-ab661cff9fca\sce


DATE: 10/04/2021                           TIME: 08:51:33

USER:

COMMENTS: ____
```

Lyons Creek - Existing Condition
25-yr 24-Hour SCS Type II

```
  ***********************************************
  ** SIMULATION : 25yr 24hr 15min SCS          **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0401  1 15.0  288.80    4.98 14.50  39.62 0.49   0.000
    [CN=77.0         ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]   0009  1 15.0  288.80    4.09 16.00  39.61  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0402  1 15.0  500.20    5.52 16.75  40.73 0.50   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]   0008  1 15.0  500.20    4.34 19.50  40.73  n/a   0.000
*
```

```
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0403  1 15.0  149.40    2.62 14.75  41.49 0.51   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    5.39 18.00  40.91  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40    9.17 16.50  40.51  n/a   0.000
*
    CHANNEL[ 2:  0010]   0411  1 15.0  938.40    8.85 17.50  40.51  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0404  1 15.0  197.30    3.45 14.75  43.90 0.54   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.52]
*
    ADD [  0404+  0411]  0011  3 15.0 1135.70   11.36 16.75  41.10  n/a   0.000
*
    CHANNEL[ 2:  0011]   0412  1 15.0 1135.70   11.29 17.00  41.09  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0405  1 15.0   56.10    1.37 13.75  43.90 0.54   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.64]
*
    ADD [  0405+  0412]  0012  3 15.0 1191.80   11.80 16.75  41.23  n/a   0.000
*
    CHANNEL[ 2:  0012]   0413  1 15.0 1191.80   11.58 17.50  41.23  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 81.60 mm ]

    remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD         0406  1 15.0   65.30    1.17 14.75  43.90 0.54   0.000
    [CN=81.0         ]
```

```
   [ N = 3.0:Tp 2.45]
*
   ADD [  0406+  0413]  0013  3 15.0 1257.10   12.34 17.25  41.36  n/a   0.000
*
   CHANNEL[ 2:  0013]   0414  1 15.0 1257.10   12.33 17.50  41.36  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 81.60 mm ]

   remark: 25yr 24hr 15min SCS

*
 ** CALIB NASHYD        0407  1 15.0   16.70    0.50 13.50  43.89 0.54   0.000
   [CN=81.0        ]
   [ N = 3.0:Tp 1.27]
*
   ADD [  0407+  0414]  0014  3 15.0 1273.80   12.42 17.50  41.40  n/a   0.000
*
===================================================================================
=======================


      V    V   I    SSSSS  U   U    A    L              (v 5.2.2003)
      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
Developed and Distributed by Civica Infrastructure
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\454
8888a-18a2-4f13-9efc-a4bdb3119889\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\454
8888a-18a2-4f13-9efc-a4bdb3119889\sce


DATE: 10/04/2021                           TIME: 08:51:32
```

```
USER:

COMMENTS: Lyons Creek - Existing Condition
          2-yr 24-Hour SCS Type II

  ************************************************
  ** SIMULATION : 2yr 24hr 15min SCS            **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0401  1 15.0  288.80    2.20 14.50  17.92 0.36   0.000
    [CN=77.0        ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]   0009  1 15.0  288.80    1.81 16.00  17.91  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0402  1 15.0  500.20    2.47 17.00  18.56 0.37   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]   0008  1 15.0  500.20    1.93 19.75  18.55  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 50.40 mm ]

    remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0403  1 15.0  149.40    1.17 14.75  18.90 0.37   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    2.39 18.25  18.63  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40    4.04 16.50  18.41  n/a   0.000
```

```
*
   CHANNEL[ 2:  0010]   0411  1 15.0  938.40    3.88 17.75  18.41  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0404  1 15.0  197.30    1.57 15.00  20.31 0.40   0.000
   [CN=81.0        ]
   [ N = 3.0:Tp 2.52]
*
   ADD [  0404+  0411]  0011  3 15.0 1135.70    4.99 17.00  18.74  n/a   0.000
*
   CHANNEL[ 2:  0011]   0412  1 15.0 1135.70    4.96 17.25  18.74  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0405  1 15.0   56.10    0.62 14.00  20.31 0.40   0.000
   [CN=81.0        ]
   [ N = 3.0:Tp 1.64]
*
   ADD [  0405+  0412]  0012  3 15.0 1191.80    5.18 17.00  18.81  n/a   0.000
*
   CHANNEL[ 2:  0012]   0413  1 15.0 1191.80    5.06 18.00  18.81  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0406  1 15.0   65.30    0.53 14.75  20.31 0.40   0.000
   [CN=81.0        ]
   [ N = 3.0:Tp 2.45]
*
   ADD [  0406+  0413]  0013  3 15.0 1257.10    5.37 17.75  18.89  n/a   0.000
*
   CHANNEL[ 2:  0013]   0414  1 15.0 1257.10    5.36 18.00  18.89  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 50.40 mm ]

   remark: 2yr 24hr 15min SCS

*
 ** CALIB NASHYD        0407  1 15.0   16.70    0.23 13.50  20.31 0.40   0.000
```

```
    [CN=81.0        ]
    [ N = 3.0:Tp 1.27]
*
    ADD [  0407+  0414]  0014  3 15.0 1273.80    5.40 17.75  18.91  n/a   0.000
*
===================================================================================
=======================


      V    V   I    SSSSS  U   U    A    L              (v 5.2.2003)
      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
Developed and Distributed by Civica Infrastructure
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\237
599fb-ead2-4946-8b3d-e2556384f7bf\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\237
599fb-ead2-4946-8b3d-e2556384f7bf\sce


DATE: 10/04/2021                           TIME: 08:51:33

USER:

COMMENTS: Lyons Creek - Existing Condition
          50-yr 24-Hour SCS Type II

  ************************************************
  ** SIMULATION : 50yr 24hr 15min SCS           **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
```

```
      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0401  1 15.0  288.80    5.93 14.50  47.02 0.52   0.000
    [CN=77.0         ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]   0009  1 15.0  288.80    4.89 15.75  47.02  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0402  1 15.0  500.20    6.56 16.75  48.27 0.53   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]   0008  1 15.0  500.20    5.18 19.50  48.26  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0403  1 15.0  149.40    3.11 14.75  49.15 0.54   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    6.44 18.00  48.47  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40   10.95 16.50  48.02  n/a   0.000
*
    CHANNEL[ 2:  0010]   0411  1 15.0  938.40   10.58 17.50  48.02  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0404  1 15.0  197.30    4.09 14.75  51.80 0.57   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.52]
*
```

```
    ADD [  0404+  0411]  0011  3 15.0 1135.70   13.58 16.75  48.68  n/a   0.000
*
    CHANNEL[ 2:  0011]   0412  1 15.0 1135.70   13.51 17.00  48.68  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0405  1 15.0   56.10    1.63 13.75  51.80 0.57   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.64]
*
    ADD [  0405+  0412]  0012  3 15.0 1191.80   14.13 16.75  48.82  n/a   0.000
*
    CHANNEL[ 2:  0012]   0413  1 15.0 1191.80   13.86 17.50  48.82  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0406  1 15.0   65.30    1.39 14.75  51.80 0.57   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.45]
*
    ADD [  0406+  0413]  0013  3 15.0 1257.10   14.77 17.25  48.98  n/a   0.000
*
    CHANNEL[ 2:  0013]   0414  1 15.0 1257.10   14.74 17.25  48.98  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 91.20 mm ]

    remark: 50yr 24hr 15min SCS

*
 ** CALIB NASHYD         0407  1 15.0   16.70    0.59 13.50  51.80 0.57   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.27]
*
    ADD [  0407+  0414]  0014  3 15.0 1273.80   14.85 17.25  49.02  n/a   0.000
*
===================================================================================
======================

       V    V   I    SSSSS  U    U    A    L              (v 5.2.2003)
       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
Developed and Distributed by Civica Infrastructure
```


```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\5c6
0145a-fe13-4965-82d7-94c32d7eaf20\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\5c6
0145a-fe13-4965-82d7-94c32d7eaf20\sce

DATE: 10/04/2021                          TIME: 08:51:32

USER:

COMMENTS: ____________________________________________________________
```

Lyons Creek - Existing Condition
5-yr 24-Hour SCS Type II

```
  ************************************************
  ** SIMULATION : 5yr 24hr 15min SCS             **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0401  1 15.0  288.80    3.20 14.50  25.74 0.41   0.000
    [CN=77.0         ]
    [ N = 3.0:Tp 2.23]
*
    CHANNEL[ 2:  0401]   0009  1 15.0  288.80    2.63 16.00  25.74  n/a   0.000
```

```
*
    READ STORM                15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0402  1 15.0  500.20    3.57 16.75  26.58 0.43   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 4.08]
*
    CHANNEL[ 2:  0402]   0008  1 15.0  500.20    2.80 19.75  26.57  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0403  1 15.0  149.40    1.69 14.75  27.09 0.43   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 2.33]
*
    ADD [  0403+  0008]  0010  3 15.0  649.60    3.46 18.25  26.69  n/a   0.000
*
    ADD [  0010+  0009]  0010  1 15.0  938.40    5.88 16.50  26.40  n/a   0.000
*
    CHANNEL[ 2:  0010]   0411  1 15.0  938.40    5.65 17.75  26.40  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0404  1 15.0  197.30    2.25 15.00  28.91 0.46   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.52]
*
    ADD [  0404+  0411]  0011  3 15.0 1135.70    7.26 16.75  26.83  n/a   0.000
*
    CHANNEL[ 2:  0011]   0412  1 15.0 1135.70    7.22 17.25  26.83  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0405  1 15.0   56.10    0.89 14.00  28.91 0.46   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.64]
```

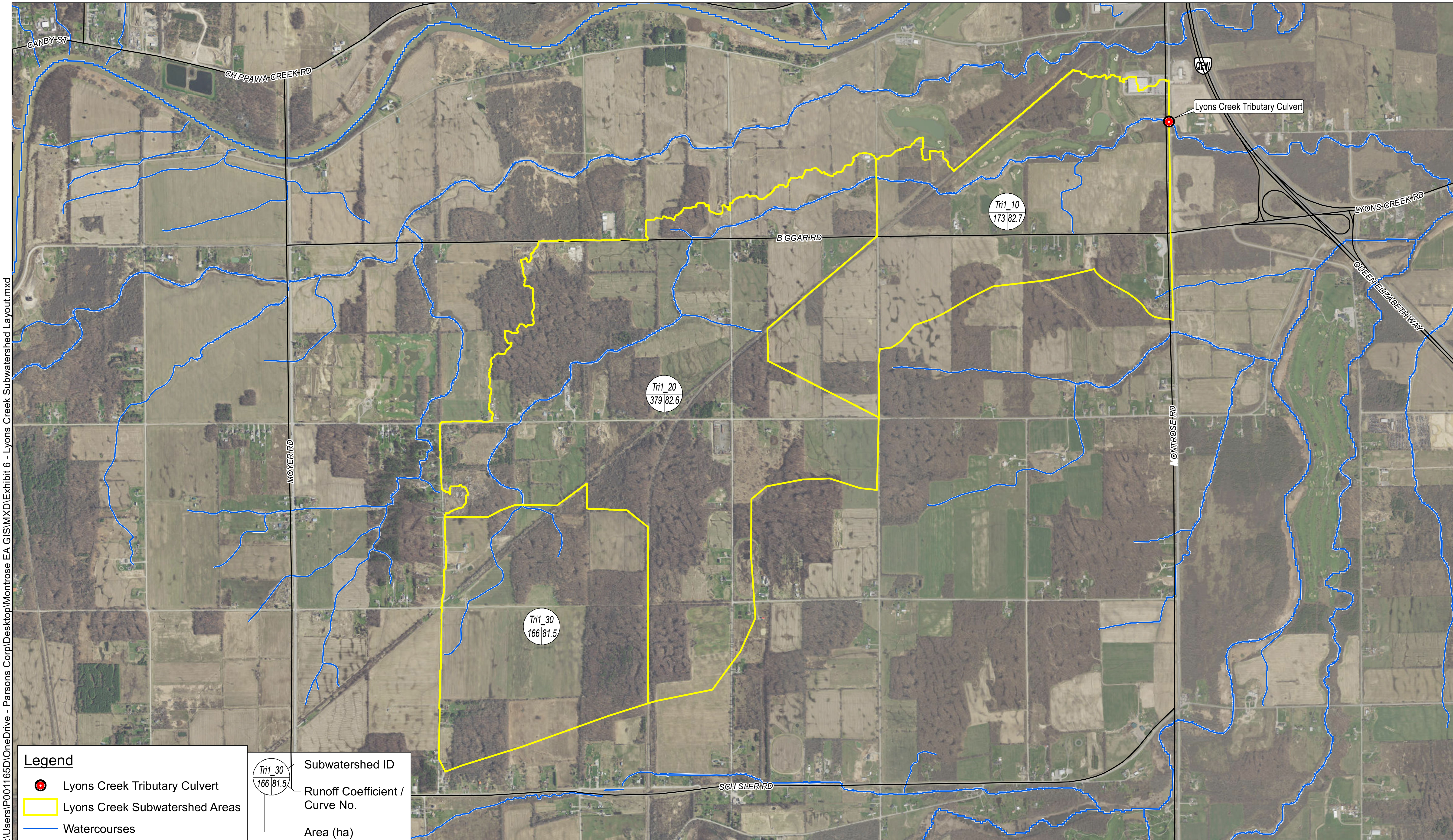
```
*
    ADD [  0405+  0412]  0012  3 15.0 1191.80    7.54 17.00  26.93  n/a   0.000
*
    CHANNEL[ 2:  0012]   0413  1 15.0 1191.80    7.35 17.75  26.93  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0406  1 15.0   65.30    0.76 14.75  28.91 0.46   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 2.45]
*
    ADD [  0406+  0413]  0013  3 15.0 1257.10    7.81 17.50  27.03  n/a   0.000
*
    CHANNEL[ 2:  0013]   0414  1 15.0 1257.10    7.80 17.75  27.03  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 62.40 mm ]

    remark: 5yr 24hr 15min SCS

*
 ** CALIB NASHYD         0407  1 15.0   16.70    0.32 13.50  28.90 0.46   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.27]
*
    ADD [  0407+  0414]  0014  3 15.0 1273.80    7.86 17.75  27.06  n/a   0.000
*
```



C:\Users\P001165D\OneDrive - Parsons Corp\Desktop\Montrose EA GIS\MXD\Exhibit 6 - Lyons Creek Subwatershed Layout.mxd

DATE	PROJECT NO.
AUGUST 2021	477511

0 0.25 0.5 0.75 1 Kilometers

1:20 000

Niagara Region

PARSONS

MONTROSE ROAD AND LYONS CREEK ROAD / BIGGAR ROAD
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT AND DETAILED DESIGN

PROJECT NO. 477511

LYONS CREEK SUBWATERSHED LAYOUT

EXHIBIT
6

Project: Lyons_Creek_Tributary
Simulation Run: SCS2yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:16

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

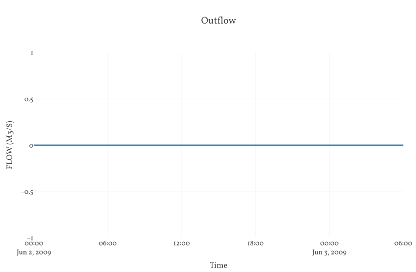
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	4.61	02Jun2009, 13:35	17.59
Tri1_30	1.66	2.18	02Jun2009, 13:15	15.91
Pt12	1.66	2.18	02Jun2009, 13:15	15.91
R_Tri1_20	1.66	1.02	02Jun2009, 17:40	14.48
Pt11	5.45	4.71	02Jun2009, 13:40	16.64
R_Tri1_10	5.45	3.6	02Jun2009, 17:10	16.31
Tri1_10	1.73	3.55	02Jun2009, 12:45	18.68
Montrose Rd	7.18	3.96	02Jun2009, 17:10	16.88
R_Tri1_00	7.18	3.73	02Jun2009, 19:00	16.64

Lyons Creek Tributary
2-yr 24-Hour SCS Type II

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

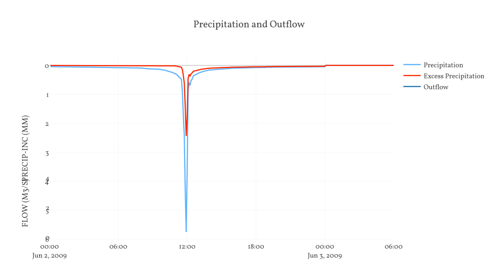
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	4.61
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	17.59
Precipitation Volume (M3)	1.88E5
Loss Volume (M3)	1.21E5
Excess Volume (M3)	66633.45
Direct Runoff Volume (M3)	66627.81
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

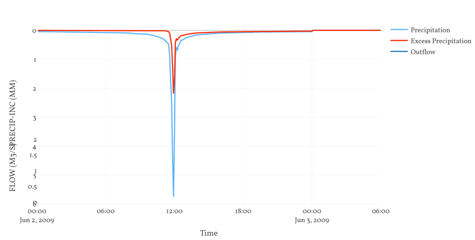
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	2.18
Time of Peak Discharge	02Jun2009, 13:15
Volume (MM)	15.91
Precipitation Volume (M3)	82155.35
Loss Volume (M3)	55754.56
Excess Volume (M3)	26400.78
Direct Runoff Volume (M3)	26400.78
Baseflow Volume (M3)	0

Precipitation and Outflow

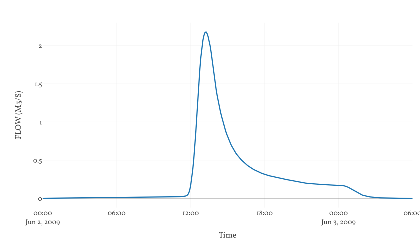


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	2.18
Time of Peak Discharge	02Jun2009, 13:15
Volume (MM)	15.91

Outflow



Reach: R_Tri1_20

Downstream : Pt11

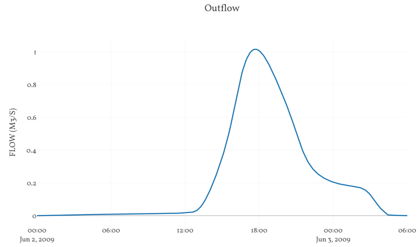
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	1.02
Time of Peak Discharge	02Jun2009, 17:40
Volume (MM)	14.48
Peak Inflow (M3/S)	2.18
Inflow Volume (M3)	26400.78

Outflow

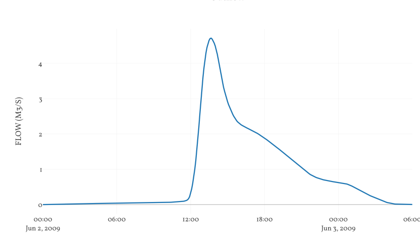


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	4.71
Time of Peak Discharge	02Jun2009, 13:40
Volume (MM)	16.64

Outflow



Reach: R_Tri1_10

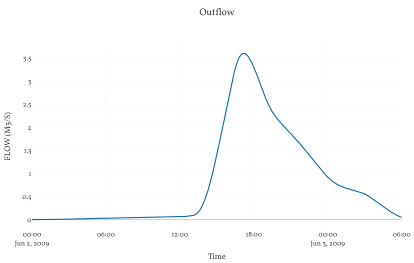
Downstream : Montrose Rd

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	3.6
Time of Peak Discharge	02Jun2009, 17:10
Volume (MM)	16.31
Peak Inflow (M3/S)	4.71
Inflow Volume (M3)	90655.57



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

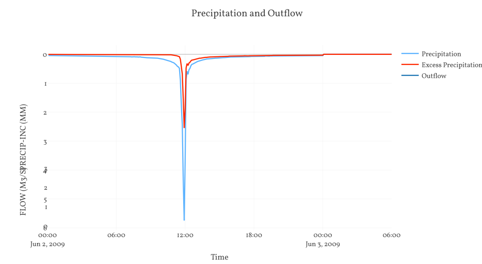
Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

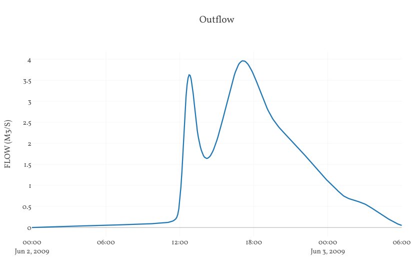
Peak Discharge (M3/S)	3.55
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	18.68
Precipitation Volume (M3)	85476.6
Loss Volume (M3)	53227.23
Excess Volume (M3)	32249.37
Direct Runoff Volume (M3)	32249.37
Baseflow Volume (M3)	0



Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	3.96
Time of Peak Discharge	02Jun2009, 17:10
Volume (MM)	16.88



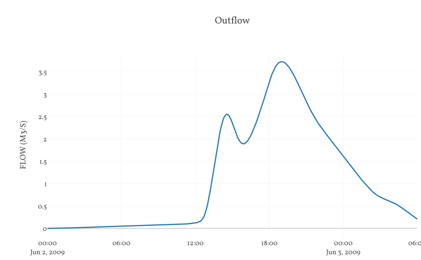
Reach: R_Tri1_00

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	3.73
Time of Peak Discharge	02Jun2009, 19:00
Volume (MM)	16.64
Peak Inflow (M3/S)	3.96
Inflow Volume (M3)	1.21E5



Project: Lyons_Creek_Tributary
Simulation Run: SCS5yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:20

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

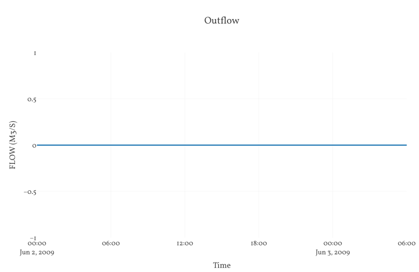
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	7.39	02Jun2009, 13:35	26.98
Tri1_30	1.66	3.59	02Jun2009, 13:10	24.92
Pt12	1.66	3.59	02Jun2009, 13:10	24.92
R_Tri1_20	1.66	1.58	02Jun2009, 17:15	22.68
Pt11	5.45	7.51	02Jun2009, 13:35	25.67
R_Tri1_10	5.45	5.52	02Jun2009, 16:50	25.09
Tri1_10	1.73	5.6	02Jun2009, 12:45	28.21
Montrose Rd	7.18	6.07	02Jun2009, 16:50	25.84
R_Tri1_00	7.18	5.63	02Jun2009, 18:35	25.44

Lyons Creek Tributary
5-yr 24-Hour SCS Type II

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

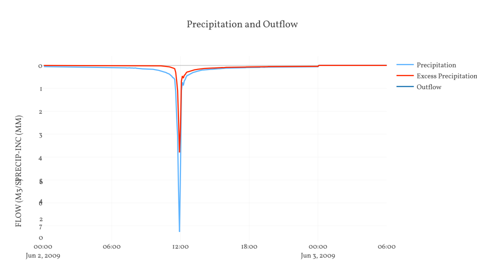
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	7.39
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	26.98
Precipitation Volume (M3)	2.37E5
Loss Volume (M3)	1.35E5
Excess Volume (M3)	1.02E5
Direct Runoff Volume (M3)	1.02E5
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

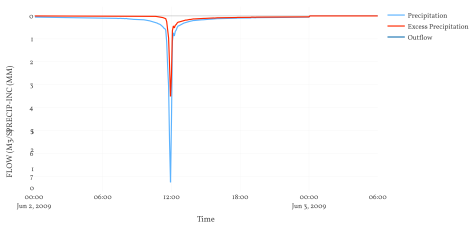
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	3.59
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	24.92
Precipitation Volume (M3)	1.04E5
Loss Volume (M3)	62540.7
Excess Volume (M3)	41356.77
Direct Runoff Volume (M3)	41356.76
Baseflow Volume (M3)	0

Precipitation and Outflow

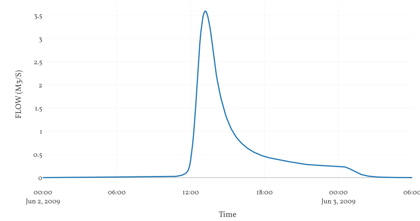


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	3.59
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	24.92

Outflow



Reach: R_Tri1_20

Downstream : Pt11

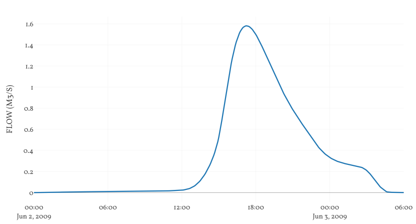
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	1.58
Time of Peak Discharge	02Jun2009, 17:15
Volume (MM)	22.68
Peak Inflow (M3/S)	3.59
Inflow Volume (M3)	41356.76

Outflow

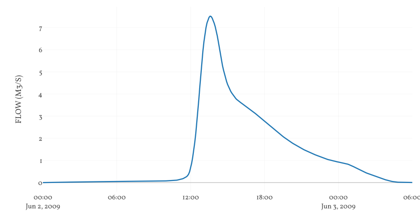


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	7.51
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	25.67

Outflow



Reach: R_Tri1_10

Downstream : Montrose Rd

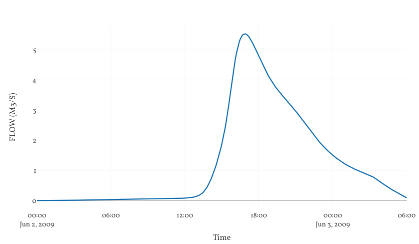
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	5.52
Time of Peak Discharge	02Jun2009, 16:50
Volume (MM)	25.09
Peak Inflow (M3/S)	7.51
Inflow Volume (M3)	1.4E5

Outflow



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

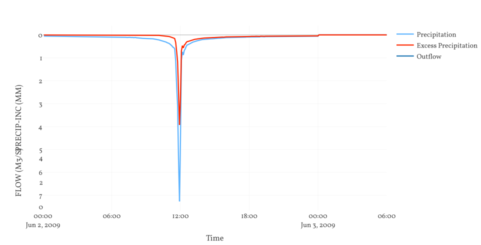
Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

Peak Discharge (M3/S)	5.6
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	28.21
Precipitation Volume (M3)	1.08E5
Loss Volume (M3)	59384.6
Excess Volume (M3)	48713.08
Direct Runoff Volume (M3)	48713.08
Baseflow Volume (M3)	0

Precipitation and Outflow

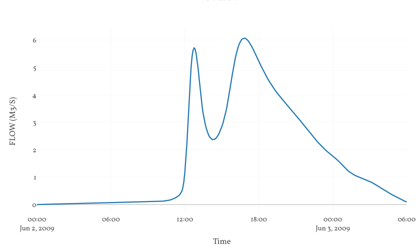


Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	6.07
Time of Peak Discharge	02Jun2009, 16:50
Volume (MM)	25.84

Outflow



Reach: R_Tri1_00

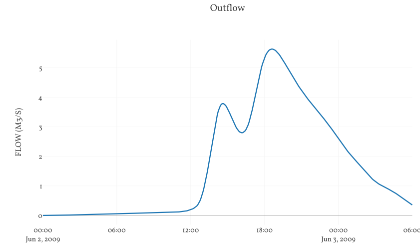
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	5.63
Time of Peak Discharge	02Jun2009, 18:35
Volume (MM)	25.44
Peak Inflow (M3/S)	6.07
Inflow Volume (M3)	1.85E5

Outflow



Project: Lyons_Creek_Tributary
Simulation Run: SCS10yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:24

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

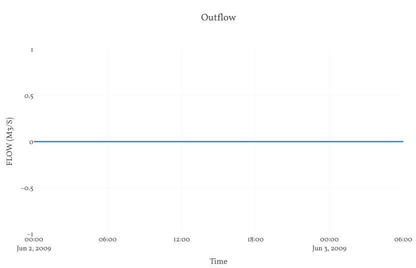
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	9.37	02Jun2009, 13:35	33.69
Tri1_30	1.66	4.62	02Jun2009, 13:10	31.41
Pt12	1.66	4.62	02Jun2009, 13:10	31.41
R_Tri1_20	1.66	2	02Jun2009, 17:00	28.63
Pt11	5.45	9.53	02Jun2009, 13:35	32.15
R_Tri1_10	5.45	6.95	02Jun2009, 16:40	31.37
Tri1_10	1.73	7.05	02Jun2009, 12:45	35
Montrose Rd	7.18	7.63	02Jun2009, 16:40	32.24
R_Tri1_00	7.18	7.06	02Jun2009, 18:20	31.72

Lyons Creek Tributary
10-yr 24-Hour SCS Type II

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

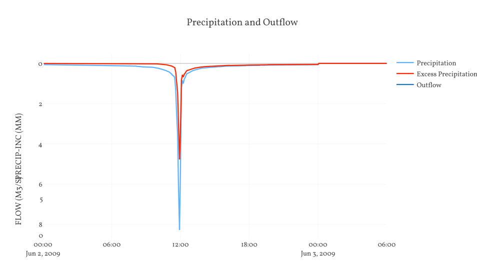
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	9.37
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	33.69
Precipitation Volume (M3)	2.7E5
Loss Volume (M3)	1.42E5
Excess Volume (M3)	1.28E5
Direct Runoff Volume (M3)	1.28E5
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

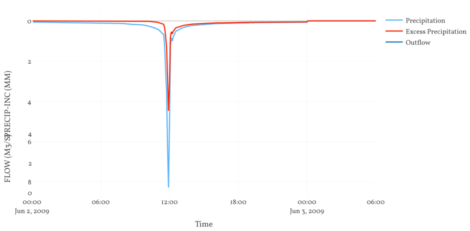
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	4.62
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	31.41
Precipitation Volume (M3)	1.18E5
Loss Volume (M3)	66211.01
Excess Volume (M3)	52125.88
Direct Runoff Volume (M3)	52125.88
Baseflow Volume (M3)	0

Precipitation and Outflow

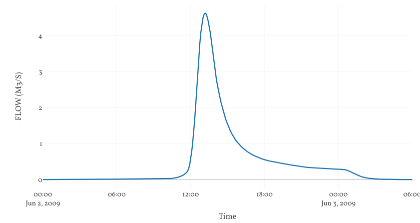


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	4.62
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	31.41

Outflow



Reach: R_Tri1_20

Downstream : Pt11

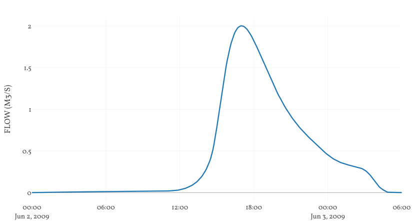
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	2
Time of Peak Discharge	02Jun2009, 17:00
Volume (MM)	28.63
Peak Inflow (M3/S)	4.62
Inflow Volume (M3)	52125.88

Outflow

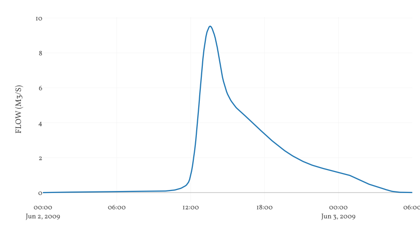


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	9.53
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	32.15

Outflow



Reach: R_Tri1_10

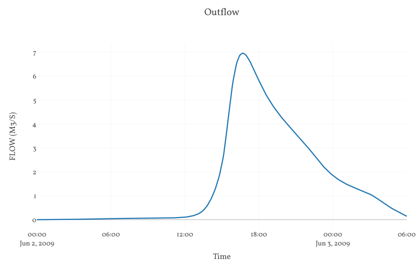
Downstream : Montrose Rd

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	6.95
Time of Peak Discharge	02Jun2009, 16:40
Volume (MM)	31.37
Peak Inflow (M3/S)	9.53
Inflow Volume (M3)	1.75E5



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

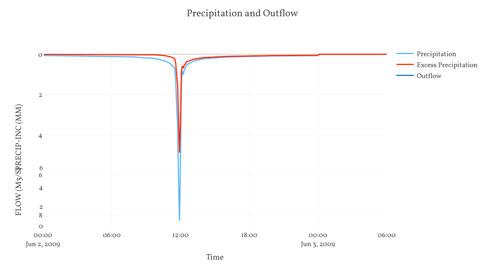
Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

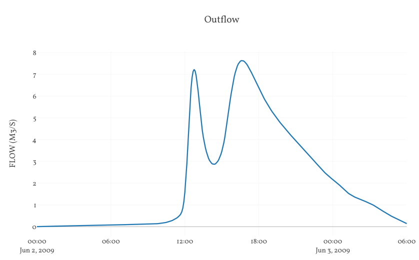
Peak Discharge (M3/S)	7.05
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	35
Precipitation Volume (M3)	1.23E5
Loss Volume (M3)	62690.77
Excess Volume (M3)	60430.07
Direct Runoff Volume (M3)	60430.07
Baseflow Volume (M3)	0



Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	7.63
Time of Peak Discharge	02Jun2009, 16:40
Volume (MM)	32.24



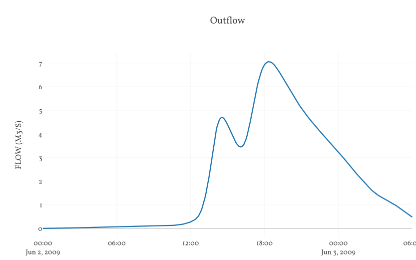
Reach: R_Tri1_00

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	7.06
Time of Peak Discharge	02Jun2009, 18:20
Volume (MM)	31.72
Peak Inflow (M3/S)	7.63
Inflow Volume (M3)	2.31E5



Project: Lyons_Creek_Tributary
Simulation Run: SCS25yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:27

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

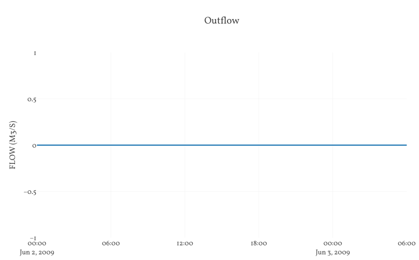
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	11.99	02Jun2009, 13:35	42.57
Tri1_30	1.66	5.98	02Jun2009, 13:10	40.04
Pt12	1.66	5.98	02Jun2009, 13:10	40.04
R_Tri1_20	1.66	2.57	02Jun2009, 16:45	36.59
Pt11	5.45	12.19	02Jun2009, 13:35	40.75
R_Tri1_10	5.45	8.91	02Jun2009, 16:30	39.72
Tri1_10	1.73	8.96	02Jun2009, 12:45	43.96
Montrose Rd	7.18	9.77	02Jun2009, 16:30	40.74
R_Tri1_00	7.18	9.02	02Jun2009, 18:05	40.02

Lyons Creek Tributary
25-yr 24-Hour SCS Type II

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

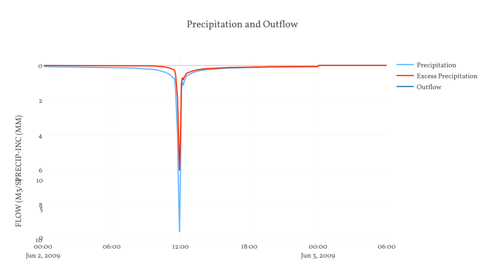
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	11.99
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	42.57
Precipitation Volume (M3)	3.12E5
Loss Volume (M3)	1.51E5
Excess Volume (M3)	1.61E5
Direct Runoff Volume (M3)	1.61E5
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

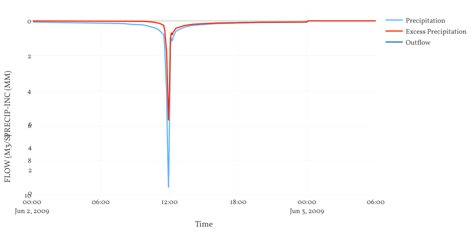
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	5.98
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	40.04
Precipitation Volume (M3)	1.37E5
Loss Volume (M3)	70139.92
Excess Volume (M3)	66453.72
Direct Runoff Volume (M3)	66453.71
Baseflow Volume (M3)	0

Precipitation and Outflow

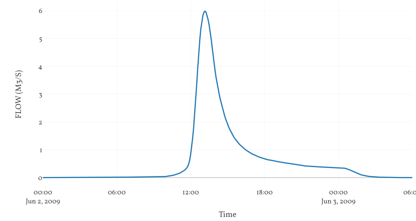


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	5.98
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	40.04

Outflow



Reach: R_Tri1_20

Downstream : Pt11

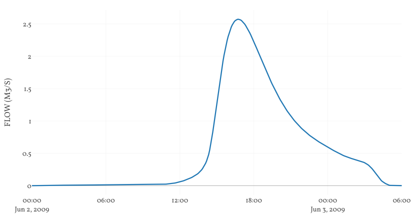
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	2.57
Time of Peak Discharge	02Jun2009, 16:45
Volume (MM)	36.59
Peak Inflow (M3/S)	5.98
Inflow Volume (M3)	66453.71

Outflow

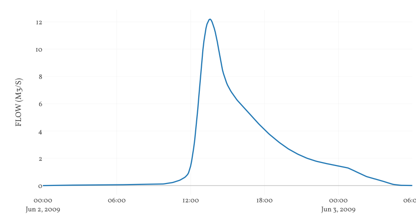


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	12.19
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	40.75

Outflow



Reach: R_Tri1_10

Downstream : Montrose Rd

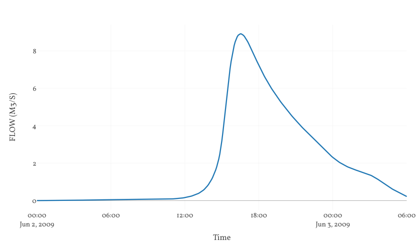
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	8.91
Time of Peak Discharge	02Jun2009, 16:30
Volume (MM)	39.72
Peak Inflow (M3/S)	12.19
Inflow Volume (M3)	2.22E5

Outflow



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

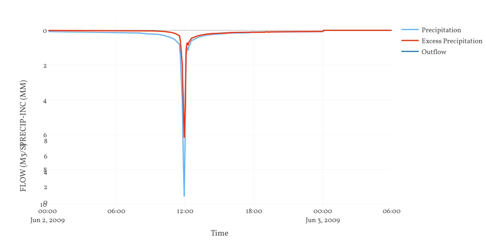
Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

Peak Discharge (M3/S)	8.96
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	43.96
Precipitation Volume (M3)	1.42E5
Loss Volume (M3)	66211.33
Excess Volume (M3)	75904.31
Direct Runoff Volume (M3)	75904.31
Baseflow Volume (M3)	0

Precipitation and Outflow

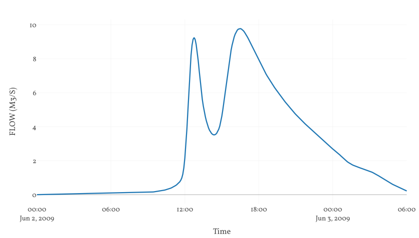


Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	9.77
Time of Peak Discharge	02Jun2009, 16:30
Volume (MM)	40.74

Outflow



Reach: R_Tri1_00

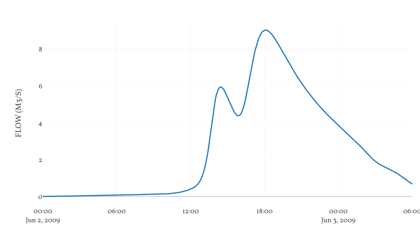
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	9.02
Time of Peak Discharge	02Jun2009, 18:05
Volume (MM)	40.02
Peak Inflow (M3/S)	9.77
Inflow Volume (M3)	2.92E5

Outflow



Project: Lyons_Creek_Tributary
Simulation Run: SCS50yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:28

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

10/4/21, 8:32 PM Standard Report

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	13.97	02Jun2009, 13:35	49.33
Tri1_30	1.66	7.01	02Jun2009, 13:10	46.64
Pt12	1.66	7.01	02Jun2009, 13:10	46.64
R_Tri1_20	1.66	3.02	02Jun2009, 16:35	42.71
Pt11	5.45	14.22	02Jun2009, 13:35	47.31
R_Tri1_10	5.45	10.45	02Jun2009, 16:25	46.08
Tri1_10	1.73	10.4	02Jun2009, 12:45	50.77
Montrose Rd	7.18	11.45	02Jun2009, 16:20	47.21
R_Tri1_00	7.18	10.57	02Jun2009, 17:55	46.34

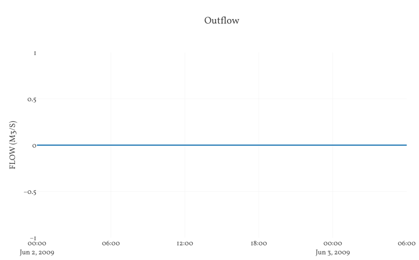
Lyons Creek Tributary
50-yr 24-Hour SCS Type II

10/4/21, 8:32 PM Standard Report

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



10/4/21, 8:32 PM Standard Report

Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

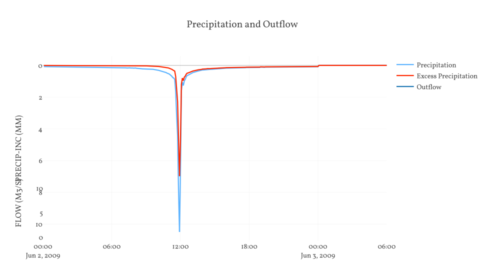
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	13.97
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	49.33
Precipitation Volume (M3)	3.43E5
Loss Volume (M3)	1.56E5
Excess Volume (M3)	1.87E5
Direct Runoff Volume (M3)	1.87E5
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

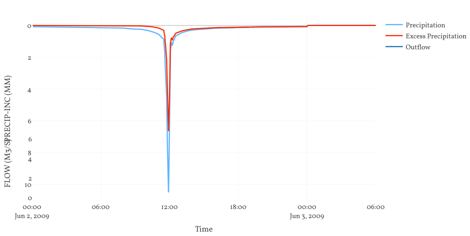
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	7.01
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	46.64
Precipitation Volume (M3)	1.5E5
Loss Volume (M3)	72628.34
Excess Volume (M3)	77408.9
Direct Runoff Volume (M3)	77408.89
Baseflow Volume (M3)	0

Precipitation and Outflow

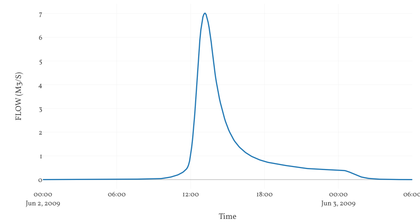


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	7.01
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	46.64

Outflow



Reach: R_Tri1_20

Downstream : Pt11

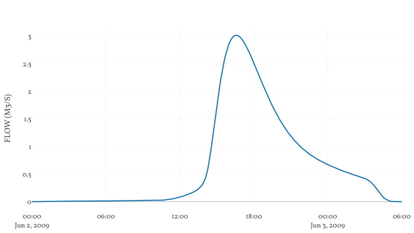
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	3.02
Time of Peak Discharge	02Jun2009, 16:35
Volume (MM)	42.71
Peak Inflow (M3/S)	7.01
Inflow Volume (M3)	77408.89

Outflow

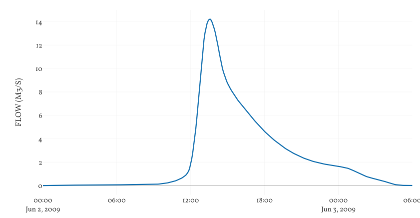


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	14.22
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	47.31

Outflow



Reach: R_Tri1_10

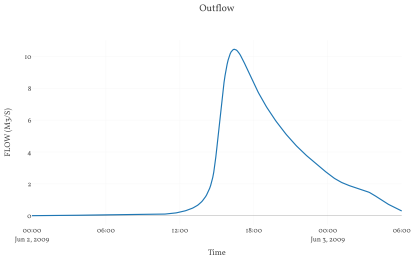
Downstream : Montrose Rd

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	10.45
Time of Peak Discharge	02Jun2009, 16:25
Volume (MM)	46.08
Peak Inflow (M3/S)	14.22
Inflow Volume (M3)	2.58E5



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

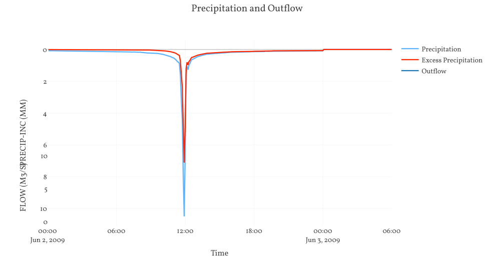
Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

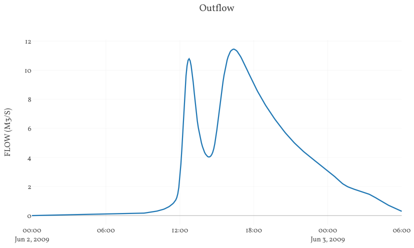
Peak Discharge (M3/S)	10.4
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	50.77
Precipitation Volume (M3)	1.56E5
Loss Volume (M3)	68431.29
Excess Volume (M3)	87671.43
Direct Runoff Volume (M3)	87671.43
Baseflow Volume (M3)	0



Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	11.45
Time of Peak Discharge	02Jun2009, 16:20
Volume (MM)	47.21



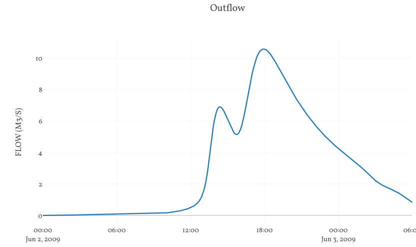
Reach: R_Tri1_00

Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	10.57
Time of Peak Discharge	02Jun2009, 17:55
Volume (MM)	46.34
Peak Inflow (M3/S)	11.45
Inflow Volume (M3)	3.39E5



Project: Lyons_Creek_Tributary
Simulation Run: SCS100yr
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 00:28

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	6.84	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

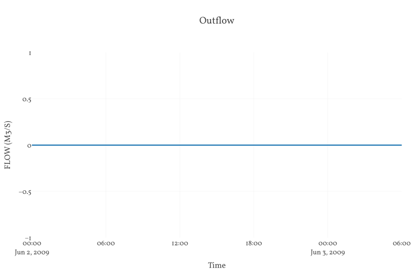
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pt2	0	0	01Jun2009, 24:00	Not specified
Tri1_20	3.79	16	02Jun2009, 13:35	56.25
Tri1_30	1.66	8.07	02Jun2009, 13:10	53.41
Pt12	1.66	8.07	02Jun2009, 13:10	53.41
R_Tri1_20	1.66	3.48	02Jun2009, 16:25	48.99
Pt11	5.45	16.28	02Jun2009, 13:35	54.03
R_Tri1_10	5.45	12.06	02Jun2009, 16:20	52.6
Tri1_10	1.73	11.87	02Jun2009, 12:45	57.73
Montrose Rd	7.18	13.2	02Jun2009, 16:15	53.83
R_Tri1_00	7.18	12.19	02Jun2009, 17:45	52.81

Lyons Creek Tributary
100-yr 24-Hour SCS Type II

Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	0
Time of Peak Discharge	01Jun2009, 24:00



Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

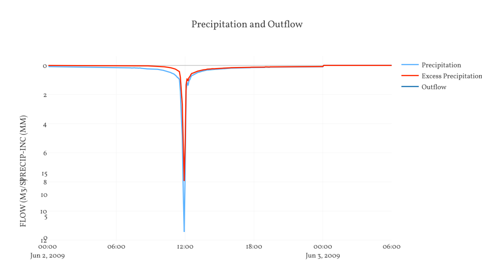
Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	16
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	56.25
Precipitation Volume (M3)	3.73E5
Loss Volume (M3)	1.6E5
Excess Volume (M3)	2.13E5
Direct Runoff Volume (M3)	2.13E5
Baseflow Volume (M3)	0



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

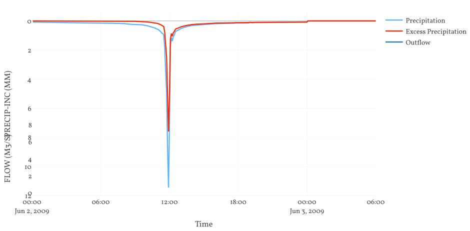
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	8.07
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	53.41
Precipitation Volume (M3)	1.63E5
Loss Volume (M3)	74838.08
Excess Volume (M3)	88642.76
Direct Runoff Volume (M3)	88642.75
Baseflow Volume (M3)	0

Precipitation and Outflow

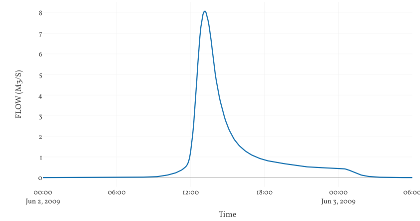


Junction: Pt12

Results: Pt12

Peak Discharge (M3/S)	8.07
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	53.41

Outflow



Reach: R_Tri1_20

Downstream : Pt11

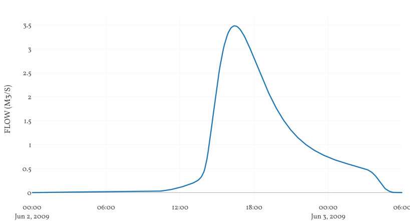
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20

Peak Discharge (M3/S)	3.48
Time of Peak Discharge	02Jun2009, 16:25
Volume (MM)	48.99
Peak Inflow (M3/S)	8.07
Inflow Volume (M3)	88642.75

Outflow

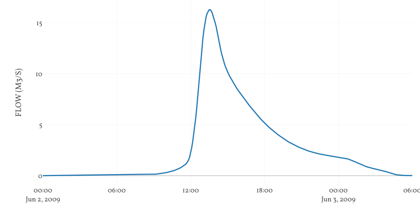


Junction: Pt11

Results: Pt11

Peak Discharge (M3/S)	16.28
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	54.03

Outflow



Reach: R_Tri1_10

Downstream : Montrose Rd

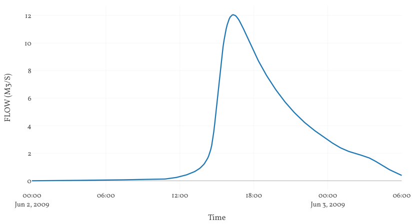
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10

Peak Discharge (M3/S)	12.06
Time of Peak Discharge	02Jun2009, 16:20
Volume (MM)	52.6
Peak Inflow (M3/S)	16.28
Inflow Volume (M3)	2.94E5

Outflow



10/4/21, 8:32 PM Standard Report

Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

Percent Impervious Area	6.84
Curve Number	82.69
Initial Abstraction	10.63

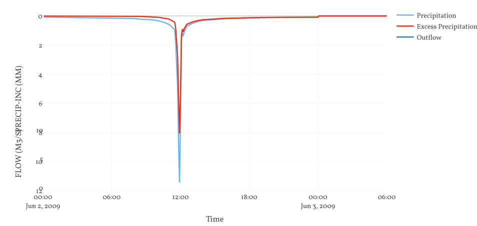
Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

Peak Discharge (M3/S)	11.87
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	57.73
Precipitation Volume (M3)	1.7E5
Loss Volume (M3)	70396.26
Excess Volume (M3)	99693.54
Direct Runoff Volume (M3)	99693.54
Baseflow Volume (M3)	0

Precipitation and Outflow



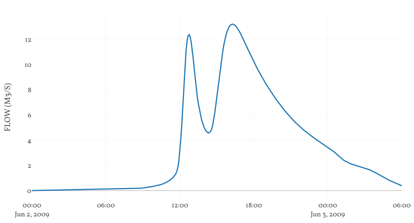
10/4/21, 8:32 PM Standard Report

Junction: Montrose Rd

Results: Montrose Rd

Peak Discharge (M3/S)	13.2
Time of Peak Discharge	02Jun2009, 16:15
Volume (MM)	53.83

Outflow



10/4/21, 8:32 PM Standard Report

Reach: R_Tri1_00

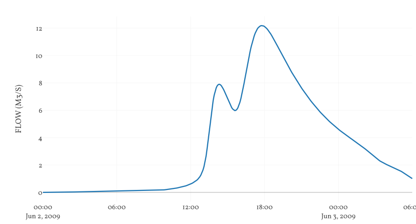
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	12.19
Time of Peak Discharge	02Jun2009, 17:45
Volume (MM)	52.81
Peak Inflow (M3/S)	13.2
Inflow Volume (M3)	3.86E5

Outflow



PARSONS

APPENDIX D

MINOR DRAINAGE AREAS HYDROLOGY

Rainfall-Runoff Parameters Calculation Sheet

Project Name: Montrose Rd and Lyons Creek Road/Biggar Rd Municipal Class Environmental Assessment
Parsons Project No.: 477511 ***Designed By:*** AZ
Consulting Engineer: Parsons ***Checked By:*** MR
Date: 10/27/2020

Culvert ID Warren Creek Tributary
Total Drainage Area (ha) 22.49

Composite Curve Number Calculation

Soil Type	Soil Series Symbol	Drainage	Hydrologic Soil Group	Land Use		Forest/ Woodland			Cultivated			Impervious Area			Lawn/Pasture			Lake/ Wetland			Avg. CN
				Area (ha)	Area (%)	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	
Niagara Heavy Clay	NGR	Imperfect	D	14.38	63.9	3.74	26	77	0	0	86	8.83	61.4	98	1.81	12.6	81	0	0	50	90.4
Fllodplain Deposits	ALU	Imperfect	D	2.31	10.3	0.88	38.1	77	0	0	86	1.43	61.9	98	0	0	81	0	0	50	90
Industrial land	NM	-	D	5.8	25.8	0.27	4.7	77	0	0	86	3.33	57.4	98	2.2	37.9	81	0	0	50	90.6
Total Area				**22.49**																**Composite CN.=**	**90.4**

Initial Abstraction Calculation

Land Cover type	Area (ha)	Area (%)	IA
Forest/woodland	4.89	21.74	10
Cultivated	0	0	7
Impervious Area	13.59	60.4	2
Lawn/Pasture	4.01	17.8	5
Lake/ Wetland	0	0	12
Total Area	**22.49**	**Avg. IA=**	**4.3**

Composite Runoff Coefficient

Soil Type	Loam		Clay	
Land Use	**Area (ha)**	**RC**	**Area (ha)**	**RC**
Woodland (Flat)	0	0.25	4.89	0.3
Cultivated (Flat)	0	0.35	0	0.5
Impervious	0	0.9	13.59	0.9
Lawn/ Pasture (Flat)	0	0.28	4.01	0.35
Composite Runoff Coefficient				**0.67**

Time of Concentration

Runoff Coef.	0.67
Area (ha)	22.49
Avg. Slope (%)	0.64
Length (m)	790
T_c (min) (Airport Method)	45.7
T_p (min) (Airport Method)	30.5
T_c (min) (Bransby Williams Method)	36.1
T_p (min) (Bransby Williams Method)	24.1

Prefered Time of Concentration Calculation Method

Calculation Method	Bransby Williams
T_c (min)	36.1
T_p (min)	24.1

Peak flow Rate calculation (Rational Method)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Rainfall Intensity (mm/hr)	31	40.3	46.5	54.1	60.6	65.9
Flow (m^3/s)	1.299	1.688	1.948	2.266	2.539	2.761

Rainfall-Runoff Parameters Calculation Sheet

Project Name: Montrose Rd and Lyons Creek Road/Biggar Rd Municipal Class Environmental Assessment
Parsons Project No.: 477511 ***Designed By:*** AZ
Consulting Engineer: Parsons ***Checked By:*** MR
Date: 10/27/2020

Culvert ID Culvert north of Chippawa Creek Rd
Total Drainage Area (ha) 9.82

Composite Curve Number Calculation

Soil Type	Soil Series Symbol	Drainage	Hydrologic Soil Group	Land Use		Forest/ Woodland			Cultivated			Impervious Area			Lawn/Pasture			Lake/ Wetland			Avg. CN
				Area (ha)	Area (%)	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	
Niagara Heavy Clay	NGR	Imperfect	D	2.58	26.3	0	0	77	0	0	86	2.06	79.8	98	0.52	20.2	81	0	0	50	94.6
Welland Heavy Clay	WLL	Poor	D	6.54	66.6	0	0	77	0	0	86	5.23	80	98	1.31	20	81	0	0	50	94.6
Industrial land	NM	-	D	0.7	7.1	0	0	77	0	0	86	0.56	80	98	0.14	20	81	0	0	50	94.6
Total Area				**9.82**															**Composite CN.=**		**94.6**

Initial Abstraction Calculation

Land Cover type	Area (ha)	Area (%)	IA
Forest/woodland	0	0	10
Cultivated	0	0	7
Impervious Area	7.85	79.9	2
Lawn/Pasture	1.97	20.1	5
Lake/ Wetland	0	0	12
Total Area	**9.82**	**Avg. IA=**	**2.6**

Composite Runoff Coefficient

Soil Type	Loam		Clay	
Land Use	**Area (ha)**	**RC**	**Area (ha)**	**RC**
Woodland (Flat)	0	0.25	0	0.3
Cultivated (Flat)	0	0.35	0	0.5
Impervious	0	0.9	7.85	0.9
Lawn/ Pasture (Flat)	0	0.28	1.97	0.35
Composite Runoff Coefficient				**0.79**

Time of Concentration

Runoff Coef.	0.79
Area (ha)	9.82
Avg. Slope (%)	0.33
Length (m)	550
T_c (min) (Airport Method)	34.2
T_p (min) (Airport Method)	22.8
T_c (min) (Bransby Williams Method)	31.1
T_p (min) (Bransby Williams Method)	20.7

Prefered Time of Concentration Calculation Method

Calculation Method	Bransby Williams
T_c (min)	31.1
T_p (min)	20.7

Peak flow Rate calculation (Rational Method)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Rainfall Intensity (mm/hr)	34.1	44.4	51.1	59.5	66.7	72.5
Flow (m^3/s)	0.735	0.958	1.102	1.283	1.438	1.564

Sensitive

Rainfall-Runoff Parameters Calculation Sheet

Project Name: Montrose Rd and Lyons Creek Road/Biggar Rd Municipal Class Environmental Assessment
Parsons Project No.: 477511 ***Designed By:*** AZ
Consulting Engineer: Parsons ***Checked By:*** MR
Date: 10/27/2020

Culvert ID FOX Limited Culvert
Total Drainage Area (ha) 3.09

Composite Curve Number Calculation

Soil Type	Soil Series Symbol	Drainage	Hydrologic Soil Group	Land Use		Forest/ Woodland			Cultivated			Impervious Area			Lawn/Pasture			Lake/ Wetland			Avg. CN
				Area (ha)	Area (%)	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	
Industrial land	NM	-	D	3.09	100	0	0	77	0	0	86	0.42	13.6	98	2.67	86.4	81	0	0	50	83.3
Total Area				**3.09**																**Composite CN.=**	**83.3**

Initial Abstraction Calculation

Land Cover type	Area (ha)	Area (%)	IA
Forest/woodland	0	0	10
Cultivated	0	0	7
Impervious Area	0.42	13.6	2
Lawn/Pasture	2.67	86.4	5
Lake/ Wetland	0	0	12
Total Area	**3.09**	**Avg. IA=**	**4.6**

Composite Runoff Coefficient

Soil Type	Loam		Clay	
Land Use	**Area (ha)**	**RC**	**Area (ha)**	**RC**
Woodland (Flat)	0	0.25	0	0.3
Cultivated (Flat)	0	0.35	0	0.5
Impervious	0	0.9	0.42	0.9
Lawn/ Pasture (Flat)	0	0.28	2.67	0.35
Composite Runoff Coefficient				**0.42**

Time of Concentration

Runoff Coef.	0.42
Area (ha)	3.09
Avg. Slope (%)	0.4
Length (m)	245
T_c (min) (Airport Method)	46.9
T_p (min) (Airport Method)	31.3
T_c (min) (Bransby Williams Method)	15
T_p (min) (Bransby Williams Method)	10

Prefered Time of Concentration Calculation Method

Calculation Method	Bransby Williams
T_c (min)	15
T_p (min)	10

Peak flow Rate calculation (Rational Method)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Rainfall Intensity (mm/hr)	53.2	68.4	78.5	90.9	102	110.2
Flow (m^3/s)	0.192	0.247	0.283	0.328	0.368	0.398

Sensitive

Rainfall-Runoff Parameters Calculation Sheet

Project Name: Montrose Rd and Lyons Creek Road/Biggar Rd Municipal Class Environmental Assessment
Parsons Project No.: 477511 ***Designed By:*** AZ
Consulting Engineer: Parsons ***Checked By:*** MR
Date: 10/27/2020

Culvert ID Biggar Rd Culvert at Sta. 4+447
Total Drainage Area (ha) 13.40

Composite Curve Number Calculation

Soil Type	Soil Series Symbol	Drainage	Hydrologic Soil Group	Land Use		Forest/ Woodland			Cultivated			Impervious Area			Lawn/Pasture			Lake/ Wetland			Avg. CN
				Area (ha)	Area (%)	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	
Welland Heavy Clay	NGR	Poor	D	12.05	100	2.75	22.8	77	0	0	86	0.75	6.2	98	8.55	71	81	0	0	50	81.1
Total Area				**12.05**														**Composite CN.=**			**81.1**

Initial Abstraction Calculation

Land Cover type	Area (ha)	Area (%)	IA
Forest/woodland	2.75	22.8	10
Cultivated	0	0	7
Impervious Area	0.75	6.2	2
Lawn/Pasture	8.55	71	5
Lake/ Wetland	0	0	12
Total Area	**12.05**	**Avg. IA=**	**6**

Composite Runoff Coefficient

Soil Type	Loam		Clay	
Land Use	**Area (ha)**	**RC**	**Area (ha)**	**RC**
Woodland (Flat)	0	0.25	2.75	0.3
Cultivated (Flat)	0	0.35	0	0.5
Impervious	0	0.9	0.75	0.9
Lawn/ Pasture (Flat)	0	0.28	8.55	0.35
Composite Runoff Coefficient				**0.37**

Time of Concentration

Runoff Coef.	0.37
Area (ha)	12.05
Avg. Slope (%)	0.45
Length (m)	455
T_c (min) (Airport Method)	66.1
T_p (min) (Airport Method)	44.1
T_c (min) (Bransby Williams Method)	23.7
T_p (min) (Bransby Williams Method)	15.8

Prefered Time of Concentration Calculation Method

Calculation Method	<u>Airport</u>
T_c (min)	66.1
T_p (min)	44.1

Peak flow Rate calculation (Rational Method)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Rainfall Intensity (mm/hr)	20.5	26.7	30.8	35.9	40.1	43.9
Flow (m^3/s)	0.283	0.368	0.425	0.495	0.553	0.605

Rainfall-Runoff Parameters Calculation Sheet

Project Name: Montrose Rd and Lyons Creek Road/Biggar Rd Municipal Class Environmental Assessment
Parsons Project No.: 477511 ***Designed By:*** AZ
Consulting Engineer: Parsons ***Checked By:*** MR
Date: 10/27/2020

Culvert ID Culvert north of Chippawa Creek Rd
Total Drainage Area (ha) 6.80

Composite Curve Number Calculation

Soil Type	Soil Series Symbol	Drainage	Hydrologic Soil Group	Land Use		Forest/ Woodland			Cultivated			Impervious Area			Lawn/Pasture			Lake/ Wetland			Avg. CN
				Area (ha)	Area (%)	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	Area (ha)	Area (%)	CN	
Welland Heavy Clay	WLL	Poor	D	6.8	100	0.82	12.1	77	0.95	14	86	0.1	1.5	98	3.3	48.5	81	1.63	24	50	74.1
Total Area				**6.8**																**Composite CN.=**	**74.1**

Initial Abstraction Calculation

Land Cover type	Area (ha)	Area (%)	IA
Forest/woodland	0.82	12.06	10
Cultivated	0.95	14	7
Impervious Area	0.1	1.5	2
Lawn/Pasture	3.3	48.5	5
Lake/ Wetland	1.63	24	12
Total Area	**6.8**	**Avg. IA=**	**7.5**

Composite Runoff Coefficient

Soil Type	Loam		Clay	
Land Use	**Area (ha)**	**RC**	**Area (ha)**	**RC**
Woodland (Flat)	0	0.25	0.82	0.3
Cultivated (Flat)	0	0.35	0.95	0.5
Impervious	0	0.9	0.1	0.9
Lawn/ Pasture (Flat)	0	0.28	3.3	0.35
Lawn/ Pasture (Flat)	0	0.05	1.63	0.05
Composite Runoff Coefficient				**0.3**

Time of Concentration

Runoff Coef.	0.3
Area (ha)	6.80
Avg. Slope (%)	0.5
Length (m)	669
T_c (min) (Airport Method)	84.8
T_p (min) (Airport Method)	56.5
T_c (min) (Bransby Williams Method)	36.2
T_p (min) (Bransby Williams Method)	24.1

Prefered Time of Concentration Calculation Method

Calculation Method	Airport
T_c (min)	84.8
T_p (min)	56.5

Peak flow Rate calculation (Rational Method)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Rainfall Intensity (mm/hr)	17.2	22.4	25.8	30.1	33.6	36.8
Flow (m^3/s)	0.098	0.127	0.146	0.171	0.191	0.209

PARSONS

APPENDIX E

IDF CURVES

Environment and Climate Change Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2020/03/27

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NIAGARA FALLS IDF ON 6135638

Latitude: 43 8'N Longitude: 79 5'W Elevation/Altitude: 182 m

Years/Années : 1965 - 1990 # Years/Années : 26

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Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

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Year Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1965	14.0	16.8	19.3	20.8	23.9	26.7	30.5	34.0	44.4
1966	6.1	12.2	13.7	15.7	15.7	17.5	24.6	34.0	34.0
1967	6.9	11.7	12.2	17.5	17.5	18.0	27.2	42.7	63.0
1968	5.1	6.1	7.4	11.7	21.8	26.4	58.2	70.1	75.7
1969	6.3	12.7	18.8	18.8	18.8	19.8	37.6	41.7	47.5
1970	8.6	9.4	13.5	14.5	15.7	19.0	29.2	29.2	37.3
1971	9.1	12.2	15.7	19.6	27.2	48.3	53.8	53.8	53.8
1972	9.4	15.5	21.1	31.0	39.1	47.8	48.0	48.0	48.8
1973	6.6	11.4	15.0	25.7	31.5	35.6	37.8	37.8	38.9
1974	5.6	7.4	9.9	14.2	14.7	22.4	30.7	30.7	36.8
1975	8.9	13.0	16.0	19.0	19.0	30.7	36.1	45.7	46.0
1976	6.9	11.7	14.5	17.8	18.8	21.6	39.1	40.9	50.3
1977	8.4	14.2	18.8	27.9	31.2	34.8	46.7	63.5	83.1
1978	8.6	12.8	15.8	21.0	26.1	31.5	52.2	52.2	56.2
1979	6.1	10.3	12.8	16.6	17.8	26.4	48.4	81.6	86.2
1980	6.7	9.0	12.9	22.1	24.3	24.8	25.4	35.2	41.0
1981	6.5	9.0	11.9	15.8	22.4	31.7	46.3	68.9	68.9
1982	3.9	6.0	6.4	8.7	11.6	15.1	20.8	25.2	29.8
1983	12.6	18.1	23.5	26.0	47.0	47.4	53.0	54.4	57.4
1984	7.6	8.6	12.5	13.9	14.4	19.8	33.0	38.8	41.0
1985	7.5	10.6	13.5	17.2	20.2	21.7	30.2	37.0	42.7
1986	9.6	10.2	11.4	14.7	18.5	23.2	34.9	34.9	51.7
1987	12.2	14.4	18.2	30.2	36.9	36.9	50.8	54.4	66.4
1988	3.8	6.3	8.8	15.6	21.2	25.4	33.7	59.6	62.1
1989	3.9	5.5	7.3	11.8	19.2	23.3	38.6	41.6	42.0
1990	5.1	8.6	9.6	11.3	12.3	18.2	27.0	39.3	45.8
# Yrs.	26	26	26	26	26	26	26	26	26
Mean Moyenne	7.5	10.9	13.9	18.4	22.6	27.5	38.2	46.0	52.0
Std. Dev. Écart-type	2.6	3.3	4.3	5.8	8.6	9.5	10.5	14.0	14.8
Skew. Dissymétrie	0.81	0.24	0.27	0.68	1.30	1.04	0.29	0.88	0.84
Kurtosis	3.80	2.90	2.99	3.16	4.74	3.59	2.23	3.54	3.36

*-99.9 Indicates Missing Data/Données manquantes

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Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	7.1	9.4	10.9	12.9	14.3	15.7	26
10 min	10.4	13.3	15.3	17.7	19.6	21.4	26
15 min	13.2	17.0	19.5	22.8	25.1	27.5	26
30 min	17.5	22.6	26.1	30.4	33.6	36.8	26
1 h	21.2	28.7	33.8	40.1	44.8	49.5	26
2 h	25.9	34.3	39.9	46.9	52.1	57.3	26
6 h	36.5	45.8	52.0	59.8	65.5	71.3	26
12 h	43.7	56.0	64.2	74.6	82.3	89.9	26
24 h	49.5	62.6	71.3	82.3	90.4	98.5	26

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Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	85.3	112.9	131.2	154.3	171.4	188.4	26
	+/- 11.0	+/- 18.6	+/- 25.1	+/- 33.8	+/- 40.4	+/- 47.1	26
10 min	62.2	79.9	91.6	106.3	117.3	128.2	26
	+/- 7.1	+/- 11.9	+/- 16.0	+/- 21.6	+/- 25.9	+/- 30.2	26
15 min	52.6	68.0	78.2	91.0	100.6	110.0	26
	+/- 6.1	+/- 10.3	+/- 14.0	+/- 18.8	+/- 22.5	+/- 26.2	26
30 min	34.9	45.3	52.1	60.8	67.2	73.5	26
	+/- 4.1	+/- 6.9	+/- 9.4	+/- 12.7	+/- 15.1	+/- 17.6	26
1 h	21.2	28.7	33.8	40.1	44.8	49.5	26
	+/- 3.0	+/- 5.1	+/- 6.9	+/- 9.3	+/- 11.1	+/- 13.0	26
2 h	13.0	17.1	19.9	23.4	26.1	28.6	26
	+/- 1.7	+/- 2.8	+/- 3.8	+/- 5.1	+/- 6.2	+/- 7.2	26
6 h	6.1	7.6	8.7	10.0	10.9	11.9	26
	+/- 0.6	+/- 1.0	+/- 1.4	+/- 1.9	+/- 2.3	+/- 2.6	26
12 h	3.6	4.7	5.4	6.2	6.9	7.5	26
	+/- 0.4	+/- 0.7	+/- 0.9	+/- 1.3	+/- 1.5	+/- 1.8	26
24 h	2.1	2.6	3.0	3.4	3.8	4.1	26
	+/- 0.2	+/- 0.4	+/- 0.5	+/- 0.7	+/- 0.8	+/- 0.9	26

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Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)
RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
T = Rainfall duration (h) / Durée de la pluie (h)

****

Statistics/Statistiques	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans
Mean of RR/Moyenne de RR	31.2	40.8	47.1	55.1	61.0	66.9
Std. Dev. /Écart-type (RR)	29.7	38.8	44.9	52.6	58.3	63.9
Std. Error/Erreur-type	6.8	8.9	10.3	12.1	13.5	14.8
Coefficient (A)	19.5	25.3	29.2	34.0	37.6	41.2
Exponent/Exposant (B)	-0.668	-0.673	-0.676	-0.678	-0.680	-0.681
Mean % Error/% erreur moyenne	8.1	8.6	8.9	9.3	9.5	9.7

IDF for: NIAGARA FALLS

Climate Change Scenario: RCP 8.5

Projection Year: 2070

ID:6135638

◉ Total PPT (mm) ○ Intensity rates (mm/h)

T (years)	2	5	10	20	25	50	100
5 min	94.28	123.80	144.79	163.36	169.00	187.04	205.81
10 min	71.05	89.85	101.54	110.24	112.50	119.14	125.25
15 min	59.96	76.37	86.69	94.51	96.59	102.71	108.37
30 min	38.48	49.63	57.66	64.83	67.04	74.02	81.59
1 h	22.48	30.12	36.36	42.70	44.71	52.70	61.05
2 h	13.90	18.27	21.73	25.17	26.23	30.26	34.53
6 h	6.85	8.53	9.63	10.50	10.75	11.49	12.20
12 h	3.96	5.06	5.89	6.68	6.93	7.76	8.67
24 h	2.25	2.83	3.27	3.69	3.82	4.25	4.72

Ontario IDF CURVE LOOKUP

Active coordinate

43° 2' 45" N, 79° 7' 14" W (43.045833,-79.120833)

Retrieved: Wed, 20 Jan 2021 17:12:29 GMT

Oops! Something went wrong.

This page didn't load Google Maps correctly. See the JavaScript console for technical details.

Location summary

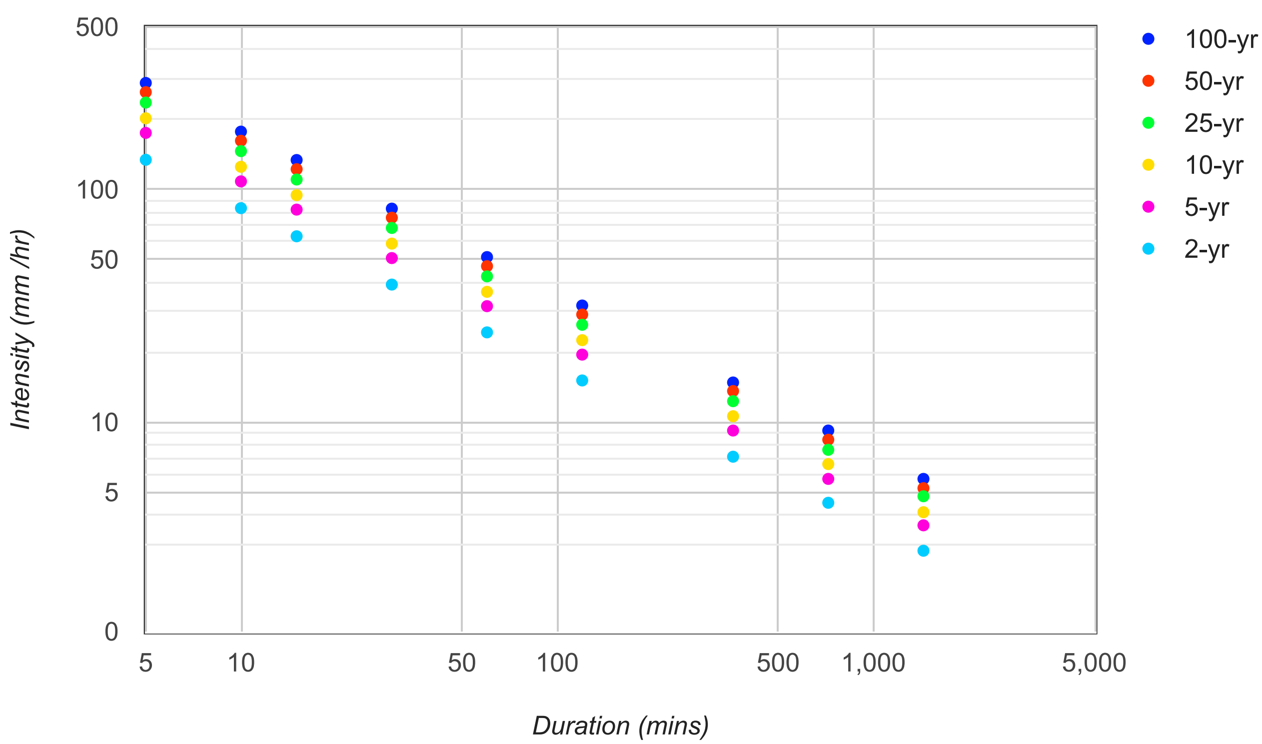
These are the locations in the selection.

IDF Curve: 43° 2' 45" N, 79° 7' 14" W (43.045833,-79.120833)

Results

An IDF curve was found.

Coordinate: 43.045833, -79.120833
IDF curve year: 2070



Coefficient summary

IDF Curve: 43° 2' 45" N, 79° 7' 14" W (43.045833,-79.120833)

Retrieved: Wed, 20 Jan 2021 17:12:29 GMT

Data year: 2010
IDF curve year: 2070

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	134.1	83.1	62.9	39.0	24.3	15.1	7.1	4.5	2.8
5-yr	175.0	108.3	81.9	50.7	31.5	19.5	9.2	5.7	3.6
10-yr	202.2	125.1	94.5	58.5	36.3	22.5	10.6	6.6	4.1
25-yr	236.3	146.1	110.3	68.3	42.3	26.2	12.3	7.6	4.8
50-yr	261.9	161.9	122.2	75.6	46.8	29.0	13.6	8.4	5.2
100-yr	286.9	177.2	133.8	82.7	51.2	31.7	14.8	9.2	5.7

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	11.2	13.9	15.7	19.5	24.3	30.2	42.6	54.0	67.2
5-yr	14.6	18.1	20.5	25.4	31.5	39.0	55.2	68.4	86.4
10-yr	16.8	20.9	23.6	29.3	36.3	45.0	63.6	79.2	98.4
25-yr	19.7	24.4	27.6	34.1	42.3	52.4	73.8	91.2	115.2
50-yr	21.8	27.0	30.6	37.8	46.8	58.0	81.6	100.8	124.8
100-yr	23.9	29.5	33.5	41.4	51.2	63.4	88.8	110.4	136.8

Terms of Use

APPENDIX F

PRELIMINARY STORMSEWER DESIGN SHEET

Sensitive

STORM SEWER DESIGN CALCULATIONS

REGIONAL	Montrose Rd, Lyons Creek Rd & Biggar Rd	DESIGN FREQUENCY	5 YEAR
ROAD NO.:	719.500	RAINFALL STATION(S)	City of Niagara Falls IDF Curve
DESIGNED BY A.Z	DATE 6/15/2021 6.340	DESIGND 'n'	0.013
CHECKED BY M.R	DATE 6/15/2021 0.769	MINIMUM COVER	1.2 m
PERVIOUS 'C'	0.2	IMPERVIOUS 'C'	0.9

LOCATION			DRAINAGE AREA						RUNOFF			PIPE SELECTION										PIPE PROFILE				
U/S MH Station	FROM	TO	SUB AREA	TOTAL AREA	IMPERVIOUS AREA	RUNOFF COEFFICIENT	A_0*C	CUMUL.	TIME OF CONC.	INTENSITY	FLOW	LENGTH	SLOPE	SIZE	HYDRAULIC RADIUS	FULL CAPACITY	FULL VELOCITY	ACTUAL VELOCITY	TIME OF FLOW	CUMUL. TIME	SURCHARGE	U/S			D/S	REMARKS
	MH or CBMH No.	MH or CBMH No.	A_0	A	A_{imp}	C		A_0*C	Tc	i	Q	L	s	D	A/P	C	V_{full}	V_{Act}		T	Q/C	SURFACE ELEV.	COVER	INVERT	INVERT	
			ha	ha	ha	-			min	mm/hr	m^3/s	m	%	mm	m	-	m/s	m/s	min		%	m		m	%	
1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Montrose Road																										
13+332	23	24	0.100	0.100	0.100	0.9	0.09	0.09	10.00	84.0	0.021	20.5	0.8%	200	0.05	0.030	0.94	1.01	0.36	10.36	71%	174.81	1.02	173.59	173.42	
13+332	24	26	0.110	0.210	0.110	0.9	0.10	0.19	10.36	82.6	0.043	28.5	0.5%	450	0.11	0.199	1.26	1.00	0.38	10.74	22%	174.92	1.30	173.17	173.03	
13+360	25	25A	0.080	0.080	0.080	0.9	0.07	0.07	10.00	84.0	0.017	10.5	0.5%	300	0.07	0.068	0.97	0.80	0.18	10.18	25%	174.77	1.21	173.26	173.21	
13+360	25A	26	0.060	0.060	0.060	0.9	0.05	0.13	10.18	83.3	0.029	12.0	0.5%	300	0.07	0.068	0.97	0.92	0.21	10.39	43%	174.77	1.26	173.21	173.15	
13+360	26	GB-O1	0.090	0.380	0.090	0.9	0.08	0.40	10.74	81.2	0.089	20.0	1.0%	450	0.11	0.282	1.79	1.57	0.19	10.93	32%	174.71	1.26	173.00	172.80	
13+532	31	32	0.060	0.060	0.060	0.9	0.05	0.05	10.00	84.0	0.013	19.5	0.7%	200	0.05	0.028	0.88	0.84	0.37	10.37	45%	177.59	1.21	176.18	176.05	
13+532	32	30	0.060	0.120	0.060	0.9	0.05	0.11	10.37	82.6	0.025	60.0	1.9%	300	0.07	0.133	1.88	1.41	0.53	10.90	19%	177.47	1.23	175.95	174.81	
13+472	29	30	0.090	0.090	0.090	0.9	0.08	0.08	10.00	84.0	0.019	19.5	0.8%	200	0.05	0.030	0.94	0.98	0.35	10.35	64%	176.44	1.21	175.03	174.88	
13+472	30	28	0.090	0.300	0.090	0.9	0.08	0.27	10.90	80.6	0.061	50.0	2.5%	300	0.07	0.152	2.16	2.01	0.39	11.29	40%	176.32	1.25	174.78	173.53	
13+422	27	28	0.075	0.075	0.075	0.9	0.07	0.07	10.00	84.0	0.016	19.5	1.5%	200	0.05	0.041	1.28	1.19	0.25	10.25	39%	175.34	1.25	173.89	173.60	
13+422	28	GB-O2	0.075	0.450	0.075	0.9	0.07	0.41	11.29	79.3	0.089	14.0	3.0%	375	0.09	0.286	2.71	2.38	0.09	11.37	31%	175.23	1.44	173.42	173.00	
13+660	34	34A	0.220	0.220	0.220	0.9	0.20	0.20	10.00	84.0	0.046	11.0	1.0%	300	0.07	0.096	1.37	1.34	0.13	10.13	48%	177.22	1.11	175.81	175.70	
13+660	33	34A	0.220	0.220	0.220	0.9	0.20	0.20	10.00	84.0	0.046	8.6	1.0%	300	0.07	0.096	1.37	1.34	0.10	10.10	48%	177.22	1.14	175.78	175.70	
13+660	34A	36D	0.000	0.440	0.000	0.85	0.00	0.40	10.13	83.5	0.092	73.7	0.7%	375	0.09	0.138	1.31	1.39	0.94	11.07	67%	177.39	1.39	175.62	175.11	
13+734	35	36D	0.060	0.060	0.060	0.9	0.05	0.05	10.00	84.0	0.013	5.5	11.0%	200	0.05	0.110	3.48	2.22	0.03	10.03	11%	177.32	1.23	175.89	175.28	
13+734	36	36D	0.060	0.060	0.060	0.9	0.05	0.05	10.00	84.0	0.013	12.2	4.0%	200	0.05	0.067	2.10	1.57	0.10	10.10	19%	177.25	1.21	175.84	175.35	
13+734	36D	38A	0.000	0.560	0.000	0.85	0.00	0.50	11.07	80.0	0.112	46.3	0.7%	375	0.09	0.138	1.31	1.45	0.59	11.66	81%	177.43	1.95	175.11	174.78	
13+780	37	38A	0.079	0.079	0.079	0.9	0.07	0.07	10.00	84.0	0.017	5.5	11.5%	200	0.05	0.113	3.55	2.38	0.03	10.03	15%	176.97	1.21	175.56	174.93	
13+780	38	38A	0.079	0.079	0.079	0.9	0.07	0.07	10.00	84.0	0.017	12.8	3.5%	200	0.05	0.062	1.96	1.67	0.11	10.11	27%	176.88	1.23	175.45	175.00	
13+780	38A	40A	0.000	0.718	0.000	0.85	0.00	0.65	11.66	78.0	0.140	52.0	0.5%	450	0.11	0.199	1.26	1.36	0.69	12.35	70%	177.08	1.95	174.68	174.42	
13+832	39	40A	0.089	0.089	0.089	0.9	0.08	0.08	10.00	84.0	0.019	5.5	8.5%	200	0.05	0.097	3.06	2.29	0.03	10.03	19%	176.50	1.19	175.11	174.64	
13+832	40	40A	0.089	0.089	0.089	0.85	0.08	0.08	10.00	84.0	0.018	13.6	2.5%	200	0.05	0.053	1.66	1.49	0.14	10.14	34%	176.40	1.22	174.98	174.64	
13+793	40A	LC-O1	0.000	0.896	0.000	0.85	0.00	0.80	12.35	75.8	0.169	12.5	0.7%	450	0.11	0.236	1.50	1.61	0.14	12.49	72%	176.61	1.77	174.39	174.30	
13+860	41	42	0.100	0.100	0.100	0.9	0.09	0.09	10.00	84.0	0.021	19.5	0.7%	300	0.07	0.080	1.14	0.97	0.28	10.28	26%	176.36	1.20	174.86	174.72	
13+860	42	LC-O2	0.120	0.220	0.120	0.9	0.11	0.20	10.28	82.9	0.046	17.0	1.0%	300	0.07	0.096	1.37	1.31	0.21	10.49	47%	176.39	1.42	174.67	174.50	
14+482	66A	62	0.000	2.382	0.000	0.85	0.00	2.14	14.09	70.8	0.422	39.0	0.4%	600	0.16	0.424	1.39	1.59	0.47	14.56	99%	180.17	2.25	177.32	177.22	
14+443	61	62	0.048	0.048	0.048	0.9	0.04	0.04	10.00	84.0	0.010	27.5	2.4%	200	0.05	0.052	1.62	1.22	0.28	10.28	20%	179.68	1.23	178.25	177.59	
14+443	62	60	0.048	2.478	0.048	0.9	0.04	2.23	14.56	69.5	0.431	60.0	0.4%	600	0.16	0.440	1.44	1.65	0.69	15.25	98%	179.80	2.01	177.19	176.94	
14+383	59	60	0.067	0.067	0.067	0.9	0.06	0.06	10.00	84.0	0.014	25.5	3.5%	200	0.05	0.062	1.96	1.63	0.22	10.22	23%	179.64	1.24	178.20	177.31	
14+383	60	58	0.067	2.612	0.067	0.9	0.06	2.35	15.25	67.8	0.443	60.0	0.4%	600	0.16	0.451	1.48	1.68	0.68	15.93	98%	179.65	2.14	176.91	176.64	
14+323	57	58	0.105	0.105	0.105	0.9	0.09	0.09	10.00	84.0	0.022	23.5	3.9%	200	0.05	0.066	2.07	1.86	0.19	10.19	34%	179.39	1.26	177.93	177.01	
14+323	58	56	0.105	2.822	0.105	0.9	0.09	2.54	15.93	66.2	0.468	60.0	0.5%	600	0.16	0.476	1.56	1.78	0.64	16.57	98%	179.35	2.14	176.61	176.32	
14+263	55	56	0.099	0.099	0.099	0.9	0.09	0.09	10.00	84.0	0.021	23.5	4.0%	200	0.05	0.067	2.10	1.84	0.19	10.19	31%	179.11	1.28	177.63	176.69	
14+263	56	54	0.099	3.020	0.099	0.9	0.09	2.72	16.57	64.8	0.490	53.0	0.5%	600	0.16	0.495	1.62	1.85	0.54	17.11	99%	179.06	2.17	176.29	176.01	
14+210	53	54	0.090	0.090	0.090	0.9	0.08	0.08	10.00	84.0	0.019	27.5	3.5%	300	0.07	0.180	2.56	1.64	0.18	10.18	11%	178.83	1.29	177.24	176.28	
14+210	54	52	0.090	3.200	0.090	0.9	0.08	2.88	17.11	63.6	0.510	67.0	0.6%	600	0.16	0.513	1.68	1.92	0.66	17.78	99%	178.72	2.14	175.98	175.60	
14+143	51	52	0.120	0.120	0.120	0.9	0.11	0.11	10.00	84.0	0.025	27.0	3.8%	200	0.05	0.065	2.04	1.90	0.22	10.22	39%	178.45	1.26	176.99	175.97	
14+143	52	50	0.120	3.440	0.120	0.9	0.11	3.10	17.78	62.3	0.536	50.0	0.3%	750	0.19	0.604	1.29	1.45	0.65	18.43	89%	178.75	2.58	175.42	175.29	
14+093	49	50	0.088	0.088	0.088	0.9	0.08	0.08	10.00	84.0	0.019	22.5	3.1%	300	0.07	0.169	2.41	1.54	0.16	10.16	11%	177.91	1.20	176.41	175.71	
14+093	50	48	0.088	3.616	0.088	0.9	0.08	3.25	18.43	61.0	0.552	70.0	0.3%	750	0.19	0.661	1.41	1.56	0.83	19.25	83%	177.85	1.84	175.26	175.05	
14+023	47	48	0.105	0.105	0.105	0.9	0.09	0.09	10.00	84.0	0.022	20.0	1.7%	200	0.05	0.043	1.37	1.37	0.24	10.24	51%	177.24	1.13	175.91	175.57	
14+023	48	46	0.105	3.826	0.105	0.9	0.09	3.44	19.25	59.5	0.570	50.0	0.3%	750	0.19	0.604	1.29	1.46	0.65	19.90	94%	177.13	1.36	175.02	174.90	
13+973	45	46	1.110	1.110	1.110	0.9	1.00	1.00	10.00	84.0	0.233	32.0	1.5%	450	0.11	0.345	2.19	2.34	0.24	10.24	68%	176.87	1.22	175.20	174.72	
13+973	46	44	0.060	4.996	0.060	0.9	0.05	4.50	19.90	58.4	0.730	40.0	0.2%	825	0.21	0.734	1.33	1.52	0.50	20.40	99%	176.85	1.23	174.79	174.70	
13+933	43	44	0.090	0.090	0.090	0.9	0.08	0.08	10.00	84.0	0.019	19.5	0.5%	200	0.05	0.024	0.74	0.82	0.44	10.44	80%	176.75	1.16	175.39	175.29	
13+933	44	LC-O3	0.090	5.176	0.090	0.9	0.08	4.66	20.40	57.5	0.745	26.5	0.3%	825	0.21	0.749	1.36	1.55	0.33	20.73	100%	176.65	1.16	174.67	174.60	

STORM SEWER DESIGN CALCULATIONS

REGIONAL	Montrose Rd, Lyons Creek Rd & Biggar Rd		
ROAD NO.:			**719.500**
DESIGNED BY	A.Z	DATE 6/15/2021	**6.340**
CHECKED BY	M.R	DATE 6/15/2021	**0.769**

DESIGN FREQUENCY	**5 YEAR**
RAINFALL STATION(S)	**City of Niagara Falls IDF Curve**
DESIGND 'n'	**0.013**
MINIMUM COVER	**1.2 m**
PERVIOUS 'C'	**0.2**
IMPERVIOUS 'C'	**0.9**

LOCATION			DRAINAGE AREA						RUNOFF			PIPE SELECTION										PIPE PROFILE				
U/S MH Station	FROM	TO	SUB AREA	TOTAL AREA	IMPERVIOUS AREA	RUNOFF COEFFICIENT	A_0*C	CUMUL.	TIME OF CONC.	INTENSITY	FLOW	LENGTH	SLOPE	SIZE	HYDRAULIC RADIUS	FULL CAPACITY	FULL VELOCITY	ACTUAL VELOCITY	TIME OF FLOW	CUMUL. TIME	SURCHARGE	U/S			D/S	REMARKS
	MH or CBMH No.	MH or CBMH No.	A_0	A	A_{imp}	C		A_0*C	Tc	i	Q	L	s	D	A/P	C	V_{full}	V_{Act}		T	Q/C	SURFACE ELEV.	COVER	INVERT	INVERT	
			ha	ha	ha	-			min	mm/hr	m^3/s	m	%	mm	m	-	m/s	m/s	min		%	m		m	%	
14+665	13	14	0.074	0.074	0.074	0.9	0.07	0.07	10.00	84.0	0.016	17.0	0.5%	200	0.05	0.024	0.74	0.79	0.38	10.38	66%	179.28	0.86	178.22	178.14	
14+665	14	12	0.074	0.148	0.074	0.9	0.07	0.13	10.38	82.5	0.031	55.0	0.3%	375	0.09	0.090	0.86	0.77	1.07	11.45	34%	179.30	0.96	177.96	177.80	
14+610	11	12	0.045	0.045	0.045	0.9	0.04	0.04	10.00	84.0	0.009	23.0	0.5%	200	0.05	0.024	0.74	0.70	0.52	10.52	40%	179.52	1.23	178.09	177.97	
14+610	12	68	0.045	0.238	0.045	0.9	0.04	0.21	11.45	78.7	0.047	80.0	0.2%	450	0.11	0.126	0.80	0.73	1.67	13.12	37%	179.49	1.32	177.72	177.56	
14+530	67	68	0.120	0.120	0.120	0.9	0.11	0.11	10.00	84.0	0.025	26.0	0.7%	300	0.07	0.080	1.14	1.01	0.38	10.38	31%	179.44	1.25	177.89	177.71	
14+530	68	66	0.120	0.478	0.120	0.9	0.11	0.43	13.12	73.5	0.088	27.0	0.2%	450	0.11	0.126	0.80	0.86	0.56	13.68	70%	179.22	1.21	177.56	177.51	
14+503	65	66	0.087	0.087	0.087	0.9	0.08	0.08	10.00	84.0	0.018	28.0	1.0%	200	0.05	0.033	1.05	1.06	0.45	10.45	55%	179.39	1.15	178.04	177.76	
14+503	66	66A	0.087	0.652	0.087	0.9	0.08	0.59	13.68	71.9	0.117	19.5	0.2%	450	0.11	0.126	0.80	0.91	0.41	14.09	93%	179.36	1.40	177.51	177.47	
Lyons Creek/Biggar Rd																										
4+305	72	71	0.018	0.018	0.018	0.9	0.02	0.02	10.00	84.0	0.004	10.6	0.5%	200	0.05	0.024	0.74	0.53	0.24	10.24	16%	180.42	1.03	179.19	179.14	
4+305	71	73	0.018	0.036	0.018	0.9	0.02	0.03	10.24	83.1	0.007	65.0	0.4%	300	0.07	0.057	0.81	0.54	1.34	11.58	13%	180.38	1.04	179.04	178.81	
4+370	74	73	0.072	0.072	0.072	0.9	0.06	0.06	10.00	84.0	0.015	12.0	0.5%	200	0.05	0.024	0.74	0.78	0.27	10.27	64%	180.07	0.93	178.94	178.88	
4+370	73	75	0.072	0.180	0.072	0.9	0.06	0.16	11.58	78.3	0.035	65.0	0.4%	300	0.07	0.057	0.81	0.84	1.34	12.92	62%	180.13	1.05	178.78	178.56	
4+435	75	76	0.072	0.072	0.072	0.9	0.06	0.23	10.00	84.0	0.053	13.5	0.5%	375	0.09	0.117	1.11	1.06	0.20	10.20	45%	179.82	0.99	178.45	178.38	
4+435	76	BRC-O1	0.072	0.324	0.072	0.9	0.06	0.29	10.20	83.2	0.067	12.0	0.5%	375	0.09	0.111	1.05	1.09	0.19	10.39	61%	179.74	1.01	178.35	178.30	
4+610	84	83	0.094	0.094	0.094	0.9	0.08	0.08	10.00	84.0	0.020	17.5	0.5%	200	0.05	0.024	0.74	0.82	0.39	10.39	84%	180.43	0.93	179.30	179.21	
4+610	83	81	0.094	0.188	0.094	0.9	0.08	0.17	10.39	82.5	0.039	60.0	0.4%	300	0.07	0.057	0.81	0.86	1.24	11.63	68%	180.37	0.96	179.11	178.90	
4+550	82	81	0.072	0.072	0.072	0.9	0.06	0.06	10.00	84.0	0.015	17.0	0.5%	200	0.05	0.024	0.74	0.78	0.38	10.38	64%	180.20	0.94	179.06	178.97	
4+550	81	79	0.072	0.332	0.072	0.9	0.06	0.30	11.63	78.1	0.065	60.0	0.3%	375	0.09	0.090	0.86	0.92	1.17	12.80	72%	180.19	1.02	178.80	178.62	
4+490	80	79	0.072	0.072	0.072	0.9	0.06	0.06	10.00	84.0	0.015	14.5	0.4%	200	0.05	0.021	0.66	0.71	0.36	10.36	72%	179.92	0.90	178.82	178.76	
4+490	79	77	0.072	0.476	0.072	0.9	0.06	0.43	12.80	74.4	0.089	38.0	0.2%	450	0.11	0.135	0.86	0.91	0.74	13.54	66%	179.91	0.95	178.51	178.42	
4+452	77	78	0.070	0.070	0.070	0.9	0.06	0.49	10.00	84.0	0.115	14.0	0.2%	450	0.11	0.138	0.88	0.97	0.27	10.27	83%	179.75	0.91	178.39	178.36	
4+452	78	BRC-O2	0.070	0.616	0.070	0.9	0.06	0.55	10.27	83.0	0.128	12.0	0.3%	450	0.11	0.141	0.89	1.01	0.22	10.49	91%	179.75	0.97	178.33	178.30	
4+755	88	87	0.120	0.120	0.120	0.9	0.11	0.11	10.00	84.0	0.025	20.0	0.9%	200	0.05	0.032	0.99	1.09	0.34	10.34	80%	180.26	1.10	178.96	178.78	
4+755	87	89	0.120	0.240	0.120	0.9	0.11	0.22	10.34	82.7	0.050	75.0	0.3%	375	0.09	0.090	0.86	0.87	1.46	11.80	55%	180.24	1.26	178.60	178.38	
4+830	90	89	0.250	0.250	0.250	0.9	0.23	0.23	10.00	84.0	0.053	24.0	0.5%	300	0.07	0.065	0.92	1.01	0.44	10.44	81%	179.83	1.00	178.53	178.42	
4+830	89	93	0.250	0.740	0.250	0.9	0.23	0.67	11.80	77.6	0.144	105.0	0.3%	450	0.11	0.154	0.98	1.11	1.79	13.58	93%	179.93	1.21	178.27	177.96	
4+935	94	93	0.081	0.081	0.081	0.9	0.07	0.07	10.00	84.0	0.017	25.5	1.5%	200	0.05	0.041	1.28	1.21	0.33	10.33	42%	179.97	1.21	178.56	178.18	
4+935	93	95	0.081	0.902	0.081	0.9	0.07	0.81	13.58	72.1	0.163	35.5	0.5%	450	0.11	0.189	1.20	1.34	0.49	14.08	86%	179.82	1.44	177.93	177.77	
4+971	96	95	0.065	0.065	0.065	0.9	0.06	0.06	10.00	84.0	0.014	26.5	1.5%	300	0.07	0.118	1.67	1.07	0.26	10.26	12%	179.78	1.20	178.28	177.89	
4+971	95	66A	0.065	1.032	0.065	0.9	0.06	0.93	14.08	70.8	0.183	44.0	0.5%	450	0.11	0.189	1.20	1.36	0.61	14.69	97%	179.64	1.45	177.74	177.54	
5+160	101	102	0.240	0.240	0.240	0.9	0.22	0.22	10.00	84.0	0.050	26.5	0.5%	300	0.07	0.068	0.97	1.05	0.46	10.46	74%	179.27	0.66	178.31	178.18	
5+160	102	100	0.240	0.480	0.240	0.9	0.22	0.43	10.46	82.3	0.099	68.0	0.4%	375	0.09	0.104	0.99	1.12	1.15	11.60	95%	179.31	0.83	178.10	177.83	
5+092	99	100	0.042	0.042	0.042	0.9	0.04	0.04	10.00	84.0	0.009	26.5	1.0%	200	0.05	0.033	1.05	0.89	0.42	10.42	27%	179.59	1.15	178.24	177.97	
5+092	100	98	0.042	0.564	0.042	0.9	0.04	0.51	11.60	78.2	0.110	57.0	0.2%	450	0.11	0.126	0.80	0.90	1.19	12.79	88%	179.65	1.48	177.72	177.61	
5+035	97	98	0.067	0.067	0.067	0.9	0.06	0.06	10.00	84.0	0.014	27.0	1.5%	200	0.05	0.041	1.28	1.16	0.35	10.35	35%	179.53	1.09	178.24	177.83	
5+035	98	66A	0.067	0.698	0.067	0.9	0.06	0.63	12.79	74.4	0.130	17.0	0.3%	450	0.11	0.141	0.89	1.01	0.32	13.11	92%	179.58	1.55	177.58	177.54	

APPENDIX G

PROPOSED CONDITION HYDROLOGY MODEL

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      V    V   I    SSSSS  U    U    A     L               (v 5.2.2003)
      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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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\335
15585-6128-4b0f-be87-8d74a9347f9d\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\c74101c6-d221-4d5f-8572-0d17b86b3930\335
15585-6128-4b0f-be87-8d74a9347f9d\sce


DATE: 10/04/2021                           TIME: 10:30:28

USER:
```

COMMENTS: Warren Creek - Climate Change
50-yr 24-Hour SCS Type II

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  ************************************************
  ** SIMULATION : 50yr 24hr 15min SCS-MTO 2070  **
  ************************************************


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|    READ STORM    |    Filename: C:\Users\p002675e\AppD
|                  |              ata\Local\Temp\
|                  |              77f92350-bf89-45fa-ac1b-fdb04b83e82e\0900522b
| Ptotal= 96.00 mm |    Comments: 50yr 24hr 15min SCS-MTO 2070
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	6.50	1.73	12.75	13.82	19.00	1.73
0.50	1.06	6.75	1.73	13.00	7.10	19.25	1.73
0.75	1.06	7.00	1.73	13.25	7.10	19.50	1.73
1.00	1.06	7.25	1.73	13.50	5.18	19.75	1.73
1.25	1.06	7.50	2.11	13.75	5.18	20.00	1.73
1.50	1.06	7.75	2.11	14.00	4.03	20.25	1.73
1.75	1.06	8.00	2.11	14.25	4.03	20.50	1.15
2.00	1.06	8.25	2.11	14.50	2.88	20.75	1.15
2.25	1.06	8.50	2.50	14.75	2.88	21.00	1.15
2.50	1.25	8.75	2.50	15.00	2.88	21.25	1.15
2.75	1.25	9.00	2.69	15.25	2.88	21.50	1.15
3.00	1.25	9.25	2.69	15.50	2.88	21.75	1.15
3.25	1.25	9.50	3.07	15.75	2.88	22.00	1.15
3.50	1.25	9.75	3.07	16.00	2.88	22.25	1.15
3.75	1.25	10.00	3.46	16.25	2.88	22.50	1.15
4.00	1.25	10.25	3.46	16.50	1.73	22.75	1.15
4.25	1.25	10.50	4.42	16.75	1.73	23.00	1.15
4.50	1.54	10.75	4.42	17.00	1.73	23.25	1.15
4.75	1.54	11.00	5.95	17.25	1.73	23.50	1.15
5.00	1.54	11.25	5.95	17.50	1.73	23.75	1.15
5.25	1.54	11.50	9.22	17.75	1.73	24.00	1.15
5.50	1.54	11.75	9.22	18.00	1.73	24.25	1.15
5.75	1.54	12.00	28.42	18.25	1.73		
6.00	1.54	12.25	117.50	18.50	1.73		
6.25	1.54	12.50	13.82	18.75	1.73		

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| CALIB            |
| NASHYD   (  0104)|   Area    (ha)=   9.24   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.642

     PEAK FLOW       (cms)=   0.703 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.396
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.619

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0103)|   Area    (ha)=   4.02
|ID= 1 DT=15.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.22         0.80
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     163.71        75.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       298.02
               over (min)       15.00        15.00
     Storage Coeff.  (min)=       3.22 (ii)   11.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.59         0.52          1.106 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        79.42          86.43
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.83           0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  84.0    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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| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     4.02    1.106    12.25    86.43
      + ID2= 2 (  0104):     9.24    0.703    12.50    59.40
        ==================================================
        ID = 3 (  0012):    13.26    1.595    12.25    67.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD   (  0105)|   Area    (ha)=   0.90   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   0.286

     PEAK FLOW       (cms)=   0.120 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  35.541
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.370

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0105):     0.90    0.120    12.25    35.54
      + ID2= 2 (  0012):    13.26    1.595    12.25    67.59
        ==================================================
        ID = 3 (  0013):    14.16    1.715    12.25    65.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   9.36   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

     Unit Hyd Qpeak  (cms)=   0.675

     PEAK FLOW       (cms)=   0.738 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.372
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.618

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| STANDHYD (  0100)|   Area    (ha)=  57.43
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      20.10        37.33
```

```
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     618.76       220.00
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        61.69
                over (min)       15.00        45.00
     Storage Coeff.  (min)=       7.15 (ii)   36.46 (ii)
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=       0.10         0.03
                                                            *TOTALS*
     PEAK FLOW       (cms)=       4.24         3.55          5.842 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.75          12.25
     RUNOFF VOLUME    (mm)=      95.00        63.02          71.02
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.66           0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):    57.43   5.842    12.25    71.02
      + ID2= 2 (  0101):     9.36   0.738    12.50    59.37
        ==================================================
        ID = 3 (  0001):    66.79   6.367    12.25    69.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=   6.13
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  20.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.15         3.98
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     202.16        50.00
```

```
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       112.22
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       3.65 (ii)   13.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.40         0.91          1.302 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        64.52          70.62
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.74

***** 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*  =  84.0    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 (  0001):    66.79   6.367    12.25    69.38
      + ID2= 2 (  0102):     6.13   1.302    12.25    70.62
        ==================================================
        ID = 3 (  0005):    72.92   7.669    12.25    69.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0007)|
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (    1.1) ------>
               Distance      Elevation       Manning
                   0.00        102.00        0.0500
                   1.00        102.00    0.0500 /0.0400  Main Channel
                   5.00        100.00        0.0400      Main Channel
                  15.00        100.00        0.0400      Main Channel
                  19.00        102.00    0.0400 /0.0500  Main Channel
                  20.00        102.00        0.0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
```

```
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10   100.10    .122E+03       0.3          0.34       5.97
       0.20   100.20    .250E+03       1.1          0.52       3.81
       0.30   100.30    .382E+03       2.2          0.68       2.95
       0.40   100.40    .518E+03       3.5          0.81       2.47
       0.50   100.50    .660E+03       5.1          0.93       2.16
       0.60   100.60    .806E+03       7.0          1.04       1.93
       0.70   100.70    .958E+03       9.1          1.13       1.76
       0.80   100.80    .111E+04      11.4          1.23       1.63
       0.90   100.90    .127E+04      13.9          1.31       1.52
       1.00   101.00    .144E+04      16.7          1.40       1.43
       1.10   101.10    .161E+04      19.8          1.47       1.36
       1.20   101.20    .179E+04      23.0          1.55       1.29
       1.30   101.30    .197E+04      26.5          1.62       1.24
       1.40   101.40    .215E+04      30.2          1.69       1.19
       1.50   101.50    .234E+04      34.2          1.75       1.14
       1.60   101.60    .253E+04      38.4          1.82       1.10
       1.70   101.70    .273E+04      42.8          1.88       1.07
       1.80   101.80    .294E+04      47.4          1.94       1.03
       1.90   101.90    .315E+04      52.3          2.00       1.00

                                        <---- hydrograph ---->   <-pipe / channel->
                                  AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                  (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0005)       72.92     7.67   12.25  69.49      0.63      1.07
   OUTFLOW: ID= 1 (  0007)       72.92     6.66   12.25  69.49      0.58      1.01

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

--------------------
| ADD HYD  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0013):    14.16   1.715    12.25    65.55
      + ID2= 2 (  0007):    72.92   6.660    12.25    69.49
        ==================================================
        ID = 3 (  0014):    87.08   8.375    12.25    68.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0015)|
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (    1.1) ------>
               Distance      Elevation       Manning
                   0.00        102.00        0.0500
                   1.00        102.00    0.0500 /0.0400  Main Channel
                   5.00        100.00        0.0400      Main Channel
                  15.00        100.00        0.0400      Main Channel
                  19.00        102.00    0.0400 /0.0500  Main Channel
```

```
                  20.00        102.00        0.0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10   100.10    .259E+03       0.3          0.34      12.63
       0.20   100.20    .528E+03       1.1          0.52       8.07
       0.30   100.30    .808E+03       2.2          0.68       6.25
       0.40   100.40    .110E+04       3.5          0.81       5.23
       0.50   100.50    .140E+04       5.1          0.93       4.56
       0.60   100.60    .171E+04       7.0          1.04       4.09
       0.70   100.70    .203E+04       9.1          1.13       3.73
       0.80   100.80    .236E+04      11.4          1.23       3.45
       0.90   100.90    .270E+04      13.9          1.31       3.22
       1.00   101.00    .305E+04      16.7          1.40       3.03
       1.10   101.10    .341E+04      19.8          1.47       2.87
       1.20   101.20    .378E+04      23.0          1.55       2.74
       1.30   101.30    .416E+04      26.5          1.62       2.62
       1.40   101.40    .455E+04      30.2          1.69       2.51
       1.50   101.50    .495E+04      34.2          1.75       2.42
       1.60   101.60    .536E+04      38.4          1.82       2.33
       1.70   101.70    .579E+04      42.8          1.88       2.25
       1.80   101.80    .622E+04      47.4          1.94       2.19
       1.90   101.90    .666E+04      52.3          2.00       2.12

                                        <---- hydrograph ---->   <-pipe / channel->
                                  AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                  (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0014)       87.08     8.37   12.25  68.85      0.67      1.10
   OUTFLOW: ID= 1 (  0015)       87.08     9.01   12.50  68.85      0.70      1.13


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

--------------------
| CALIB            |
| NASHYD   (  0107)|   Area    (ha)=   2.33   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.11

     Unit Hyd Qpeak  (cms)=   0.809

     PEAK FLOW       (cms)=   0.275 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  30.977
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.323

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| STANDHYD ( 0106)|   Area    (ha)=   5.90
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.07        3.84
     Dep. Storage     (mm)=       1.00        4.84
     Average Slope     (%)=       1.50        1.50
     Length            (m)=     198.33       68.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     117.50      102.93
                over (min)       15.00       15.00
     Storage Coeff.  (min)=       3.20 (ii)   13.66 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=       0.11        0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.48        0.79         1.264 (iii)
     TIME TO PEAK    (hrs)=      12.25       12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00       63.02         71.02
     TOTAL RAINFALL   (mm)=      96.00       96.00         96.00
     RUNOFF COEFFICIENT   =       0.99        0.66          0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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.

--------------------------------------------------------------------------------
--------------------
| DIVERTHYD(  0017)|
| IN= 1   # OUT= 5 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 + Flow 3 + Flow 4 + Flow 5 = Total
       (cms)    (cms)    (cms)    (cms)    (cms)    (cms)
        0.00     0.00     0.00     0.00     0.00     0.00
        0.56     0.00     0.00     0.00     0.00     0.56
                     OUTFLOW TABLES EXCEEDED

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   5.90      1.26     12.25   71.02
     ==================================================
     ID= 2  (   2)    :   5.90      1.26     12.25   71.02
     ID= 3  (   2)    :   0.00      0.00      0.00    0.00
     ID= 4  (   2)    :   0.00      0.00      0.00    0.00
     ID= 5  (   2)    :   0.00      0.00      0.00    0.00
     ID= 6  (   2)    :   0.00      0.00      0.00    0.00
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0020)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0107):     2.33    0.275    12.25    30.98
      + ID2= 2 (  0017):     5.90    1.264    12.25    71.02
        ==================================================
        ID = 3 (  0020):     8.23    1.539    12.25    59.68

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


--------------------
| CALIB            |
| STANDHYD ( 0108)|   Area    (ha)=  11.33
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.97        7.36
     Dep. Storage     (mm)=       1.00        4.84
     Average Slope     (%)=       1.50        1.50
     Length            (m)=     274.83       80.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     117.50      102.93
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       3.89 (ii)   15.42 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=       0.11        0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.91        1.15         1.640 (iii)
     TIME TO PEAK    (hrs)=      12.25       12.50         12.25
     RUNOFF VOLUME    (mm)=      95.00       63.02         71.02
     TOTAL RAINFALL   (mm)=      96.00       96.00         96.00
     RUNOFF COEFFICIENT   =       0.99        0.66          0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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--------------------
| ADD HYD  (  0021)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0108):    11.33    1.640    12.25    71.02
      + ID2= 2 (  0020):     8.23    1.539    12.25    59.68
        ==================================================
        ID = 3 (  0021):    19.56    3.180    12.25    66.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD ( 0109)|   Area    (ha)=   3.20
|ID= 1 DT=15.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.24        0.96
     Dep. Storage     (mm)=       1.00        4.84
     Average Slope     (%)=       1.00        1.00
     Length            (m)=      20.00       20.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     117.50      124.67
                over (min)       15.00       15.00
     Storage Coeff.  (min)=       0.91 (ii)    6.16 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=       0.11        0.10
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.63        0.31         0.936 (iii)
     TIME TO PEAK    (hrs)=      12.25       12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00       66.32         83.53
     TOTAL RAINFALL   (mm)=      96.00       96.00         96.00
     RUNOFF COEFFICIENT   =       0.99        0.69          0.87

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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--------------------
| ADD HYD  (  0022)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0109):     3.20    0.936    12.25    83.53
      + ID2= 2 (  0021):    19.56    3.180    12.25    66.25
        ==================================================
        ID = 3 (  0022):    22.76    4.115    12.25    68.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD   (  0113)|   Area    (ha)=   4.52   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

     Unit Hyd Qpeak  (cms)=   0.822

     PEAK FLOW       (cms)=   0.713 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  54.315
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.566

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| NASHYD   (  0115)|   Area    (ha)=   3.51   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.670

     PEAK FLOW       (cms)=   0.564 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  53.435
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.557

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| STANDHYD ( 0114)|   Area    (ha)=   1.33
|ID= 1 DT=15.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=       1.13         0.20
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=      10.00        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       165.40
              over (min)       15.00        15.00
     Storage Coeff.  (min)=       0.53 (ii)    3.27 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.33         0.09         0.417 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00        70.97         88.99
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.74          0.93

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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.

--------------------------------------------------------------------------------
--------------------
| DIVERTHYD(  0077)|
| IN= 1   # OUT= 5 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 + Flow 3 + Flow 4 + Flow 5 = Total
      (cms)    (cms)    (cms)    (cms)    (cms)    (cms)
       0.00     0.00     0.00     0.00     0.00     0.00
       0.28     0.00     0.00     0.00     0.00     0.28
                     OUTFLOW TABLES EXCEEDED

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.33      0.42     12.25   88.99
     ==================================================
     ID= 2  (   1)    :   1.33      0.42     12.25   88.99
     ID= 3  (   1)    :   0.00      0.00      0.00    0.00
     ID= 4  (   1)    :   0.00      0.00      0.00    0.00
     ID= 5  (   1)    :   0.00      0.00      0.00    0.00
     ID= 6  (   1)    :   0.00      0.00      0.00    0.00

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```

```
| CALIB            |
| STANDHYD (  0116)|   Area    (ha)=   2.94
|ID= 1 DT=15.0 min |   Total Imp(%)=  46.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.35         1.59
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     140.00        80.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       120.17
              over (min)       15.00        15.00
     Storage Coeff.  (min)=       2.60 (ii)   13.43 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.29         0.38         0.671 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00        65.69         74.48
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.68          0.78

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0033)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0115):     3.51   0.564    12.25    53.43
      + ID2= 2 (  0116):     2.94   0.671    12.25    74.48
        ===================================================
        ID = 3 (  0033):     6.45   1.235    12.25    63.03

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

--------------------
| ADD HYD  (  0033)|
|  3 +  2 =  1     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0033):     6.45   1.235    12.25    63.03
      + ID2= 2 (  0077):     1.33   0.417    12.25    88.99
        ===================================================
```

```
        ID = 1 (  0033):     7.78   1.651    12.25    67.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| STANDHYD (  0117)|   Area    (ha)=   4.06
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.23         1.83
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     164.52        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       138.21
              over (min)       15.00        15.00
     Storage Coeff.  (min)=       3.23 (ii)   13.91 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.46         0.50         0.961 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00        68.05         77.48
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.71          0.81

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0078)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0017 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0003 = HYDROGRAPH 0001
        ID1= 1 (  0117):     4.06   0.961    12.25    77.48
      + ID2= 2 (  0017):     0.00   0.000     0.00     0.00
        ===================================================
        ID = 3 (  0078):     4.06   0.961    12.25    77.48

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

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

--------------------
| ADD HYD  (  0078)|
|  3 +  2 =  1     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0078):     4.06   0.961    12.25    77.48
      + ID2= 2 (  0033):     7.78   1.651    12.25    67.47
        ===================================================
        ID = 1 (  0078):    11.84   2.612    12.25    70.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DIVERTHYD(  0079)|
| IN= 1   # OUT= 5 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 + Flow 3 + Flow 4 + Flow 5 = Total
      (cms)    (cms)    (cms)    (cms)    (cms)    (cms)
       0.00     0.00     0.00     0.00     0.00     0.00
       1.48     0.00     0.00     0.00     0.00     1.48
                     OUTFLOW TABLES EXCEEDED

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  11.84      2.61     12.25   70.90
     ==================================================
     ID= 2  (   2)    :  11.84      2.61     12.25   70.90
     ID= 3  (   2)    :   0.00      0.00      0.00    0.00
     ID= 4  (   2)    :   0.00      0.00      0.00    0.00
     ID= 5  (   2)    :   0.00      0.00      0.00    0.00
     ID= 6  (   2)    :   0.00      0.00      0.00    0.00

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

--------------------
| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=   3.36
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.18         2.18
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     149.67        72.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       112.22
              over (min)       15.00        15.00
     Storage Coeff.  (min)=       2.70 (ii)   13.16 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.22         0.50          0.716 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        64.52          70.61
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.74

***** 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*  =  84.0    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 ( 0111)|   Area    (ha)=  18.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.55        12.16
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     353.08        60.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       112.22
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       4.52 (ii)   13.89 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.19         2.70          3.884 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        64.52          70.62
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.74

***** 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*  =  84.0    Ia = Dep. Storage  (Above)
```

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

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

--------------------
| ADD HYD  (  0025)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0110):     3.36   0.716    12.25    70.61
      + ID2= 2 (  0111):    18.70   3.884    12.25    70.62
        ===================================================
        ID = 3 (  0025):    22.06   4.600    12.25    70.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| STANDHYD ( 0112)|   Area    (ha)=   0.89
|ID= 1 DT=15.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  85.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.85         0.04
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      10.00        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       328.47
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       0.60 (ii)    2.95 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.11
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.25         0.04          0.287 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        80.61          92.84
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.84           0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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```

```
--------------------
| ADD HYD  (  0028)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0112):     0.89   0.287    12.25    92.84
      + ID2= 2 (  0025):    22.06   4.600    12.25    70.62
        ===================================================
        ID = 3 (  0028):    22.95   4.887    12.25    71.48

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

--------------------
| ADD HYD  (  0036)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0113):     4.52   0.713    12.25    54.31
      + ID2= 2 (  0015):    87.08   9.005    12.50    68.85
        ===================================================
        ID = 3 (  0036):    91.60   9.347    12.50    68.13

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

--------------------
| ADD HYD  (  0036)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0036):    91.60   9.347    12.50    68.13
      + ID2= 2 (  0022):    22.76   4.115    12.25    68.68
        ===================================================
        ID = 1 (  0036):   114.36  11.228    12.50    68.24

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

--------------------
| ADD HYD  (  0036)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0036):   114.36  11.228    12.50    68.24
      + ID2= 2 (  0028):    22.95   4.887    12.25    71.48
        ===================================================
        ID = 3 (  0036):   137.31  15.933    12.25    68.78

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

--------------------
| ADD HYD  (  0036)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0036):   137.31  15.933    12.25    68.78
      + ID2= 2 (  0079):    11.84   2.612    12.25    70.90
        ===================================================
        ID = 1 (  0036):   149.15  18.545    12.25    68.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0035)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5300     1.9610
                          0.0260     0.2540   |   1.2610     2.5280
                          0.1380     0.6120   |   3.9270     3.0600
                          0.2070     1.0100   |   6.2240     3.4500
                          0.2500     1.3720   |   8.0100     3.7210
                          0.2630     1.4460   |   9.9860     4.0179

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0036)    149.150     18.545     12.25      68.95
   OUTFLOW: ID= 1 (  0035)    149.150      8.646     12.75      68.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.62
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  3.8427


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

--------------------
| CALIB            |
| STANDHYD ( 0119)|   Area    (ha)=   0.93
|ID= 1 DT=15.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.33         0.60
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      78.74        50.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       112.22
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       2.08 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.15          0.206 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
```

```
     RUNOFF VOLUME    (mm)=      95.00        64.52          70.61
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.74

***** 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*  =  84.0    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  (  0038)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0119):     0.93   0.206    12.25    70.61
      + ID2= 2 (  0035):   149.15   8.646    12.75    68.93
        ==================================================
        ID = 3 (  0038):   150.08   8.687    12.75    68.94

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

--------------------
| ADD HYD  (  0038)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0079 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0038):   150.08   8.687    12.75    68.94
      + ID2= 2 (  0079):     0.00   0.000     0.00     0.00
        ==================================================
        ID = 1 (  0038):   150.08   8.687    12.75    68.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0039)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                  0.00        102.00        0.0500
                  2.00        102.00    0.0500 /0.0400  Main Channel
                  8.00        100.00        0.0400      Main Channel
                 35.00        100.00        0.0400      Main Channel
                 41.00        102.00    0.0400 /0.0500  Main Channel
```

```
                 43.00       102.00       0.0500

      <--------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
        (m)       (m)     (cu.m.)       (cms)        (m/s)       (min)
       0.10    100.10    .250E+04        0.9          0.32       47.57
       0.20    100.20    .505E+04        2.8          0.50       30.20
       0.30    100.30    .766E+04        5.5          0.66       23.22
       0.40    100.40    .103E+05        8.9          0.79       19.31
       0.50    100.50    .130E+05       13.0          0.91       16.76
       0.60    100.60    .158E+05       17.6          1.02       14.94
       0.70    100.70    .186E+05       22.9          1.12       13.57
       0.80    100.80    .215E+05       28.7          1.22       12.50
       0.90    100.90    .245E+05       35.1          1.31       11.63
       1.00    101.00    .274E+05       42.0          1.40       10.90
       1.10    101.10    .305E+05       49.4          1.48       10.29
       1.20    101.20    .336E+05       57.3          1.56        9.77
       1.30    101.30    .368E+05       65.8          1.64        9.31
       1.40    101.40    .400E+05       74.7          1.71        8.91
       1.50    101.50    .432E+05       84.2          1.78        8.56
       1.60    101.60    .466E+05       94.2          1.85        8.24
       1.70    101.70    .499E+05      104.6          1.92        7.95
       1.80    101.80    .534E+05      115.6          1.98        7.69
       1.90    101.90    .568E+05      127.1          2.05        7.46

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (  0038)  150.08     8.69   12.75  68.94      0.39      0.78
    OUTFLOW: ID= 1 (  0039)  150.08     7.68   13.25  68.94      0.36      0.73


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

--------------------
| CALIB            |
| NASHYD   (  0200)|   Area    (ha)=  24.31   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   1.629

     PEAK FLOW       (cms)=   1.785 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.417
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.619

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

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

--------------------
| CALIB            |
| NASHYD   (  0300)|   Area    (ha)=  10.50   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.691

     PEAK FLOW       (cms)=   0.760 (i)
     TIME TO PEAK    (hrs)=  12.750
     RUNOFF VOLUME    (mm)=  59.426
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.619

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| STANDHYD (  0310)|   Area    (ha)=  14.39
|ID= 1 DT=15.0 min |   Total Imp(%)=  43.00   Dir. Conn.(%)=  30.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.19         8.20
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     310.00       200.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        67.19
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       4.72 (ii)   26.45 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.36         1.10          2.058 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50          12.25
     RUNOFF VOLUME    (mm)=      95.00        64.47          73.63
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.77

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0045)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0300):    10.50   0.760    12.75    59.43
      + ID2= 2 (  0310):    14.39   2.058    12.25    73.63
        ==================================================
        ID = 3 (  0045):    24.89   2.569    12.25    67.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| STANDHYD (  0320)|   Area    (ha)=  12.97
|ID= 1 DT=15.0 min |   Total Imp(%)=  93.00   Dir. Conn.(%)=  70.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.06         0.91
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     295.00       270.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       484.02
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       3.72 (ii)   15.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.92         0.67          3.370 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50          12.25
     RUNOFF VOLUME    (mm)=      95.00        84.78          91.93
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.88           0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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--------------------
| ADD HYD  (  0046)|
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0320):    12.97   3.370    12.25    91.93
      + ID2= 2 (  0045):    24.89   2.569    12.25    67.64
        ==================================================
        ID = 3 (  0046):    37.86   5.939    12.25    75.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0047)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000    0.0000    |   0.6600     0.8040
                          0.0590    0.2820    |   0.7220     0.9540
                          0.0720    0.3990    |   0.7800     1.1120
                          0.0750    0.4300    |   0.9210     1.2790
                          0.5910    0.6630    |   1.0350     1.4540

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0046)     37.860      5.939     12.25      75.96
   OUTFLOW: ID= 1 (  0047)     37.860      1.030     13.50      75.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.33
                  TIME SHIFT OF PEAK FLOW         (min)= 75.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.4498

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

--------------------
| ADD HYD  (  0040)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0200):    24.31   1.785    12.50    59.42
      + ID2= 2 (  0039):   150.08   7.676    13.25    68.94
        ==================================================
        ID = 3 (  0040):   174.39   9.087    13.00    67.61

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

--------------------
| ADD HYD  (  0040)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0040):   174.39   9.087    13.00    67.61
      + ID2= 2 (  0047):    37.86   1.030    13.50    75.93
        ==================================================
        ID = 1 (  0040):   212.25  10.085    13.00    69.10
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0048)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    0.00        102.00        0.0500
                    2.00        102.00    0.0500 /0.0400  Main Channel
                    8.00        100.00        0.0400      Main Channel
                   35.00        100.00        0.0400      Main Channel
                   41.00        102.00    0.0400 /0.0500  Main Channel
                   43.00        102.00        0.0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV       VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)       (m)      (cu.m.)       (cms)        (m/s)      (min)
       0.10    100.10    .161E+04        0.9          0.32      30.67
       0.20    100.20    .326E+04        2.8          0.50      19.47
       0.30    100.30    .494E+04        5.5          0.66      14.97
       0.40    100.40    .665E+04        8.9          0.79      12.45
       0.50    100.50    .841E+04       13.0          0.91      10.81
       0.60    100.60    .102E+05       17.6          1.02       9.64
       0.70    100.70    .120E+05       22.9          1.12       8.75
       0.80    100.80    .139E+05       28.7          1.22       8.06
       0.90    100.90    .158E+05       35.1          1.31       7.50
       1.00    101.00    .177E+05       42.0          1.40       7.03
       1.10    101.10    .197E+05       49.4          1.48       6.64
       1.20    101.20    .217E+05       57.3          1.56       6.30
       1.30    101.30    .237E+05       65.8          1.64       6.01
       1.40    101.40    .258E+05       74.7          1.71       5.75
       1.50    101.50    .279E+05       84.2          1.78       5.52
       1.60    101.60    .300E+05       94.2          1.85       5.31
       1.70    101.70    .322E+05      104.6          1.92       5.13
       1.80    101.80    .344E+05      115.6          1.98       4.96
       1.90    101.90    .367E+05      127.1          2.05       4.81

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0040)  212.25    10.09   13.00  69.10      0.43      0.82
   OUTFLOW: ID= 1 (  0048)  212.25    10.16   13.25  69.10      0.43      0.82


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

--------------------
| CALIB            |
| NASHYD   (  0600)|   Area    (ha)=   3.88   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.86

     Unit Hyd Qpeak  (cms)=   0.172

     PEAK FLOW       (cms)=   0.214 (i)
     TIME TO PEAK    (hrs)=  13.000
     RUNOFF VOLUME    (mm)=  59.527
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.620

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=  52.66
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      23.70        28.96
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     577.60       200.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        70.52
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.57 (ii)   26.89 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.89         4.05          7.443 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50         12.25
     RUNOFF VOLUME    (mm)=      95.00        65.28         74.20
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.68          0.77

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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            |
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```
| STANDHYD (  0500)|   Area    (ha)=   1.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  70.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.46         0.16
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     103.90       103.90
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       328.47
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       1.99 (ii)    9.77 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.37         0.12          0.492 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25         12.25
     RUNOFF VOLUME    (mm)=      95.00        80.61         90.68
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.84          0.94

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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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--------------------
| ADD HYD  (  0051)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0400):    52.66   7.443    12.25    74.20
      + ID2= 2 (  0500):     1.62   0.492    12.25    90.68
        ==================================================
        ID = 3 (  0051):    54.28   7.935    12.25    74.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0053)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    0.00        102.00        0.0500
                    2.00        102.00    0.0500 /0.0400  Main Channel
                    8.00        100.00        0.0400      Main Channel
```

```
             35.00        100.00       0.0400      Main Channel
             41.00        102.00    0.0400 /0.0500  Main Channel
             43.00        102.00       0.0500

     <--------------------- TRAVEL TIME TABLE ---------------------->
      DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
       (m)      (m)      (cu.m.)      (cms)        (m/s)      (min)
      0.10   100.10    .184E+04       0.9          0.32      35.09
      0.20   100.20    .373E+04       2.8          0.50      22.28
      0.30   100.30    .565E+04       5.5          0.66      17.13
      0.40   100.40    .761E+04       8.9          0.79      14.25
      0.50   100.50    .962E+04      13.0          0.91      12.36
      0.60   100.60    .117E+05      17.6          1.02      11.02
      0.70   100.70    .137E+05      22.9          1.12      10.01
      0.80   100.80    .159E+05      28.7          1.22       9.22
      0.90   100.90    .180E+05      35.1          1.31       8.58
      1.00   101.00    .202E+05      42.0          1.40       8.04
      1.10   101.10    .225E+05      49.4          1.48       7.59
      1.20   101.20    .248E+05      57.3          1.56       7.21
      1.30   101.30    .271E+05      65.8          1.64       6.87
      1.40   101.40    .295E+05      74.7          1.71       6.57
      1.50   101.50    .319E+05      84.2          1.78       6.31
      1.60   101.60    .343E+05      94.2          1.85       6.08
      1.70   101.70    .368E+05     104.6          1.92       5.87
      1.80   101.80    .394E+05     115.6          1.98       5.67
      1.90   101.90    .419E+05     127.1          2.05       5.50

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0051)   54.28     7.93   12.25  74.69      0.37      0.75
   OUTFLOW: ID= 1 (  0053)   54.28     5.94   12.50  74.69      0.31      0.67


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--------------------
| CALIB              |
| STANDHYD (  0700)|   Area    (ha)=  39.37
|ID= 1 DT=15.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  30.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      19.68        19.68
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     515.00       200.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        80.05
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       5.20 (ii)   25.46 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.04
                                                          *TOTALS*
     PEAK FLOW      (cms)=       3.69         3.21         5.725 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50         12.25
     RUNOFF VOLUME    (mm)=      95.00        67.38         75.67
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.70          0.79

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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(  0056)|    OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.2490     0.7270
                         0.0160     0.0530   |   0.3860     0.9190
                         0.0340     0.1040   |   1.5000     1.3090
                         0.0830     0.4530   |   3.5070     1.8090
                         0.1430     0.5900   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0700)     39.370     5.725     12.25      75.67
   OUTFLOW: ID= 1 (  0056)     39.370     1.765     13.00      75.65

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.84
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.3765


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--------------------
| CALIB              |
| STANDHYD (  0800)|   Area    (ha)=   2.61
|ID= 1 DT=15.0 min |   Total Imp(%)=  82.00   Dir. Conn.(%)=  60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.14         0.47
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     131.90       131.90
     Mannings n          =      0.013        0.250
```

```
     Max.Eff.Inten.(mm/hr)=     117.50       233.52
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       2.83 (ii)   15.49 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       0.51         0.17         0.619 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50         12.25
     RUNOFF VOLUME    (mm)=      95.00        76.15         87.46
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.79          0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0052)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0048):   212.25  10.159    13.25    69.10
      + ID2= 2 (  0053):    54.28   5.937    12.50    74.69
        ==================================================
        ID = 3 (  0052):   266.53  12.572    13.25    70.24

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

--------------------
| ADD HYD  (  0052)|
|  3 +  2 =  1     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0052):   266.53  12.572    13.25    70.24
      + ID2= 2 (  0056):    39.37   1.765    13.00    75.65
        ==================================================
        ID = 1 (  0052):   305.90  14.272    13.25    70.93

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

--------------------
| ADD HYD  (  0052)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0052):   305.90  14.272    13.25    70.93
```

```
      + ID2= 2 (  0600):     3.88   0.214    13.00    59.53
        ==================================================
        ID = 3 (  0052):   309.78  14.472    13.25    70.79

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

--------------------
| ADD HYD  (  0052)|
|  3 +  2 =  1     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0052):   309.78  14.472    13.25    70.79
      + ID2= 2 (  0800):     2.61   0.619    12.25    87.46
        ==================================================
        ID = 1 (  0052):   312.39  14.535    13.25    70.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0058)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
                   <------ DATA FOR SECTION (   1.1) ------>
                    Distance      Elevation       Manning
                        0.00        102.00        0.0500
                        2.00        102.00    0.0500 /0.0400  Main Channel
                        8.00        100.00        0.0400      Main Channel
                       35.00        100.00        0.0400      Main Channel
                       41.00        102.00    0.0400 /0.0500  Main Channel
                       43.00        102.00        0.0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)      (cms)        (m/s)      (min)
       0.10   100.10    .109E+04       0.9          0.32      20.80
       0.20   100.20    .221E+04       2.8          0.50      13.20
       0.30   100.30    .335E+04       5.5          0.66      10.15
       0.40   100.40    .451E+04       8.9          0.79       8.44
       0.50   100.50    .570E+04      13.0          0.91       7.33
       0.60   100.60    .691E+04      17.6          1.02       6.53
       0.70   100.70    .815E+04      22.9          1.12       5.93
       0.80   100.80    .941E+04      28.7          1.22       5.46
       0.90   100.90    .107E+05      35.1          1.31       5.08
       1.00   101.00    .120E+05      42.0          1.40       4.77
       1.10   101.10    .133E+05      49.4          1.48       4.50
       1.20   101.20    .147E+05      57.3          1.56       4.27
       1.30   101.30    .161E+05      65.8          1.64       4.07
       1.40   101.40    .175E+05      74.7          1.71       3.90
       1.50   101.50    .189E+05      84.2          1.78       3.74
       1.60   101.60    .204E+05      94.2          1.85       3.60
       1.70   101.70    .218E+05     104.6          1.92       3.48
       1.80   101.80    .233E+05     115.6          1.98       3.36
```

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       1.90   101.90    .249E+05     127.1          2.05       3.26

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (  0052)  312.39    14.53   13.25  70.93      0.53      0.94
    OUTFLOW: ID= 1 (  0058)  312.39    14.66   13.25  70.93      0.54      0.95


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

--------------------
| CALIB              |
| NASHYD   (  0900)|   Area    (ha)=   4.09   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.274

     PEAK FLOW       (cms)=   0.300 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.417
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.619

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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

--------------------
| CALIB              |
| STANDHYD (  0910)|   Area    (ha)=   6.07
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.73         3.34
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     201.00       201.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        70.52
              over (min)       15.00        30.00
     Storage Coeff.  (min)=       3.22 (ii)    26.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.04
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.59         0.47          0.887 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50          12.25
     RUNOFF VOLUME    (mm)=      95.00        65.28          74.20
```

```
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.68           0.77

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0061)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0900):     4.09   0.300    12.50    59.42
      + ID2= 2 (  0910):     6.07   0.887    12.25    74.20
        ==================================================
        ID = 3 (  0061):    10.16   1.091    12.25    68.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB              |
| STANDHYD (  0920)|   Area    (ha)=   0.87
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  45.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.35
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.00         1.50
     Length            (m)=      76.00        76.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       129.74
              over (min)       15.00        15.00
     Storage Coeff.  (min)=       2.03 (ii)    12.22 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.09          0.222 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.25          12.25
     RUNOFF VOLUME    (mm)=      95.00        66.99          79.59
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.70           0.83

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0062)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0061):    10.16   1.091    12.25    68.25
      + ID2= 2 (  0920):     0.87   0.222    12.25    79.59
        ==================================================
        ID = 3 (  0062):    11.03   1.313    12.25    69.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB              |
| STANDHYD (  0930)|   Area    (ha)=   5.40
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.43         2.97
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     190.00       190.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        70.52
              over (min)       15.00        30.00
     Storage Coeff.  (min)=       3.12 (ii)    25.65 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.04
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.53         0.43          0.794 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50          12.25
     RUNOFF VOLUME    (mm)=      95.00        65.28          74.19
     TOTAL RAINFALL   (mm)=      96.00        96.00          96.00
     RUNOFF COEFFICIENT   =       0.99         0.68           0.77

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0065)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0062):    11.03   1.313    12.25    69.14
      + ID2= 2 (  0930):     5.40   0.794    12.25    74.19
        ==================================================
        ID = 3 (  0065):    16.43   2.107    12.25    70.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0066)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.4090      0.3550
                           0.0160     0.0420   |   0.6210      0.4390
                           0.0250     0.0970   |   0.8250      0.5560
                           0.0310     0.1640   |   0.8930      0.6850
                           0.1660     0.2430   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0065)     16.430      2.107     12.25      70.80
   OUTFLOW: ID= 1 (  0066)     16.430      0.687     13.00      70.76

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 32.61
                 TIME SHIFT OF PEAK FLOW         (min)= 45.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.4811


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

--------------------
| CALIB              |
| STANDHYD (  1000)|   Area    (ha)=  12.99
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.85         7.14
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       1.50         1.50
     Length            (m)=     295.00       295.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50        70.52
              over (min)       15.00        45.00
     Storage Coeff.  (min)=       4.06 (ii)    33.40 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=       0.11         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.25         0.81         1.617 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.75         12.25
     RUNOFF VOLUME    (mm)=      95.00        65.28         74.20
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.68          0.77

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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( 0069)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1110     0.2210
                          0.0110     0.0420   |   0.1810     0.2630
                          0.0200     0.0890   |   0.2620     0.3080
                          0.0260     0.1430   |   0.3530     0.3550
                          0.0650     0.1810   |   0.0000     0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1000)     12.990     1.617     12.25      74.20
   OUTFLOW: ID= 1 (  0069)     12.990     0.477     13.50      74.12

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.49
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.4219

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

--------------------
| ADD HYD  (  0067)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0058):   312.39  14.664    13.25    70.93
      + ID2= 2 (  0066):    16.43   0.687    13.00    70.76
        ==================================================
        ID = 3 (  0067):   328.82  15.351    13.25    70.92

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

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--------------------
| ADD HYD  (  0067)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0067):   328.82  15.351    13.25    70.92
      + ID2= 2 (  0069):    12.99   0.477    13.50    74.12
        ==================================================
        ID = 1 (  0067):   341.81  15.827    13.25    71.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0070)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (    1.1) ------>
               Distance      Elevation       Manning
                   0.00       102.00      0.0500
                   2.00       102.00    0.0500 /0.0250  Main Channel
                   8.00       100.00      0.0250      Main Channel
                  35.00       100.00      0.0250      Main Channel
                  41.00       102.00    0.0250 /0.0500  Main Channel
                  43.00       102.00      0.0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
        (m)       (m)      (cu.m.)      (cms)        (m/s)       (min)
       0.10    100.10    .184E+04       0.7          0.27        41.62
       0.20    100.20    .373E+04       2.4          0.43        26.42
       0.30    100.30    .565E+04       4.6          0.55        20.32
       0.40    100.40    .761E+04       7.5          0.67        16.89
       0.50    100.50    .962E+04      10.9          0.77        14.66
       0.60    100.60    .117E+05      14.9          0.86        13.07
       0.70    100.70    .137E+05      19.3          0.95        11.87
       0.80    100.80    .159E+05      24.2          1.03        10.93
       0.90    100.90    .180E+05      29.6          1.11        10.17
       1.00    101.00    .202E+05      35.4          1.18         9.54
       1.10    101.10    .225E+05      41.6          1.25         9.00
       1.20    101.20    .248E+05      48.3          1.32         8.55
       1.30    101.30    .271E+05      55.5          1.38         8.15
       1.40    101.40    .295E+05      63.0          1.44         7.80
       1.50    101.50    .319E+05      71.0          1.50         7.49
       1.60    101.60    .343E+05      79.4          1.56         7.21
       1.70    101.70    .368E+05      88.2          1.62         6.96
       1.80    101.80    .394E+05      97.5          1.67         6.73
       1.90    101.90    .419E+05     107.2          1.72         6.52

                                     <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0067)  341.81    15.83   13.25  71.04      0.62      0.88
   OUTFLOW: ID= 1 (  0070)  341.81    15.25   13.50  71.04      0.61      0.87
```

```
------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  1100)|   Area    (ha)=  21.15   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.42

     Unit Hyd Qpeak  (cms)=   1.923

     PEAK FLOW       (cms)=   1.974 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.109
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.616

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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

--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=  17.50   Curve Number   (CN)= 84.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.84   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.51

     Unit Hyd Qpeak  (cms)=   1.311

     PEAK FLOW       (cms)=   1.427 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  59.342
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.618

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


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

--------------------
| CALIB            |
| STANDHYD (  1300)|   Area    (ha)=   5.06
|ID= 1 DT=15.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  65.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.30         0.76
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
```

```
     Length           (m)=     184.00       184.00
     Mannings n          =      0.025        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       247.12
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       4.15 (ii)   16.43 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.11         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.05         0.28         1.235 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.50         12.25
     RUNOFF VOLUME    (mm)=      95.00        76.94         88.68
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.80          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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 (  1400)|   Area    (ha)=  26.51
|ID= 1 DT=15.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  80.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      23.86         2.65
     Dep. Storage     (mm)=       1.00         4.84
     Average Slope     (%)=       2.00         2.00
     Length           (m)=     417.00       417.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     117.50       125.49
                over (min)      15.00        45.00
     Storage Coeff.  (min)=       4.58 (ii)   30.89 (ii)
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=       0.11         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.72         0.55         6.982 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.75         12.25
     RUNOFF VOLUME    (mm)=      95.00        74.36         90.87
     TOTAL RAINFALL   (mm)=      96.00        96.00         96.00
     RUNOFF COEFFICIENT   =       0.99         0.77          0.95

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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  (  0071)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1100):    21.15   1.974    12.50    59.11
      + ID2= 2 (  1200):    17.50   1.427    12.50    59.34
        =====================================================
        ID = 3 (  0071):    38.65   3.401    12.50    59.21

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

--------------------
| ADD HYD  (  0071)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0071):    38.65   3.401    12.50    59.21
      + ID2= 2 (  1300):     5.06   1.235    12.25    88.68
        =====================================================
        ID = 1 (  0071):    43.71   3.953    12.25    62.63

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

--------------------
| ADD HYD  (  0071)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0071):    43.71   3.953    12.25    62.63
      + ID2= 2 (  1400):    26.51   6.982    12.25    90.87
        =====================================================
        ID = 3 (  0071):    70.22  10.935    12.25    73.29

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

--------------------
| ADD HYD  (  0071)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0071):    70.22  10.935    12.25    73.29
      + ID2= 2 (  0070):   341.81  15.246    13.50    71.04
        =====================================================
        ID = 1 (  0071):   412.03  17.420    13.25    71.42

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

 FINISH
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=======================
      V    V   I    SSSSS  U   U    A    L              (v 5.2.2003)
      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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***** D E T A I L E D   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.2\VO2\voin.dat

  Output  filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\362
e333f-7021-4339-963a-e1ed8bec4ea5\sce
  Summary filename:
C:\Users\p002675e\AppData\Local\Civica\VH5\f3458b28-58c2-4b83-abfc-afd3ae730420\362
e333f-7021-4339-963a-e1ed8bec4ea5\sce


DATE: 10/04/2021                  TIME: 10:42:47

USER:

COMMENTS:
```

Grassy Brook - Climate Change
50-yr 24-Hour SCS Type II

```
----------------------------------------------------------------------------------
-----------------------
  **************************************************
  ** SIMULATION : 50yr 24hr 15min SCS-MTO 2070  **
  **************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\p002675e\AppD
|                  |              ata\Local\Temp\
|                  |              e81a3506-f42f-4369-8145-da6feee00a3d\55d8f3a3
| Ptotal= 96.00 mm |    Comments: 50yr 24hr 15min SCS-MTO 2070
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	6.50	1.73	12.75	13.82	19.00	1.73
0.50	1.06	6.75	1.73	13.00	7.10	19.25	1.73
0.75	1.06	7.00	1.73	13.25	7.10	19.50	1.73
1.00	1.06	7.25	1.73	13.50	5.18	19.75	1.73
1.25	1.06	7.50	2.11	13.75	5.18	20.00	1.73
1.50	1.06	7.75	2.11	14.00	4.03	20.25	1.73
1.75	1.06	8.00	2.11	14.25	4.03	20.50	1.15
2.00	1.06	8.25	2.11	14.50	2.88	20.75	1.15
2.25	1.06	8.50	2.50	14.75	2.88	21.00	1.15
2.50	1.25	8.75	2.50	15.00	2.88	21.25	1.15
2.75	1.25	9.00	2.69	15.25	2.88	21.50	1.15
3.00	1.25	9.25	2.69	15.50	2.88	21.75	1.15
3.25	1.25	9.50	3.07	15.75	2.88	22.00	1.15
3.50	1.25	9.75	3.07	16.00	2.88	22.25	1.15
3.75	1.25	10.00	3.46	16.25	2.88	22.50	1.15
4.00	1.25	10.25	3.46	16.50	1.73	22.75	1.15
4.25	1.25	10.50	4.42	16.75	1.73	23.00	1.15
4.50	1.54	10.75	4.42	17.00	1.73	23.25	1.15
4.75	1.54	11.00	5.95	17.25	1.73	23.50	1.15
5.00	1.54	11.25	5.95	17.50	1.73	23.75	1.15
5.25	1.54	11.50	9.22	17.75	1.73	24.00	1.15
5.50	1.54	11.75	9.22	18.00	1.73	24.25	1.15
5.75	1.54	12.00	28.42	18.25	1.73		
6.00	1.54	12.25	117.50	18.50	1.73		
6.25	1.54	12.50	13.82	18.75	1.73		

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

--------------------
| CALIB            |
| NASHYD   (  0401)|   Area    (ha)= 288.80   Curve Number   (CN)= 77.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   3.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.23

    Unit Hyd Qpeak  (cms)=   4.947

    PEAK FLOW       (cms)=   6.421 (i)
    TIME TO PEAK    (hrs)=  14.500
    RUNOFF VOLUME    (mm)=  50.818
    TOTAL RAINFALL   (mm)=  96.000
    RUNOFF COEFFICIENT   =   0.529

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0009)|
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
```

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
1342.00	178.95	0.0500	
1349.00	178.45	0.0500	
1356.00	177.95	0.0500	
1363.00	177.45	0.0500	
1370.00	176.95	0.0500	
1371.00	176.83	0.0500	
1398.85	175.84	0.0500	
1415.82	175.59	0.0500 /0.0300	Main Channel
1417.56	175.37	0.0300	Main Channel
1419.80	175.10	0.0300	Main Channel
1421.16	175.34	0.0300	Main Channel
1422.57	175.76	0.0300 /0.0500	Main Channel
1433.24	176.23	0.0500	
1457.10	176.88	0.0500	
1458.00	176.95	0.0500	
1460.00	177.45	0.0500	
1470.00	177.95	0.0500	
1477.00	178.45	0.0500	
1488.00	178.95	0.0500	

<-------------------- TRAVEL TIME TABLE --------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	175.26	.494E+03	0.0	0.22	196.60
0.33	175.43	.195E+04	0.3	0.37	120.94
0.49	175.59	.423E+04	0.8	0.48	91.51
0.70	175.80	.119E+05	2.3	0.51	86.89
0.91	176.01	.278E+05	5.6	0.53	83.19
1.12	176.22	.498E+05	10.9	0.58	76.10
1.33	176.43	.785E+05	18.5	0.62	70.68
1.54	176.64	.115E+06	28.9	0.67	66.08
1.75	176.85	.159E+06	42.7	0.71	61.87
1.96	177.06	.208E+06	61.6	0.79	56.13
2.17	177.27	.259E+06	83.9	0.86	51.35
2.38	177.48	.312E+06	109.3	0.93	47.56
2.59	177.69	.368E+06	136.6	0.98	44.96
2.80	177.90	.429E+06	167.3	1.03	42.74
3.01	178.11	.493E+06	202.2	1.09	40.65
3.22	178.32	.561E+06	240.9	1.14	38.80
3.43	178.53	.632E+06	282.6	1.19	37.25
3.64	178.74	.707E+06	327.2	1.23	35.99
3.85	178.95	.786E+06	375.9	1.27	34.84

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
		<---- hydrograph ---->			<-pipe / channel->	
INFLOW : ID= 2 (0401)	288.80	6.42	14.50	50.82	0.94	0.54
OUTFLOW: ID= 1 (0009)	288.80	5.30	15.75	50.81	0.89	0.53

```
----------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0402)|   Area    (ha)= 500.20   Curve Number   (CN)= 78.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   3.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   4.08

    Unit Hyd Qpeak  (cms)=   4.683

    PEAK FLOW       (cms)=   7.094 (i)
    TIME TO PEAK    (hrs)=  16.750
    RUNOFF VOLUME    (mm)=  52.127
    TOTAL RAINFALL   (mm)=  96.000
    RUNOFF COEFFICIENT   =   0.543

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0008)|
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
```

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
1342.00	178.95	0.0450	
1349.00	178.45	0.0450	
1356.00	177.95	0.0450	
1363.00	177.45	0.0450	
1370.00	176.95	0.0450	
1371.00	176.83	0.0450	
1398.85	175.84	0.0450	
1415.82	175.59	0.0450 /0.0300	Main Channel
1417.56	175.37	0.0300	Main Channel
1419.80	175.10	0.0300	Main Channel
1421.16	175.34	0.0300	Main Channel
1422.57	175.76	0.0300 /0.0450	Main Channel
1433.24	176.23	0.0450	
1457.10	176.88	0.0450	
1458.00	176.95	0.0450	
1460.00	177.45	0.0450	
1470.00	177.95	0.0450	
1477.00	178.45	0.0450	
1488.00	178.95	0.0450	

<-------------------- TRAVEL TIME TABLE --------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	175.26	.110E+04	0.0	0.22	438.46
0.33	175.43	.435E+04	0.3	0.37	269.72
0.49	175.59	.942E+04	0.8	0.48	204.09

```
        0.70   175.80    .265E+05       2.3          0.51     191.53
        0.91   176.01    .621E+05       5.8          0.55     179.56
        1.12   176.22    .111E+06      11.4          0.61     161.99
        1.33   176.43    .175E+06      19.6          0.66     149.10
        1.54   176.64    .256E+06      30.8          0.71     138.43
        1.75   176.85    .354E+06      45.7          0.76     128.88
        1.96   177.06    .463E+06      66.3          0.85     116.33
        2.17   177.27    .577E+06      90.6          0.93     106.06
        2.38   177.48    .696E+06     118.3          1.01      97.98
        2.59   177.69    .822E+06     148.1          1.07      92.48
        2.80   177.90    .957E+06     181.6          1.12      87.77
        3.01   178.11    .110E+07     219.8          1.18      83.38
        3.22   178.32    .125E+07     262.2          1.24      79.49
        3.43   178.53    .141E+07     307.9          1.29      76.25
        3.64   178.74    .158E+07     356.8          1.34      73.61
        3.85   178.95    .175E+07     410.2          1.38      71.20

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (  0402)  500.20     7.09   16.75  52.13      0.96      0.56
    OUTFLOW: ID= 1 (  0008)  500.20     5.62   19.50  52.12      0.90      0.55


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

 --------------------
 | CALIB              |
 | NASHYD   (  0403)|   Area    (ha)= 149.40   Curve Number   (CN)= 79.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   4.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   2.33

      Unit Hyd Qpeak  (cms)=   2.449

      PEAK FLOW       (cms)=   3.363 (i)
      TIME TO PEAK    (hrs)=  14.750
      RUNOFF VOLUME    (mm)=  53.059
      TOTAL RAINFALL   (mm)=  96.000
      RUNOFF COEFFICIENT   =   0.553

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

 --------------------
 | ADD HYD  (  0010)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0403):   149.40   3.363    14.75    53.06
       + ID2= 2 (  0008):   500.20   5.618    19.50    52.12
         ====================================================
```

```
         ID = 3 (  0010):   649.60   6.982    17.75    52.34

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

 --------------------
 | ADD HYD  (  0010)|
 |   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (  0010):   649.60   6.982    17.75    52.34
       + ID2= 2 (  0009):   288.80   5.297    15.75    50.81
         ====================================================
         ID = 1 (  0010):   938.40  11.861    16.50    51.87

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

 --------------------
 | ROUTE CHN(  0411)|
 | IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (    1.1) ------>
                 Distance       Elevation       Manning
                  1342.00        177.00        0.0450
                  1349.00        176.50        0.0450
                  1356.00        176.00        0.0450
                  1363.00        175.50        0.0450
                  1370.00        175.00        0.0450
                  1371.00        174.88        0.0450
                  1398.85        173.89        0.0450
                  1415.82        173.64    0.0450 /0.0300  Main Channel
                  1417.56        173.42        0.0300      Main Channel
                  1419.80        173.15        0.0300      Main Channel
                  1421.16        173.39        0.0300      Main Channel
                  1422.57        173.81    0.0300 /0.0450  Main Channel
                  1433.24        174.28        0.0450
                  1457.10        174.93        0.0450
                  1458.00        175.00        0.0450
                  1460.00        175.50        0.0450
                  1470.00        176.00        0.0450
                  1477.00        176.50        0.0450
                  1488.00        177.00        0.0450

       <-------------------- TRAVEL TIME TABLE --------------------->
         DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
          (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
         0.16    173.31     .428E+03        0.1           0.28      137.56
         0.33    173.48     .169E+04        0.3           0.45       84.62
         0.49    173.64     .367E+04        1.0           0.60       64.03
         0.70    173.85     .103E+05        2.9           0.64       60.09
         0.91    174.06     .242E+05        7.1           0.68       56.34
         1.12    174.27     .432E+05       14.2           0.75       50.83
         1.33    174.48     .681E+05       24.3           0.82       46.78
```

```
        1.54   174.69    .996E+05      38.2          0.88      43.43
        1.75   174.90    .138E+06      56.7          0.95      40.44
        1.96   175.11    .180E+06      82.2          1.05      36.50
        2.17   175.32    .224E+06     112.4          1.15      33.28
        2.38   175.53    .271E+06     146.8          1.25      30.74
        2.59   175.74    .320E+06     183.7          1.32      29.01
        2.80   175.95    .372E+06     225.3          1.39      27.54
        3.01   176.16    .428E+06     272.7          1.47      26.16
        3.22   176.37    .487E+06     325.3          1.54      24.94
        3.43   176.58    .548E+06     381.9          1.60      23.92
        3.64   176.79    .613E+06     442.6          1.66      23.10
        3.85   177.00    .682E+06     508.8          1.72      22.34

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (  0010)  938.40    11.86   16.50  51.87      1.05      0.73
    OUTFLOW: ID= 1 (  0411)  938.40    11.48   17.25  51.87      1.04      0.72


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

 --------------------
 | CALIB              |
 | NASHYD   (  0404)|   Area    (ha)= 197.30   Curve Number   (CN)= 81.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   4.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   2.52

      Unit Hyd Qpeak  (cms)=   2.990

      PEAK FLOW       (cms)=   4.416 (i)
      TIME TO PEAK    (hrs)=  14.750
      RUNOFF VOLUME    (mm)=  55.838
      TOTAL RAINFALL   (mm)=  96.000
      RUNOFF COEFFICIENT   =   0.582

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

 --------------------
 | ADD HYD  (  0011)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0404):   197.30   4.416    14.75    55.84
       + ID2= 2 (  0411):   938.40  11.477    17.25    51.87
         ====================================================
         ID = 3 (  0011):  1135.70  14.727    16.50    52.56

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

```
 --------------------
 | ROUTE CHN(  0412)|
 | IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (    1.1) ------>
                 Distance       Elevation       Manning
                  1113.00        175.50        0.0450
                  1126.00        175.00        0.0450
                  1130.00        174.72        0.0450
                  1136.00        174.50        0.0450
                  1157.90        173.73        0.0450
                  1174.80        173.48    0.0450 /0.0300  Main Channel
                  1176.50        173.26        0.0300      Main Channel
                  1178.80        172.99        0.0300      Main Channel
                  1180.10        173.23        0.0300      Main Channel
                  1181.50        173.65    0.0300 /0.0450  Main Channel
                  1192.20        174.12        0.0450
                  1216.00        174.77        0.0450
                  1218.00        175.00        0.0450
                  1232.00        175.50        0.0450

       <-------------------- TRAVEL TIME TABLE --------------------->
         DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
          (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
         0.12    173.11     .918E+02        0.0           0.21       69.02
         0.24    173.23     .367E+03        0.1           0.34       43.39
         0.37    173.36     .808E+03        0.4           0.45       32.20
         0.49    173.48     .139E+04        0.9           0.55       26.45
         0.62    173.61     .268E+04        1.8           0.59       24.72
         0.76    173.75     .518E+04        3.5           0.59       24.82
         0.89    173.88     .871E+04        6.2           0.62       23.53
         1.03    174.02     .131E+05        9.9           0.66       22.04
         1.16    174.15     .182E+05       14.7           0.71       20.70
         1.30    174.29     .244E+05       20.7           0.74       19.65
         1.43    174.42     .315E+05       28.1           0.78       18.71
         1.57    174.56     .398E+05       37.1           0.82       17.85
         1.70    174.69     .490E+05       47.9           0.86       17.06
         1.84    174.83     .591E+05       61.2           0.91       16.11
         1.97    174.96     .697E+05       76.9           0.97       15.12
         2.11    175.10     .808E+05       93.0           1.01       14.47
         2.24    175.23     .927E+05      110.7           1.05       13.97
         2.38    175.37     .106E+06      130.3           1.08       13.50
         2.51    175.50     .119E+06      152.0           1.12       13.07

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (  0011) 1135.70    14.73   16.50  52.56      1.16      0.71
    OUTFLOW: ID= 1 (  0412) 1135.70    14.66   17.00  52.56      1.16      0.71
```

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

--------------------
| CALIB             |
| NASHYD   (  0405)|   Area    (ha)=  56.10   Curve Number   (CN)= 81.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.64

     Unit Hyd Qpeak  (cms)=   1.307

     PEAK FLOW       (cms)=   1.755 (i)
     TIME TO PEAK    (hrs)=  13.750
     RUNOFF VOLUME    (mm)=  55.836
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.582

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0405):    56.10   1.755    13.75    55.84
      + ID2= 2 (  0412):  1135.70  14.658    17.00    52.56
        ==================================================
        ID = 3 (  0012):  1191.80  15.331    16.75    52.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0413)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation      Manning
                1143.00        176.00       0.0450
                1156.00        175.50       0.0450
                1164.00        175.00       0.0450
                1170.00        174.50       0.0450
                1176.00        174.00       0.0450
                1196.00        173.50       0.0450
                1209.00        173.01       0.0450
                1209.00        173.00       0.0450
                1224.76        173.03       0.0300      Main Channel
                1227.52        172.35       0.0300      Main Channel
                1230.30        172.05       0.0300      Main Channel
                1231.10        172.22       0.0300      Main Channel
                1232.00        173.00       0.0300      Main Channel
                1234.95        173.16       0.0450
                1239.00        173.50       0.0450
```

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                1248.00        174.00       0.0450
                1251.00        174.50       0.0450
                1256.00        175.00       0.0450
                1276.00        175.50       0.0450
                1301.00        176.00       0.0450

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
       0.20   172.25    .425E+03       0.1          0.26     102.86
       0.39   172.44    .153E+04       0.4          0.44      60.21
       0.59   172.64    .301E+04       1.1          0.59      44.81
       0.78   172.83    .480E+04       2.2          0.71      37.16
       0.98   173.03    .730E+04       3.4          0.75      35.48
       1.19   173.24    .170E+05       6.6          0.62      43.07
       1.40   173.45    .296E+05      12.7          0.69      38.76
       1.62   173.67    .453E+05      21.0          0.74      35.89
       1.83   173.88    .652E+05      32.2          0.79      33.72
       2.04   174.09    .890E+05      47.4          0.85      31.26
       2.25   174.30    .114E+06      67.0          0.93      28.50
       2.46   174.51    .141E+06      89.7          1.01      26.26
       2.68   174.73    .170E+06     115.3          1.08      24.50
       2.89   174.94    .199E+06     144.3          1.15      23.04
       3.10   175.15    .231E+06     174.0          1.20      22.18
       3.31   175.36    .267E+06     207.4          1.24      21.49
       3.53   175.58    .308E+06     244.4          1.27      20.97
       3.74   175.79    .353E+06     284.6          1.29      20.66
       3.95   176.00    .403E+06     330.8          1.31      20.32

                              <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
    INFLOW : ID= 2 (  0012) 1191.80    15.33   16.75  52.71      1.47      0.70
    OUTFLOW: ID= 1 (  0413) 1191.80    15.03   17.25  52.71      1.46      0.70


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

--------------------
| CALIB             |
| NASHYD   (  0406)|   Area    (ha)=  65.30   Curve Number   (CN)= 81.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.45

     Unit Hyd Qpeak  (cms)=   1.018

     PEAK FLOW       (cms)=   1.496 (i)
     TIME TO PEAK    (hrs)=  14.750
     RUNOFF VOLUME    (mm)=  55.838
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.582
```

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

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0406):    65.30   1.496    14.75    55.84
      + ID2= 2 (  0413):  1191.80  15.032    17.25    52.71
        ==================================================
        ID = 3 (  0013):  1257.10  16.019    17.25    52.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0414)|
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation      Manning
                1132.00        174.50       0.0450
                1137.00        174.00       0.0450
                1144.00        173.50       0.0450
                1146.00        173.50       0.0450
                1155.00        173.50       0.0450
                1161.00        173.00       0.0450
                1204.36        172.58       0.0450
                1209.99        172.32    0.0450 /0.0300  Main Channel
                1212.00        171.59       0.0300      Main Channel
                1214.06        171.06       0.0300      Main Channel
                1215.59        171.47       0.0300      Main Channel
                1217.67        172.09    0.0300 /0.0450  Main Channel
                1226.25        172.29       0.0450
                1230.00        172.50       0.0450
                1234.00        173.00       0.0450
                1237.00        173.50       0.0450
                1240.00        174.00       0.0450
                1243.00        174.50       0.0450
                1246.00        175.00       0.0450

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
       0.17   171.23    .472E+02       0.0          0.22      31.35
       0.35   171.40    .189E+03       0.2          0.35      19.75
       0.52   171.58    .424E+03       0.5          0.46      14.98
       0.69   171.75    .743E+03       1.0          0.57      12.13
       0.86   171.92    .114E+04       1.8          0.67      10.40
       1.04   172.09    .160E+04       2.9          0.75       9.20
       1.22   172.28    .248E+04       4.7          0.79       8.81
```

```
       1.41   172.46    .393E+04       7.5          0.79       8.71
       1.59   172.65    .598E+04      11.5          0.80       8.64
       1.78   172.83    .939E+04      17.3          0.76       9.05
       1.96   173.02    .144E+05      25.7          0.74       9.32
       2.15   173.20    .201E+05      37.8          0.78       8.87
       2.33   173.39    .261E+05      52.7          0.84       8.27
       2.52   173.57    .328E+05      67.8          0.86       8.05
       2.70   173.76    .402E+05      88.9          0.92       7.53
       2.89   173.94    .478E+05     112.8          0.98       7.07
       3.07   174.13    .558E+05     139.9          1.04       6.65
       3.26   174.31    .640E+05     169.8          1.10       6.28
       3.44   174.50    .724E+05     202.5          1.16       5.96

                              <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
    INFLOW : ID= 2 (  0013) 1257.10    16.02   17.25  52.87      1.74      0.77
    OUTFLOW: ID= 1 (  0414) 1257.10    15.98   17.25  52.87      1.74      0.77


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

--------------------
| CALIB             |
| NASHYD   (  0407)|   Area    (ha)=  16.70   Curve Number   (CN)= 82.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   4.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.27

     Unit Hyd Qpeak  (cms)=   0.502

     PEAK FLOW       (cms)=   0.660 (i)
     TIME TO PEAK    (hrs)=  13.500
     RUNOFF VOLUME    (mm)=  57.867
     TOTAL RAINFALL   (mm)=  96.000
     RUNOFF COEFFICIENT   =   0.603

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0407):    16.70   0.660    13.50    57.87
      + ID2= 2 (  0414):  1257.10  15.983    17.25    52.87
        ==================================================
        ID = 3 (  0014):  1273.80  16.109    17.25    52.94

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

Project: LC_Proposed_Condition
Simulation Run: SCS50yr - MTO
Simulation Start: 1 June 2009, 24:00
Simulation End: 3 June 2009, 06:00

HMS Version: 4.7.1
Executed: 05 October 2021, 14:38

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Tri1_20	3.79
Tri1_30	1.66
Tri1_10	1.73

Downstream

Element Name	Downstream
Tri1_20	Pt11
Tri1_30	Pt12
Tri1_10	Montrose Rd

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Tri1_20	3.83	82.61	10.7
Tri1_30	2.44	81.49	11.54
Tri1_10	9.28	82.69	10.63

Transform: Scs

Element Name	Lag	Unitgraph Type
Tri1_20	93.96	Standard
Tri1_30	72.49	Standard
Tri1_10	49.8	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
R_Tri1_20	Pt11
R_Tri1_10	Montrose Rd
R_Tri1_00	Pt2

Route: Muskingum Cunge

Element Name	Method	Channel	Length (M)	Energy Slope	Mannings n	Bottom Width	Side Slope	Initial Variable	Space - Time Method	Index Parameter Type	Index Celerity	Maximum Depth Iterations	Maximum Route Step Iterations
R_Tri1_20	Muskingum Cunge	Trapezoid	3638.1	0	0.04	16.38	16.97	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_10	Muskingum Cunge	Trapezoid	4658.8	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30
R_Tri1_00	Muskingum Cunge	Trapezoid	2520	0	0.04	33.81	15.35	Combined Inflow	Automatic DX and DT	Index Celerity	1.52	20	30

Global Results Summary

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Tri1_20	3.79	15.39	02Jun2009, 13:35	54.18
Tri1_30	1.66	7.76	02Jun2009, 13:10	51.39
Pt12	1.66	7.76	02Jun2009, 13:10	51.39
R_Tri1_20	1.66	3.34	02Jun2009, 16:30	47.11
Pt11	5.45	15.67	02Jun2009, 13:35	52.03
R_Tri1_10	5.45	11.57	02Jun2009, 16:20	50.66
Tri1_10	1.73	11.6	02Jun2009, 12:45	56.71
Montrose Rd	7.18	12.68	02Jun2009, 16:20	52.11
R_Tri1_00	7.18	11.71	02Jun2009, 17:50	51.13
Pt2	7.18	11.71	02Jun2009, 17:50	51.13

Lyons Creek Trib @ Montrose Road - Climate Change
50-year 24-Hour SCS Type II

Subbasin: Tri1_20

Area (KM2) : 3.79
Downstream : Pt11

Loss Rate: Scs

Percent Impervious Area	3.83
Curve Number	82.61
Initial Abstraction	10.7

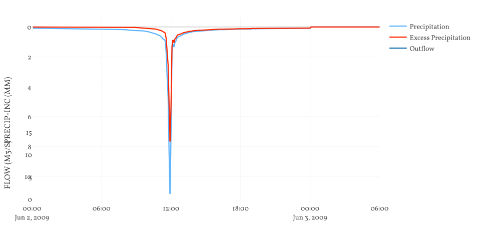
Transform: Scs

Lag	93.96
Unitgraph Type	Standard

Results: Tri1_20

Peak Discharge (M3/S)	15.39
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	54.18
Precipitation Volume (M3)	3.64E5
Loss Volume (M3)	1.59E5
Excess Volume (M3)	2.05E5
Direct Runoff Volume (M3)	2.05E5
Baseflow Volume (M3)	0

Precipitation and Outflow



Subbasin: Tri1_30

Area (KM2) : 1.66
Downstream : Pt12

Loss Rate: Scs

Percent Impervious Area	2.44
Curve Number	81.49
Initial Abstraction	11.54

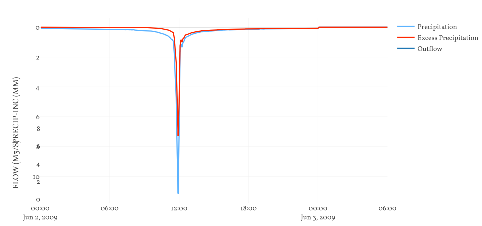
Transform: Scs

Lag	72.49
Unitgraph Type	Standard

Results: Tri1_30

Peak Discharge (M3/S)	7.76
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	51.39
Precipitation Volume (M3)	1.59E5
Loss Volume (M3)	74209.58
Excess Volume (M3)	85287.97
Direct Runoff Volume (M3)	85287.97
Baseflow Volume (M3)	0

Precipitation and Outflow

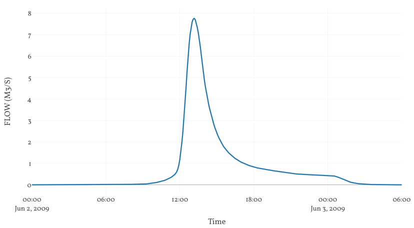


Junction: Pt12

Downstream : R_Tri1_20

Results: Pt12	
Peak Discharge (M3/S)	7.76
Time of Peak Discharge	02Jun2009, 13:10
Volume (MM)	51.39

Outflow



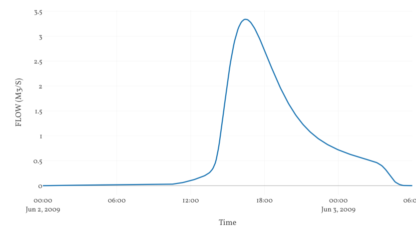
Reach: R_Tri1_20

Downstream : Pt11

Route: Muskingum Cunge	
Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	3638.1
Energy Slope	0
Mannings n	0.04
Bottom Width	16.38
Side Slope	16.97
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_20	
Peak Discharge (M3/S)	3.34
Time of Peak Discharge	02Jun2009, 16:30
Volume (MM)	47.11
Peak Inflow (M3/S)	7.76
Inflow Volume (M3)	85287.97

Outflow

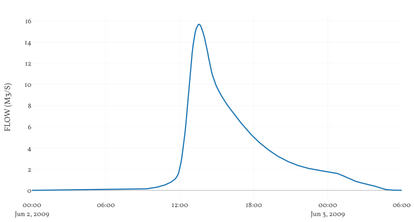


Junction: Pt11

Downstream : R_Tri1_10

Results: Pt11	
Peak Discharge (M3/S)	15.67
Time of Peak Discharge	02Jun2009, 13:35
Volume (MM)	52.03

Outflow



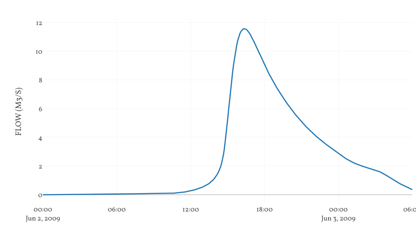
Reach: R_Tri1_10

Downstream : Montrose Rd

Route: Muskingum Cunge	
Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	4658.8
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_10	
Peak Discharge (M3/S)	11.57
Time of Peak Discharge	02Jun2009, 16:20
Volume (MM)	50.66
Peak Inflow (M3/S)	15.67
Inflow Volume (M3)	2.83E5

Outflow



Subbasin: Tri1_10

Area (KM2) : 1.73
Downstream : Montrose Rd

Loss Rate: Scs

Percent Impervious Area	9.28
Curve Number	82.69
Initial Abstraction	10.63

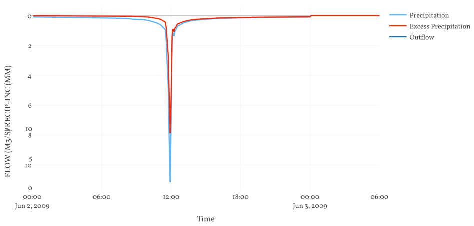
Transform: Scs

Lag	49.8
Unitgraph Type	Standard

Results: Tri1_10

Peak Discharge (M3/S)	11.6
Time of Peak Discharge	02Jun2009, 12:45
Volume (MM)	56.71
Precipitation Volume (M3)	1.66E5
Loss Volume (M3)	68013.99
Excess Volume (M3)	97931.49
Direct Runoff Volume (M3)	97931.49
Baseflow Volume (M3)	0

Precipitation and Outflow



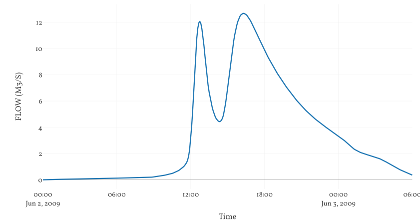
Junction: Montrose Rd

Downstream : R_Tri1_00

Results: Montrose Rd

Peak Discharge (M3/S)	12.68
Time of Peak Discharge	02Jun2009, 16:20
Volume (MM)	52.11

Outflow



Reach: R_Tri1_00

Downstream : Pt2

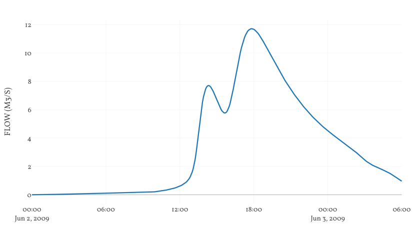
Route: Muskingum Cunge

Method	Muskingum Cunge
Channel	Trapezoid
Length (M)	2520
Energy Slope	0
Mannings n	0.04
Bottom Width	33.81
Side Slope	15.35
Initial Variable	Combined Inflow
Space - Time Method	Automatic DX and DT
Index Parameter Type	Index Celerity
Index Celerity	1.52
Maximum Depth Iterations	20
Maximum Route Step Iterations	30

Results: R_Tri1_00

Peak Discharge (M3/S)	11.71
Time of Peak Discharge	02Jun2009, 17:50
Volume (MM)	51.13
Peak Inflow (M3/S)	12.68
Inflow Volume (M3)	3.74E5

Outflow

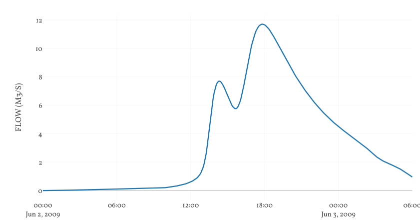


Junction: Pt2

Results: Pt2

Peak Discharge (M3/S)	11.71
Time of Peak Discharge	02Jun2009, 17:50
Volume (MM)	51.13

Outflow



APPENDIX H

HYDRAULIC ANALYSIS RESULTS

HY-8 Culvert Analysis Report

Table 1 - Culvert Summary Table: Proposed Warren Creek Tributary

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	2.27	2.27	177.66	1.207	1.252	2-M2c	1.225	0.714	0.714	0.438	2.646	1.199
50-yr	2.63	2.63	177.79	1.331	1.380	2-M2c	1.383	0.787	0.787	0.474	2.780	1.252
100-yr	2.76	2.76	177.84	1.377	1.427	2-M2c	1.442	0.814	0.814	0.487	2.827	1.271

****

Straight Culvert

Inlet Elevation (invert): 176.41 m,   Outlet Elevation (invert): 176.35 m

Culvert Length: 44.60 m,   Culvert Slope: 0.0013

****

Water Surface Profile

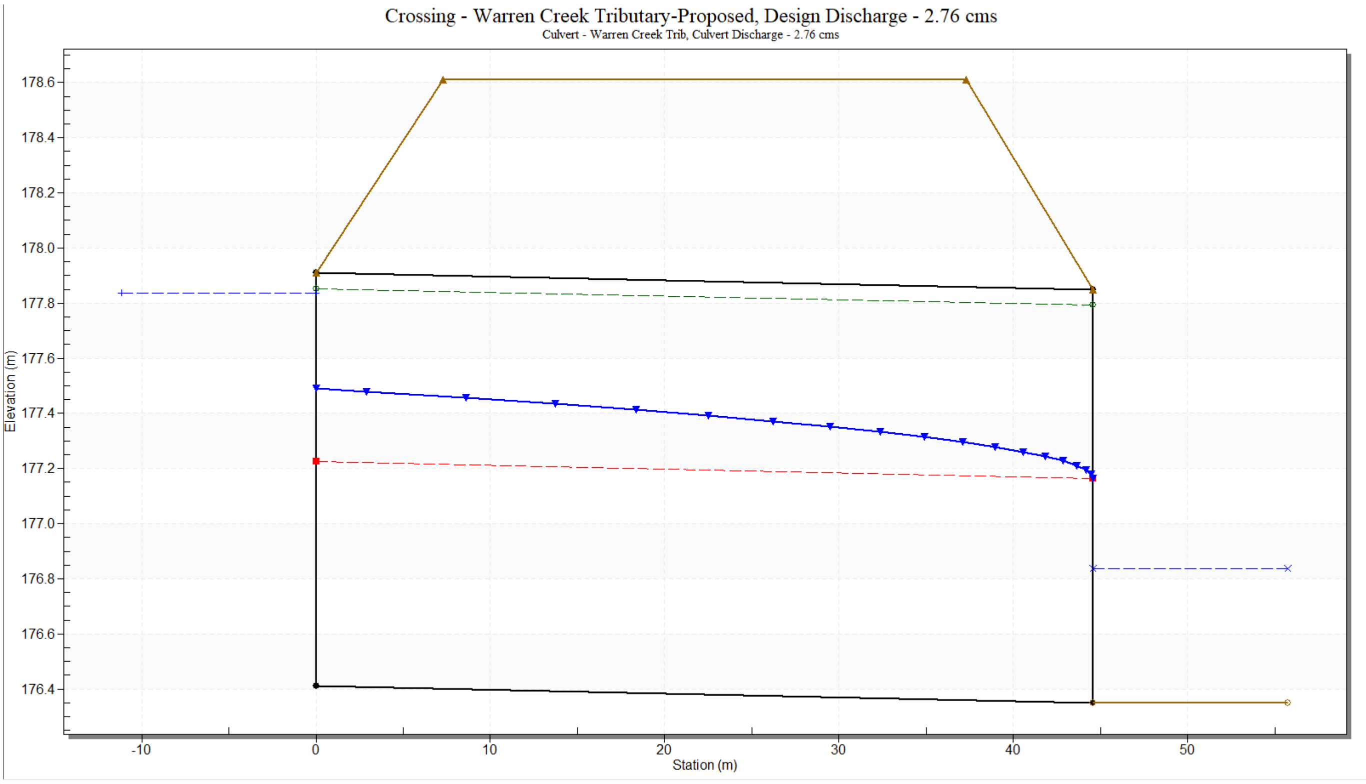


Table 2 - Culvert Summary Table: Proposed Warren Creek Culvert

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	11.67	11.67	175.22	1.312	0.786	1-S2n	0.769	0.771	0.769	0.847	2.759	1.828
50-yr	17.46	17.46	175.61	1.705	1.098	1-S2n	1.005	1.009	1.005	1.046	3.157	2.051
100-yr	18.46	18.46	175.68	1.769	1.159	1-S2n	1.044	1.047	1.044	1.077	3.215	2.084

****

Straight Culvert

Inlet Elevation (invert): 173.91 m, Outlet Elevation (invert): 173.80 m

Culvert Length: 43.60 m, Culvert Slope: 0.0025

****

Water Surface Profile

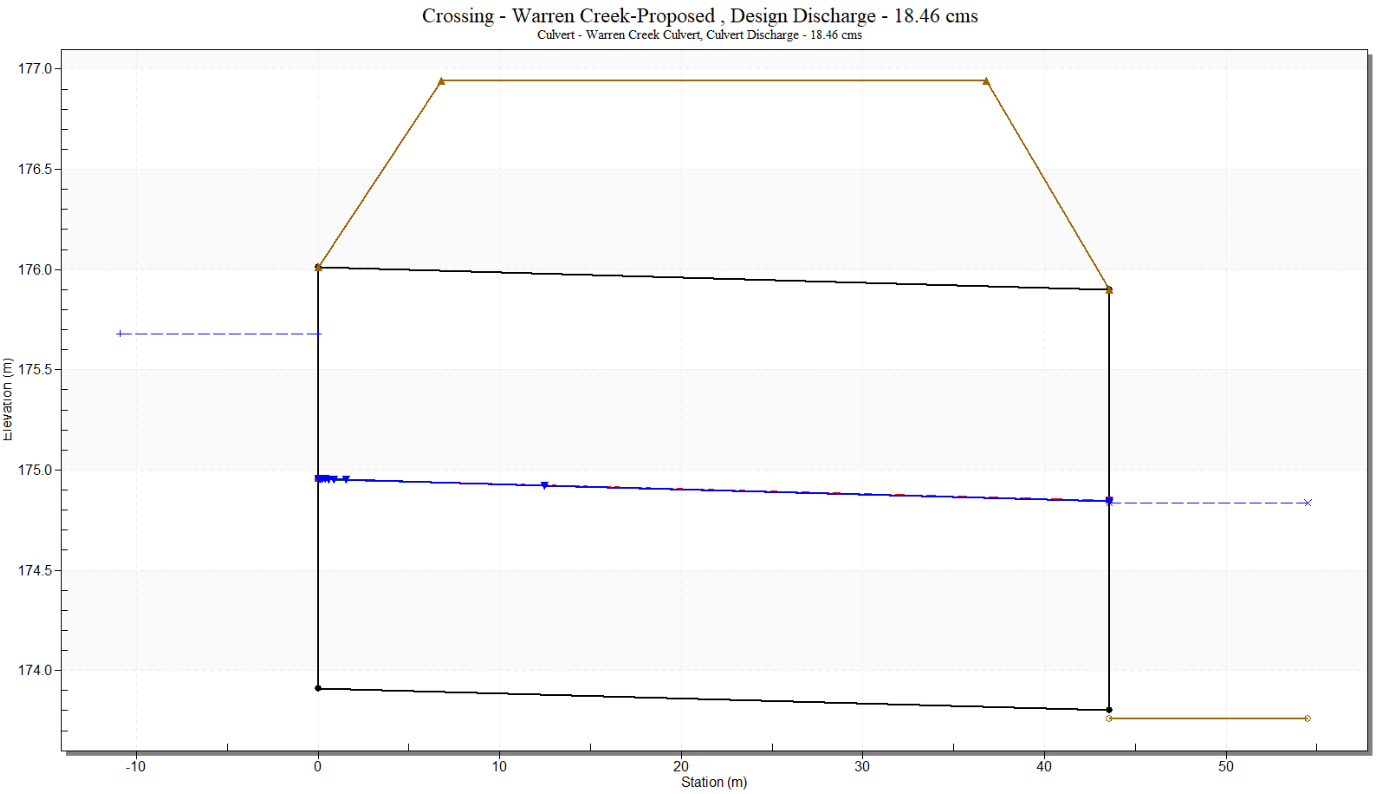


Table 3 - Culvert Summary Table: Proposed North of Chippawa Creek Rd Culvert

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	1.28	1.28	176.89	0.83	0.84	2-M2c	0.63	0.49	0.49	0.32	2.19	1.01
50-yr	1.44	1.44	176.96	0.89	0.91	2-M2c	0.69	0.53	0.53	0.34	2.27	1.05
100-yr	1.56	1.56	177.01	0.94	0.96	2-M2c	0.73	0.56	0.56	0.36	2.34	1.07

****

Straight Culvert

Inlet Elevation (invert): 176.05 m, Outlet Elevation (invert): 175.95 m

Culvert Length: 42.80 m, Culvert Slope: 0.0023

****

Water Surface Profile

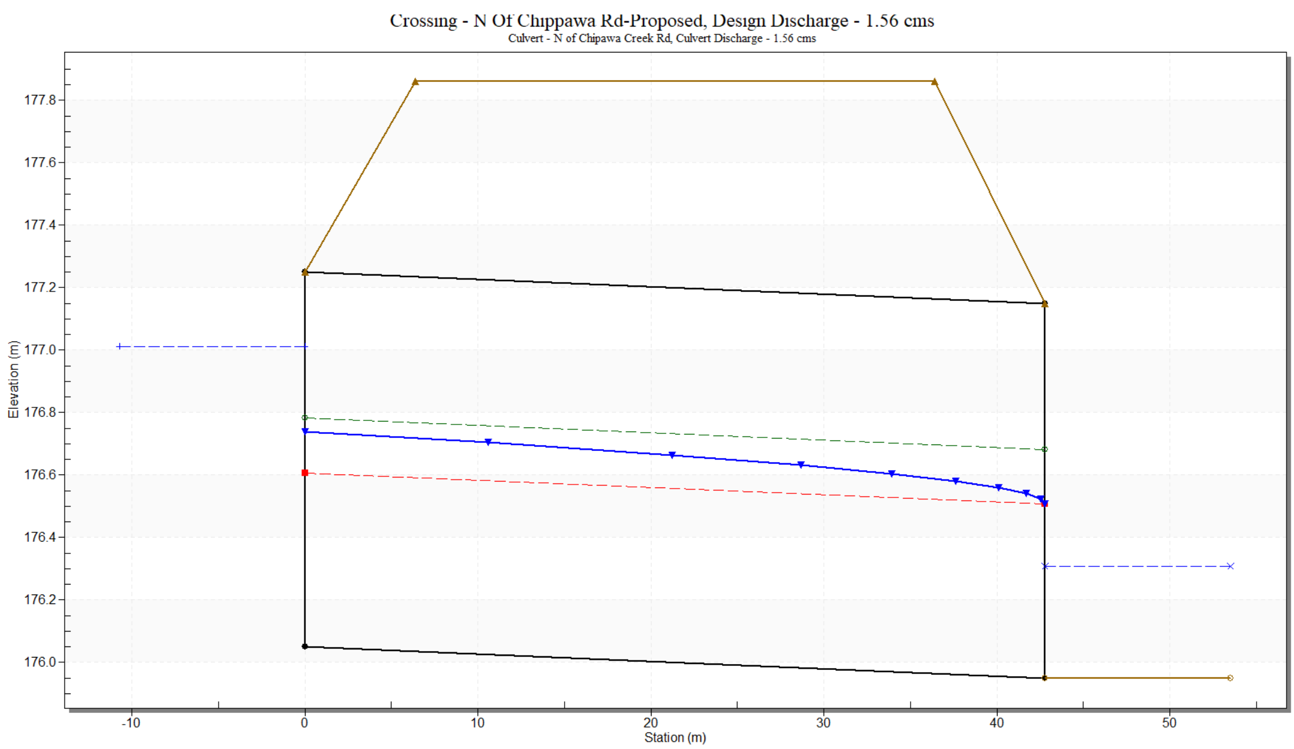


Table 4 - Culvert Summary Table: Proposed E.S. Fox Limited Culvert

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	0.33	0.33	174.76	0.52	0.61	2-M2c	0.60	0.34	0.34	0.15	1.60	0.65
50-yr	0.38	0.38	174.82	0.57	0.67	2-M2c	0.71	0.37	0.37	0.16	1.67	0.68
100-yr	0.40	0.40	174.84	0.59	0.69	2-M2c	0.80	0.38	0.38	0.17	1.70	0.69

****

Straight Culvert

Inlet Elevation (invert): 174.15 m, Outlet Elevation (invert): 174.05 m

Culvert Length: 39.90 m, Culvert Slope: 0.0025

****

Water Surface Profile

Crossing - Fox Limited Culvert, Design Discharge - 0.40 cms

Culvert - Fox Limited Culvert, Culvert Discharge - 0.40 cms

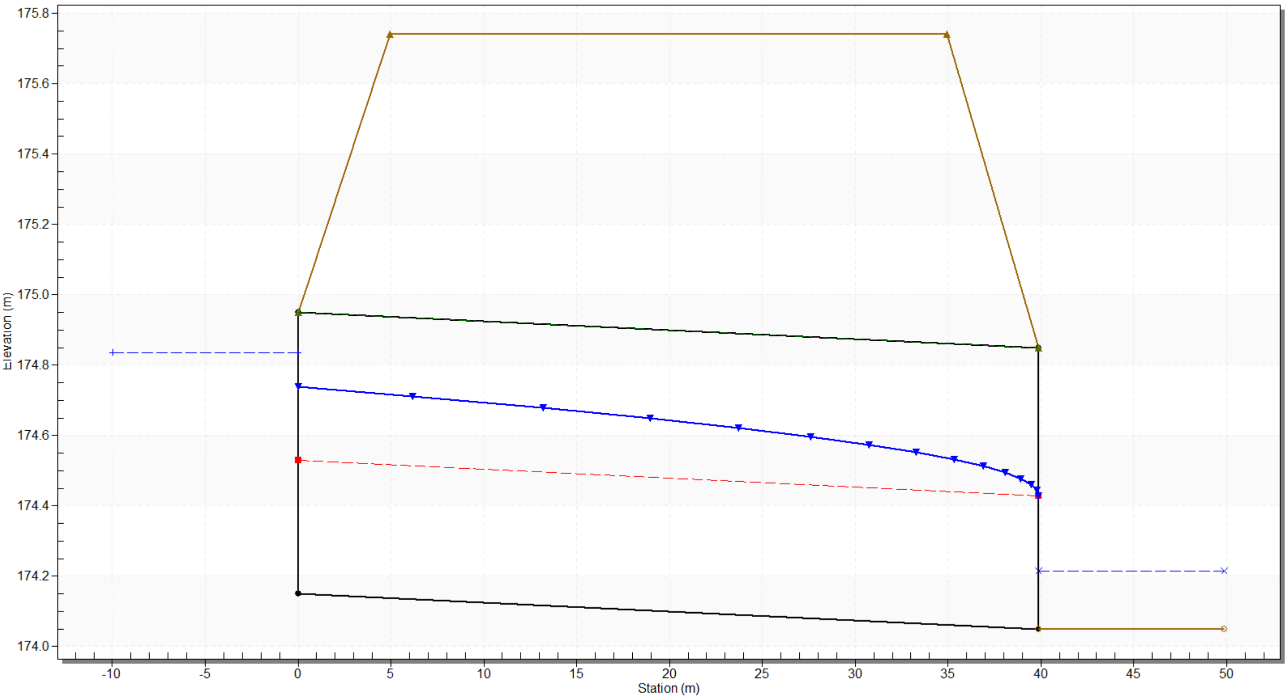


Table 5 - Culvert Summary Table: Proposed Biggar Road Culvert

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	0.49	0.49	179.14	0.69~	0.67	7-M2c	0.38	0.34	0.34	0.19	1.87	0.74
50-yr	0.57	0.57	179.24	0.79~	0.75	7-M2c	0.44	0.38	0.38	0.20	1.99	0.78
100-yr	0.60	0.60	179.29	0.84~	0.78	7-M2c	0.46	0.39	0.39	0.21	2.04	0.79

****

Straight Culvert

Inlet Elevation (invert): 178.25 m, Outlet Elevation (invert): 178.11 m

Culvert Length: 35.00 m, Culvert Slope: 0.0040

****

Water Surface Profile

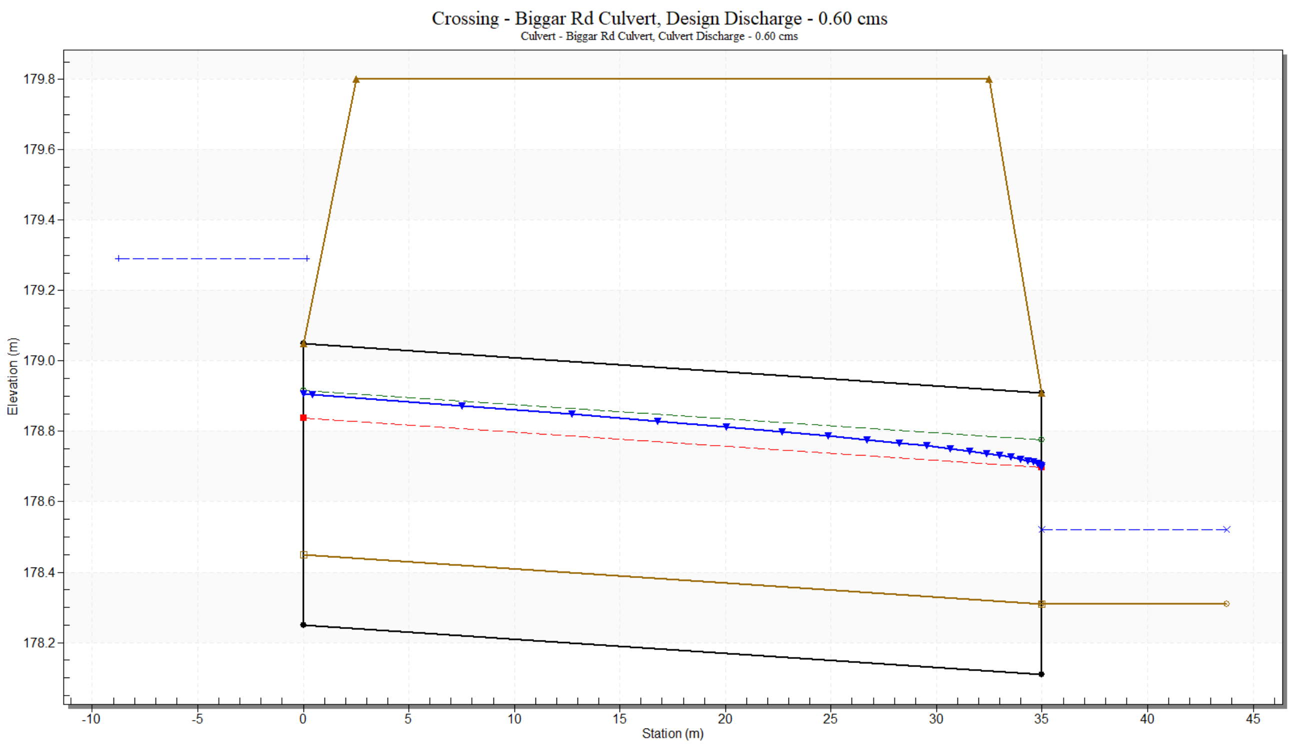


Table 6 - Culvert Summary Table: Proposed Culvert 01

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
25-yr	0.49	0.49	179.14	0.69~	0.67	7-M2c	0.38	0.34	0.34	0.19	1.87	0.74
50-yr	0.57	0.57	179.24	0.79~	0.75	7-M2c	0.44	0.38	0.38	0.20	1.99	0.78
100-yr	0.60	0.60	179.29	0.84~	0.78	7-M2c	0.46	0.39	0.39	0.21	2.04	0.79

****

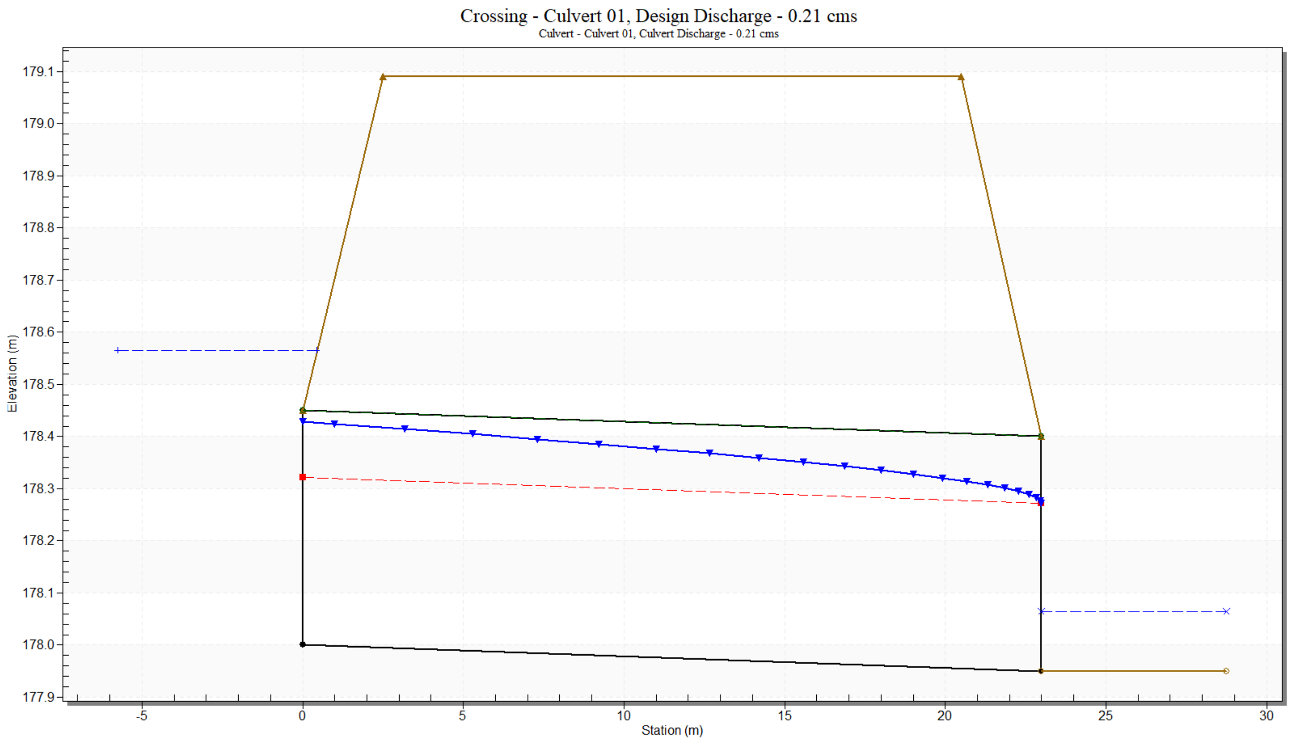
Straight Culvert

Inlet Elevation (invert): 178.00 m, Outlet Elevation (invert): 177.95 m

Culvert Length: 23.00 m, Culvert Slope: 0.0022

****

Water Surface Profile



HEC-RAS DETAIL OUTPUT TABLE

Design Parameters	
Condition:	Existing - Grassy Brook Culvert
Culvert Dimension:	Twin 3.0x 2.1 & 2.4 x 1.8 Box Culvert
Road Elevation:	175.08
U/S Invert:	170.78, 171.11
D/S Invert:	170.75, 171.08

Project: Montrose Road EA Study
Consulting Engineer: PARSONS
Project No.: 477511
Designed by: AZ
Checked by: MR
Last Revision: June 3, 2021

River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
115	50 yr	14.86	173.15	174.65	174.08	174.67	0.000349	0.71	40.78	69.64	0.2
114	50 yr	14.86	172.99	174.47		174.48	0.000394	0.75	38.86	67.95	0.22
113	50 yr	14.86	172.19	174.29	173.07	174.34	0.000373	0.99	15.7	68.92	0.22
112.5		Culvert									
112	50 yr	14.86	172.14	173.91	173.06	173.92	0.000188	0.62	46.09	64.99	0.15
111	50 yr	14.86	172.11	173.82		173.83	0.000281	0.7	45.51	61.79	0.19
110	50 yr	14.86	172.05	173.68		173.71	0.0006	0.83	29.4	53.7	0.26
109.5	50 yr	14.86	171.95	173.66		173.66	0.00017	0.5	53.36	76.79	0.14
109	50 yr	14.86	171.76	173.62		173.64	0.000335	0.76	41.08	70.32	0.2
108	50 yr	14.86	171.75	173.53		173.54	0.000267	0.65	51.5	75.45	0.18
107	50 yr	14.86	171.53	173.25	172.6	173.37	0.001329	1.54	9.67	71.7	0.41
106.5		Bridge									
106	50 yr	14.86	171.48	173.11	172.73	173.28	0.002721	1.84	8.07	93.42	0.55
105	50 yr	14.86	171.06	172.65		172.74	0.001999	1.49	14.37	33.92	0.47
104	50 yr	14.86	170.79	172.67		172.67	0.000127	0.45	69.76	110.43	0.12
103	50 yr	14.86	170.78	172.62	171.68	172.66	0.000422	0.97	20.69	31.95	0.24
102.5		Culvert									
102	50 yr	14.86	170.75	172.4	171.7	172.5	0.001226	1.43	11.33	20.18	0.38
101	50 yr	14.86	170.56	171.87	171.84	172.23	0.007401	2.71	6.83	13.33	0.87
100	50 yr	14.86	170.48	171.69	171.2	171.75	0.001231	1.13	13.89	18.1	0.37

Culvert Summary

River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
		(m)	(m)	(m)	(m)	(m)	(m3/s)	(m3/s)	(m)	(m/s)	(m/s)
112.5 Culvert #1	50 yr	174.34	174.29	173.95	174.34	174.69	14.86		0.38	2.3	2.3
102.5 Culvert #1	50 yr	172.66	172.62	172.41	172.66	175.02	9.15		0.22	1.81	1.79
102.5 Culvert #2	50 yr	172.66	172.62	172.51	172.66	175.02	5.7		0.22	1.8	1.77

HEC-RAS DETAIL OUTPUT TABLE

Design Parameters	
Condition:	**Proposed - Grassy Brook Culvert**
Culvert Dimension:	Twin 3.0x 2.1 & 2.4 x 1.8 Box Culvert
Road Elevation:	175.08
U/S Invert:	170.80, 171.21
D/S Invert:	170.70, 170.92

Project: Montrose Road EA Study
Consulting Engineer: PARSONS
Project No.: 477511
Designed by: AZ
Checked by: MR
Last Revision: June 3, 2021

River Sta	Storm Event	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m^3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	
115	50yr	16.11	173.15	174.73	174.1	174.74	0.000307	0.69	46.02	74.36	0.19
114	50yr	16.11	172.99	174.57		174.59	0.000299	0.69	46.58	74.89	0.19
113	50yr	16.11	172.19	174.42	173.12	174.47	0.000357	1.01	16.72	70.16	0.22
112.5	50yr	Culvert									
112	50yr	16.11	172.14	173.96	173.09	173.97	0.000185	0.63	49.3	65.53	0.15
111	50yr	16.11	172.11	173.87		173.88	0.000283	0.71	48.59	63.96	0.19
110	50yr	16.11	172.05	173.74		173.76	0.000567	0.83	32.28	56.73	0.25
109.5	50yr	16.11	171.95	173.71		173.72	0.000162	0.5	57.55	78.17	0.14
109	50yr	16.11	171.76	173.68		173.7	0.000328	0.77	44.98	72.73	0.2
108	50yr	16.11	171.75	173.58		173.6	0.000256	0.66	55.9	76.5	0.18
107	50yr	16.11	171.53	173.29	172.64	173.43	0.001408	1.62	9.97	73.2	0.42
106.5	50yr	Bridge									
106	50yr	16.11	171.48	173.14	172.78	173.33	0.00291	1.94	8.3	94.79	0.57
105	50yr	16.11	171.06	172.72		172.8	0.001749	1.46	16.91	41.39	0.44
104	50yr	16.11	170.79	172.74		172.74	0.000111	0.43	77.26	111.36	0.12
103.3	50yr	16.11	170.78	172.7	171.7	172.73	0.000364	0.92	24.33	40.67	0.22
102.5	50yr	Montrose Road Culvert									
101.8	50yr	16.11	170.71	172.42	171.75	172.51	0.001214	1.45	14.43	21.95	0.37
101	50yr	16.11	170.56	171.9	171.9	172.29	0.007629	2.81	7.32	14.17	0.89
100	50yr	16.11	170.48	171.74	171.23	171.8	0.001231	1.16	14.75	18.81	0.37

Culvert Summary

River Sta		Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(m)	(m)	(m)	(m)	(m)	(m3/s)	(m3/s)	(m)	(m/s)	(m/s)
112.5	Culvert #1	50 yr	174.47	174.42	174.08	174.47	174.69	16.11		0.46	2.49	2.49
102.5	Culvert #1	50 yr	172.73	172.7	172.53	172.73	174.91	10.02		0.28	1.98	1.88
102.5	Culvert #2	50 yr	172.73	172.7	172.67	172.73	174.91	6.09		0.28	2.16	1.67

HEC-RAS DETAIL OUTPUT TABLE

Design Parameters	
Condition:	Existing - Lyons Creek Trib. Culver
Culvert Dimension:	4.25 x 1.24 Open Footing Concrete
Road Elevation:	175.76
U/S Invert:	173.845
D/S Invert:	173.838

Project: Montrose Road EA Study
Consulting Engineer: PARSONS
Project No.: 477511
Designed by: AZ
Checked by: MR
Last Revision: June 3, 2021

River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
207	50 yr	11.45	175.03	176.11	175.74	176.13	0.000632	0.84	31.5	69.66	0.27
206	50 yr	11.45	174.97	176.08		176.09	0.000601	0.83	30.02	58.7	0.26
205	50 yr	11.45	174.56	175.71		175.75	0.001787	1.34	25.39	59.01	0.44
204	50 yr	11.45	174.1	175.57		175.58	0.000139	0.48	56.65	85.52	0.13
203.5	50 yr	11.45	174.07	175.56		175.56	0.000061	0.32	78.56	154.87	0.09
203	50 yr	11.45	173.85	175.26	174.86	175.48	0.002742	2.07	5.53	94.81	0.58
202.5		Culvert									
202	50 yr	11.45	173.84	174.88	174.87	175.32	0.008666	2.95	3.94	61.27	0.98
201	50 yr	11.45	173.96	175		175.02	0.000977	0.97	29.27	55.03	0.32
200.75	50 yr	11.45	173.84	174.94	174.93	174.98	0.001551	1.34	21.56	57.16	0.42
200.25	50 yr	11.45	173.65	174.85	174.65	174.94	0.002407	1.74	20.15	53.13	0.53
200	50 yr	11.45	173.2	174.39	174.13	174.46	0.00206	1.52	18.33	36.67	0.48

Culvert Summary

River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
		(m)	(m)	(m)	(m)	(m)	(m3/s)	(m3/s)	(m)	(m/s)	(m/s)
202.5 Culvert #1	50 yr	175.48	175.26	175.47	175.48	175.81	11.45		0.37	2.17	2.17

HEC-RAS DETAIL OUTPUT TABLE

Design Parameters	
Condition:	**Proposed - Lyons Creek Trib. Culv**
Culvert Dimension:	Twin 3.0 x 1.5 Box Culverts
Road Elevation:	176.29
U/S Invert:	173.54
D/S Invert:	173.53

Project: Montrose Road EA Study
Consulting Engineer: PARSONS
Project No.: 477511
Designed by: AZ
Checked by: MR
Last Revision: June 3, 2021

River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
207	50 yr (PR)	12.67	175.03	176.16	175.76	176.17	0.000621	0.86	34.46	73.49	0.27
206	50 yr (PR)	12.67	174.97	176.12		176.13	0.000614	0.86	32.48	62.3	0.27
205	50 yr (PR)	12.67	174.56	175.71		175.76	0.002198	1.49	25.34	58.94	0.49
204	50 yr (PR)	12.67	174.1	175.36		175.38	0.000392	0.72	40.49	72.73	0.21
203.5	50 yr (PR)	12.67	174.07	175.32		175.32	0.000195	0.5	52.12	87.72	0.15
203	50 yr (PR)	12.67	173.53	175.16	174.22	175.22	0.000531	1.05	12.05	91.25	0.26
202.5		Culvert									
202	50 yr (PR)	12.67	173.53	174.87	174.22	174.96	0.001117	1.3	10.2	60.4	0.36
200	50 yr (PR)	12.67	173.2	174.44	174.16	174.51	0.002057	1.57	20.2	39.41	0.48

Culvert Summary

River Sta	Profile	E.G. US. (m)	W.S. US. (m)	E.G. IC (m)	E.G. OC (m)	Min El Weir Flow (m)	Q Culv Group (m3/s)	Q Weir (m3/s)	Delta WS (m)	Culv Vel US (m/s)	Culv Vel DS (m/s)
202.5 Culvert #2	50 yr (PR)	175.22	175.16	175.21	175.23	176.3	6.31		0.29	1.89	2.01
202.5 Culvert #1	50 yr (PR)	175.22	175.16	175.21	175.22	176.3	6.36		0.29	1.95	2.03

APPENDIX I

Oil/Grit Separator Sizing Reports

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33
Site Name:	Montrose Rd - 13+925
Drainage Area (ha):	3.65
% Imperviousness:	87.00

Runoff Coefficient 'c': 0.82

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	105.65
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	47
EF6	62
EF8	72
EF10	78
EF12	81

Recommended Stormceptor EF Model:	**EF12**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**81**
Water Quality Runoff Volume Capture (%):	**> 90**

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 waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

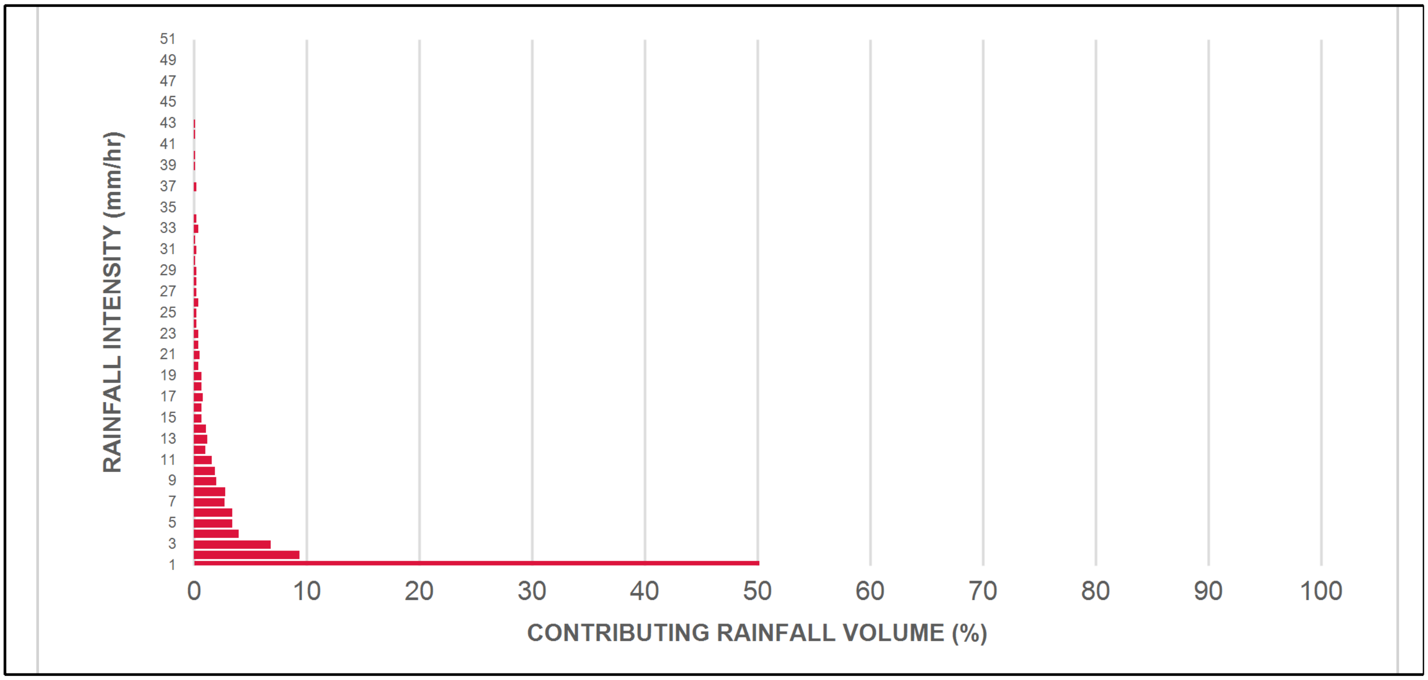
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

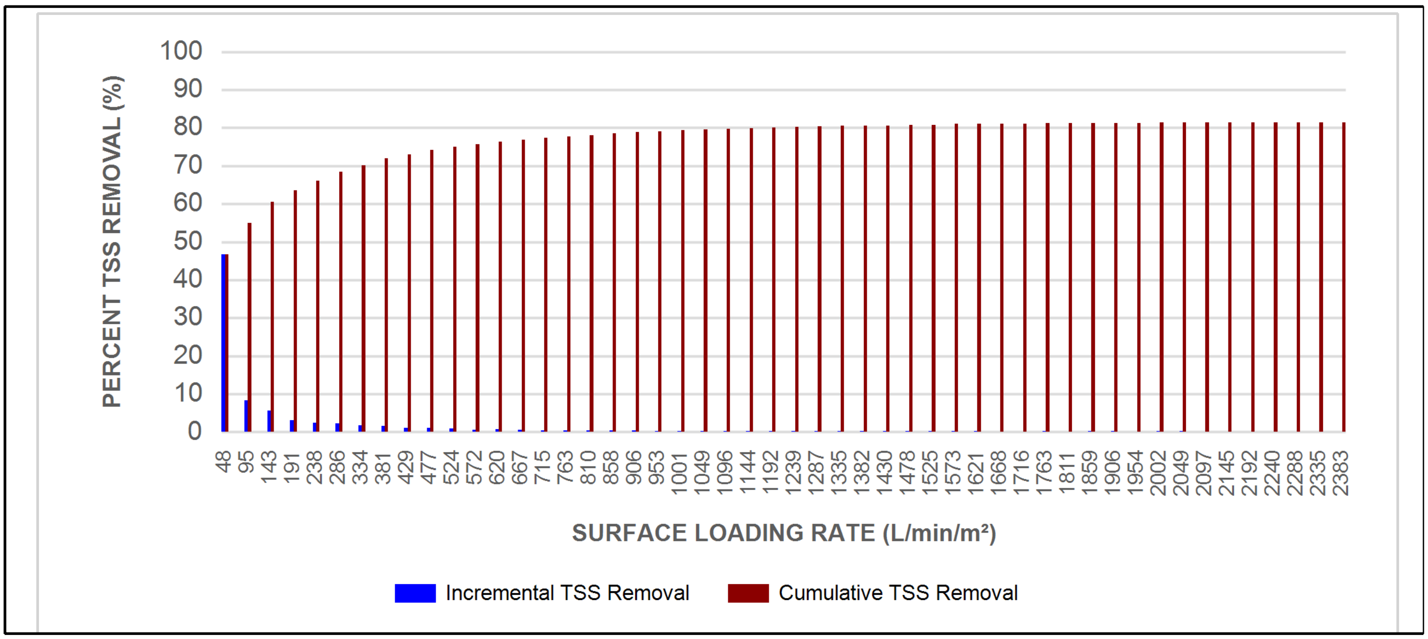
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.2	50.2	8.34	500.0	48.0	93	46.7	46.7
2	9.4	59.6	16.68	1001.0	95.0	88	8.3	55.0
3	6.8	66.4	25.02	1501.0	143.0	83	5.6	60.6
4	4.0	70.4	33.36	2002.0	191.0	77	3.1	63.6
5	3.4	73.8	41.70	2502.0	238.0	73	2.5	66.1
6	3.4	77.2	50.05	3003.0	286.0	69	2.3	68.5
7	2.7	79.9	58.39	3503.0	334.0	64	1.7	70.2
8	2.8	82.7	66.73	4004.0	381.0	60	1.7	71.9
9	2.0	84.7	75.07	4504.0	429.0	58	1.2	73.0
10	1.9	86.6	83.41	5005.0	477.0	57	1.1	74.1
11	1.6	88.2	91.75	5505.0	524.0	57	0.9	75.0
12	1.0	89.2	100.09	6005.0	572.0	56	0.6	75.6
13	1.2	90.4	108.43	6506.0	620.0	56	0.7	76.3
14	1.1	91.5	116.77	7006.0	667.0	56	0.6	76.9
15	0.7	92.2	125.11	7507.0	715.0	55	0.4	77.3
16	0.7	92.9	133.45	8007.0	763.0	55	0.4	77.7
17	0.8	93.7	141.79	8508.0	810.0	55	0.4	78.1
18	0.7	94.4	150.14	9008.0	858.0	55	0.4	78.5
19	0.7	95.1	158.48	9509.0	906.0	55	0.4	78.9
20	0.4	95.5	166.82	10009.0	953.0	54	0.2	79.1
21	0.5	96.0	175.16	10509.0	1001.0	54	0.3	79.4
22	0.4	96.4	183.50	11010.0	1049.0	55	0.2	79.6
23	0.4	96.8	191.84	11510.0	1096.0	55	0.2	79.8
24	0.2	97.0	200.18	12011.0	1144.0	56	0.1	79.9
25	0.2	97.2	208.52	12511.0	1192.0	56	0.1	80.0

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 (%)
26	0.4	97.6	216.86	13012.0	1239.0	57	0.2	80.2
27	0.2	97.8	225.20	13512.0	1287.0	58	0.1	80.4
28	0.2	98.0	233.54	14013.0	1335.0	58	0.1	80.5
29	0.2	98.2	241.88	14513.0	1382.0	59	0.1	80.6
30	0.1	98.3	250.23	15014.0	1430.0	58	0.1	80.6
31	0.2	98.5	258.57	15514.0	1478.0	56	0.1	80.8
32	0.1	98.6	266.91	16014.0	1525.0	54	0.1	80.8
33	0.4	99.0	275.25	16515.0	1573.0	53	0.2	81.0
34	0.2	99.2	283.59	17015.0	1621.0	51	0.1	81.1
35	0.0	99.2	291.93	17516.0	1668.0	50	0.0	81.1
36	0.0	99.2	300.27	18016.0	1716.0	48	0.0	81.1
37	0.2	99.4	308.61	18517.0	1763.0	47	0.1	81.2
38	0.0	99.4	316.95	19017.0	1811.0	46	0.0	81.2
39	0.1	99.5	325.29	19518.0	1859.0	45	0.0	81.3
40	0.1	99.6	333.63	20018.0	1906.0	43	0.0	81.3
41	0.0	99.6	341.97	20518.0	1954.0	42	0.0	81.3
42	0.1	99.7	350.32	21019.0	2002.0	41	0.0	81.4
43	0.1	99.8	358.66	21519.0	2049.0	40	0.0	81.4
44	0.0	99.8	367.00	22020.0	2097.0	40	0.0	81.4
45	0.0	99.8	375.34	22520.0	2145.0	39	0.0	81.4
46	0.0	99.8	383.68	23021.0	2192.0	38	0.0	81.4
47	0.0	99.8	392.02	23521.0	2240.0	37	0.0	81.4
48	0.0	99.8	400.36	24022.0	2288.0	36	0.0	81.4
49	0.0	99.8	408.70	24522.0	2335.0	35	0.0	81.4
50	0.0	99.8	417.04	25023.0	2383.0	35	0.0	81.4
							Estimated Net Annual Sediment (TSS) Load Reduction =	**81 %**

RAINFALL DATA FROM ST CATHARINES AP 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

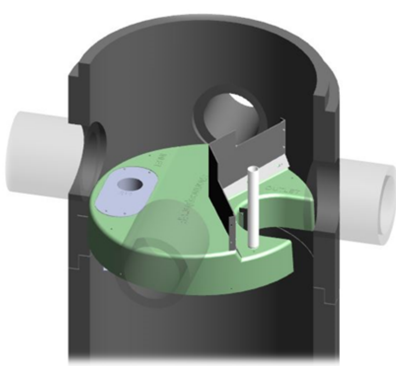
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

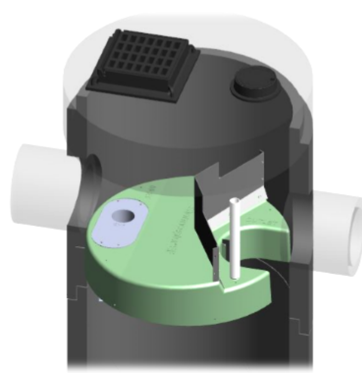
DESIGN FLEXIBILITY

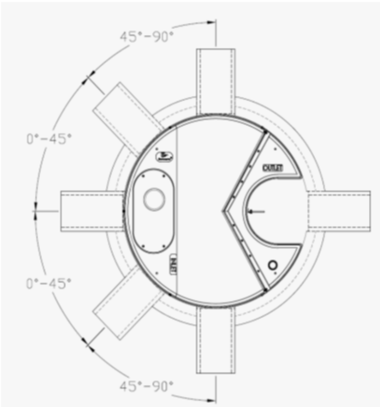
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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

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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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33
Site Name:	Montrose Rd - 13+825
Drainage Area (ha):	0.80
% Imperviousness:	86.60
Runoff Coefficient 'c':	0.81
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	23.09
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	74
EF6	82
EF8	86
EF10	89
EF12	90

Recommended Stormceptor EF Model:	**EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**82**
Water Quality Runoff Volume Capture (%):	**> 90**

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 waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

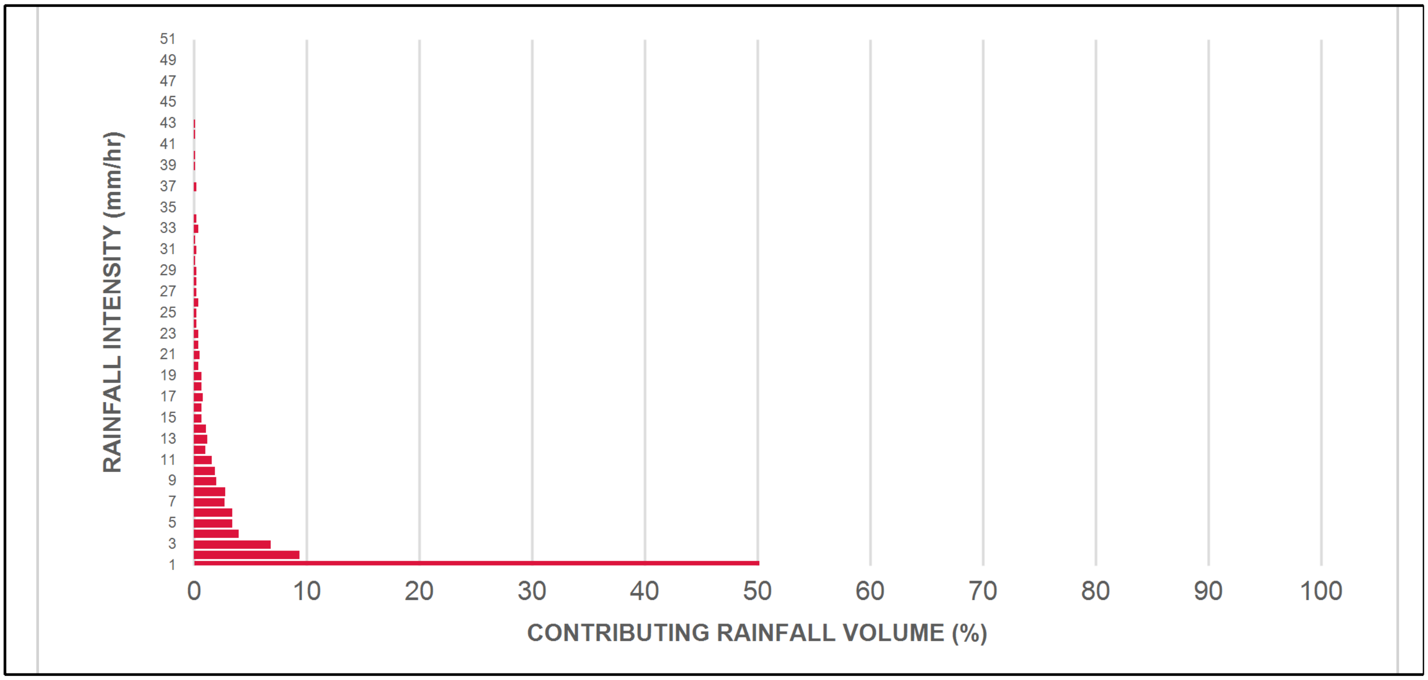
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

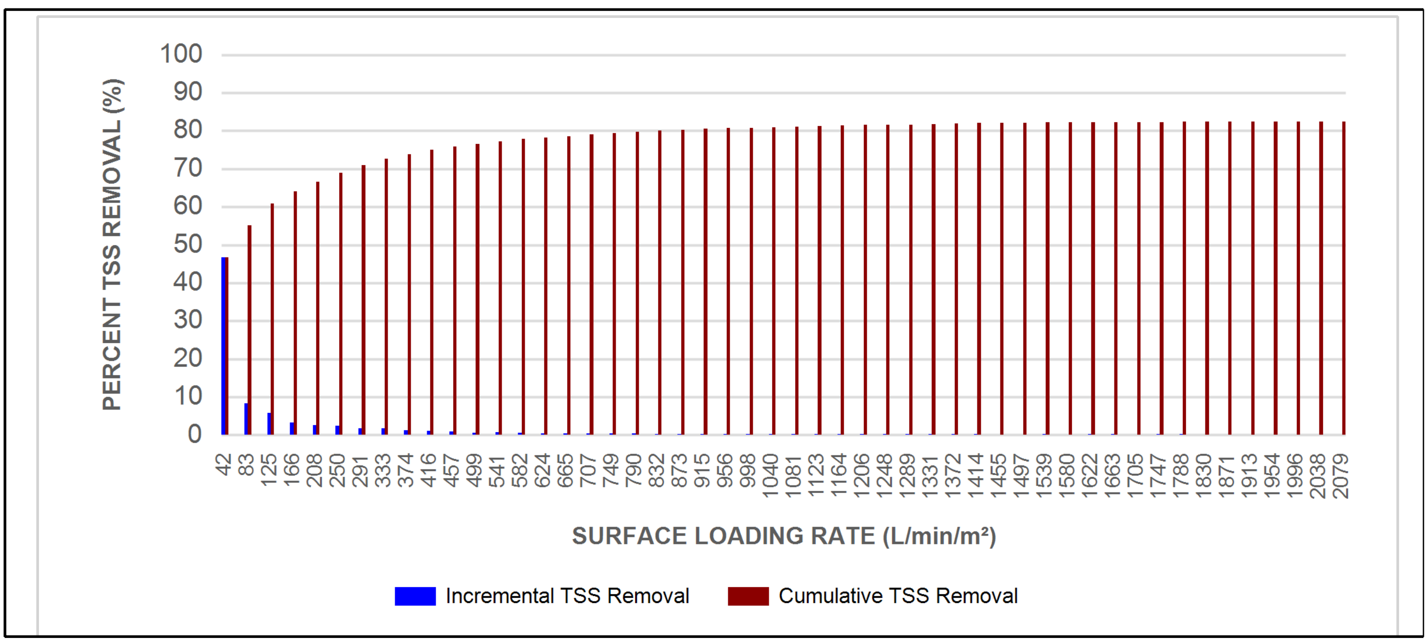
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.2	50.2	1.82	109.0	42.0	93	46.7	46.7
2	9.4	59.6	3.65	219.0	83.0	89	8.4	55.1
3	6.8	66.4	5.47	328.0	125.0	85	5.8	60.8
4	4.0	70.4	7.29	437.0	166.0	80	3.2	64.0
5	3.4	73.8	9.11	547.0	208.0	76	2.6	66.6
6	3.4	77.2	10.94	656.0	250.0	72	2.4	69.0
7	2.7	79.9	12.76	766.0	291.0	68	1.8	70.9
8	2.8	82.7	14.58	875.0	333.0	64	1.8	72.7
9	2.0	84.7	16.41	984.0	374.0	61	1.2	73.9
10	1.9	86.6	18.23	1094.0	416.0	58	1.1	75.0
11	1.6	88.2	20.05	1203.0	457.0	58	0.9	75.9
12	1.0	89.2	21.87	1312.0	499.0	57	0.6	76.5
13	1.2	90.4	23.70	1422.0	541.0	57	0.7	77.2
14	1.1	91.5	25.52	1531.0	582.0	56	0.6	77.8
15	0.7	92.2	27.34	1641.0	624.0	56	0.4	78.2
16	0.7	92.9	29.16	1750.0	665.0	56	0.4	78.6
17	0.8	93.7	30.99	1859.0	707.0	56	0.4	79.0
18	0.7	94.4	32.81	1969.0	749.0	55	0.4	79.4
19	0.7	95.1	34.63	2078.0	790.0	55	0.4	79.8
20	0.4	95.5	36.46	2187.0	832.0	55	0.2	80.0
21	0.5	96.0	38.28	2297.0	873.0	55	0.3	80.3
22	0.4	96.4	40.10	2406.0	915.0	54	0.2	80.5
23	0.4	96.8	41.92	2515.0	956.0	54	0.2	80.7
24	0.2	97.0	43.75	2625.0	998.0	54	0.1	80.8
25	0.2	97.2	45.57	2734.0	1040.0	55	0.1	80.9

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 (%)
26	0.4	97.6	47.39	2844.0	1081.0	55	0.2	81.1
27	0.2	97.8	49.22	2953.0	1123.0	56	0.1	81.2
28	0.2	98.0	51.04	3062.0	1164.0	56	0.1	81.4
29	0.2	98.2	52.86	3172.0	1206.0	57	0.1	81.5
30	0.1	98.3	54.68	3281.0	1248.0	57	0.1	81.5
31	0.2	98.5	56.51	3390.0	1289.0	58	0.1	81.6
32	0.1	98.6	58.33	3500.0	1331.0	58	0.1	81.7
33	0.4	99.0	60.15	3609.0	1372.0	59	0.2	81.9
34	0.2	99.2	61.97	3718.0	1414.0	59	0.1	82.1
35	0.0	99.2	63.80	3828.0	1455.0	57	0.0	82.1
36	0.0	99.2	65.62	3937.0	1497.0	55	0.0	82.1
37	0.2	99.4	67.44	4047.0	1539.0	54	0.1	82.2
38	0.0	99.4	69.27	4156.0	1580.0	52	0.0	82.2
39	0.1	99.5	71.09	4265.0	1622.0	51	0.1	82.2
40	0.1	99.6	72.91	4375.0	1663.0	50	0.1	82.3
41	0.0	99.6	74.73	4484.0	1705.0	49	0.0	82.3
42	0.1	99.7	76.56	4593.0	1747.0	47	0.0	82.3
43	0.1	99.8	78.38	4703.0	1788.0	46	0.0	82.4
44	0.0	99.8	80.20	4812.0	1830.0	45	0.0	82.4
45	0.0	99.8	82.03	4922.0	1871.0	44	0.0	82.4
46	0.0	99.8	83.85	5031.0	1913.0	43	0.0	82.4
47	0.0	99.8	85.67	5140.0	1954.0	42	0.0	82.4
48	0.0	99.8	87.49	5250.0	1996.0	42	0.0	82.4
49	0.0	99.8	89.32	5359.0	2038.0	41	0.0	82.4
50	0.0	99.8	91.14	5468.0	2079.0	40	0.0	82.4
							Estimated Net Annual Sediment (TSS) Load Reduction =	**82 %**

RAINFALL DATA FROM ST CATHARINES AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	Model Diameter (ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	Max Inlet Pipe Diameter (in)	Max Outlet Pipe Diameter (mm)	Max Outlet Pipe Diameter (in)	Peak Conveyance Flow Rate (L/s)	Peak Conveyance Flow Rate (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
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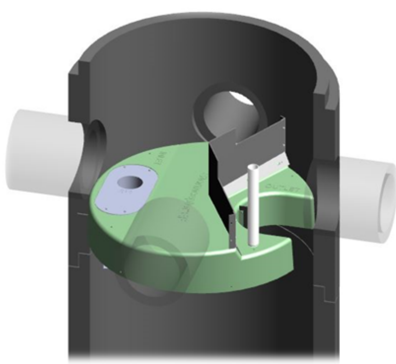

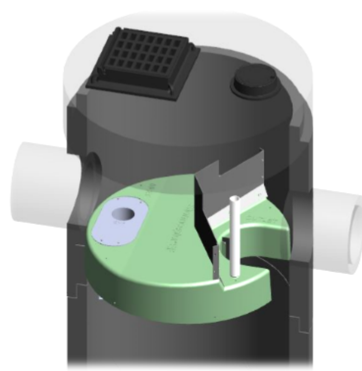

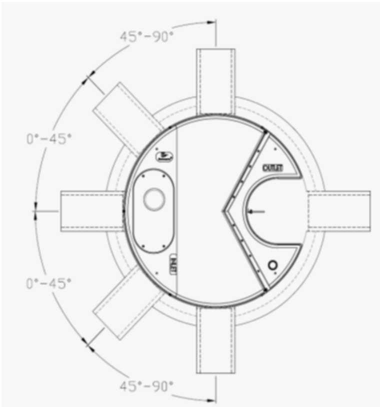

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*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
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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

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STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
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	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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33
Site Name:	Montrose Rd - 13+415
Drainage Area (ha):	0.45
% Imperviousness:	86.60

Runoff Coefficient 'c': 0.81

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	12.99
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	80
EF6	86
EF8	89
EF10	91
EF12	92

Recommended Stormceptor EF Model: EF4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 80

Water Quality Runoff Volume Capture (%): > 90

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 waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

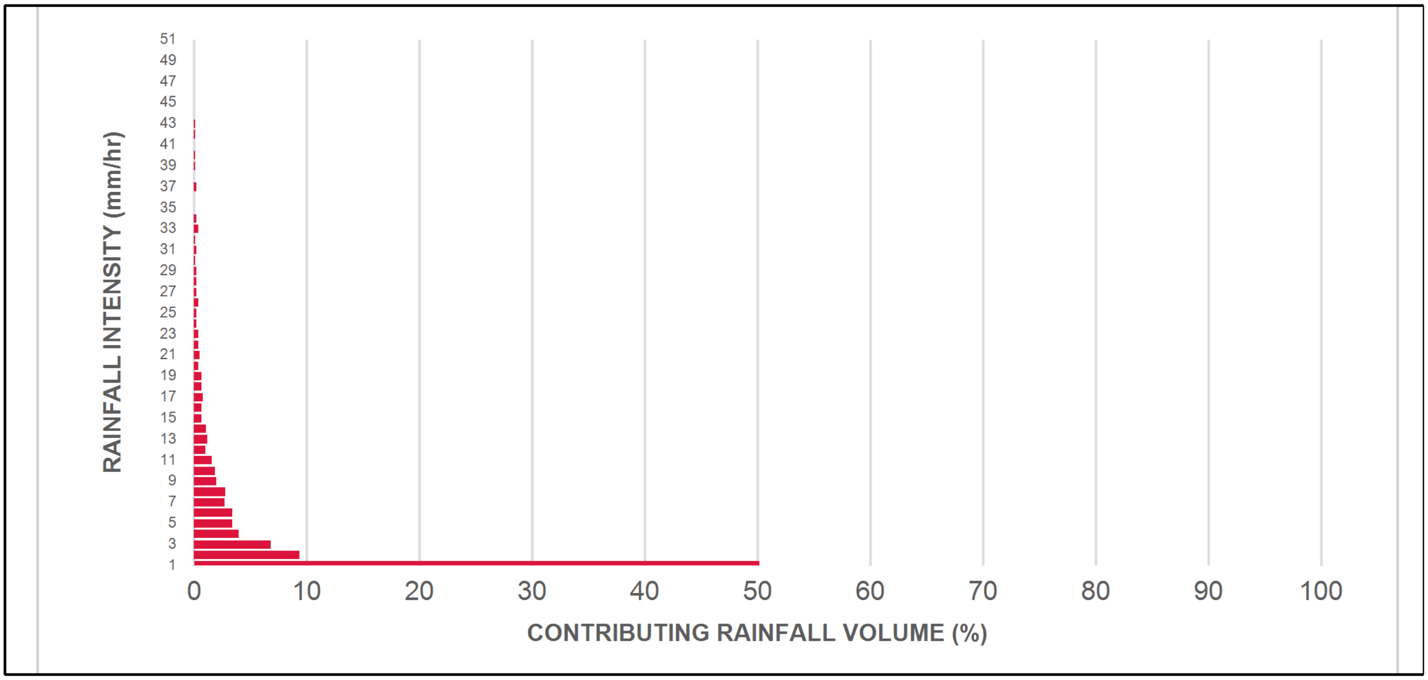
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

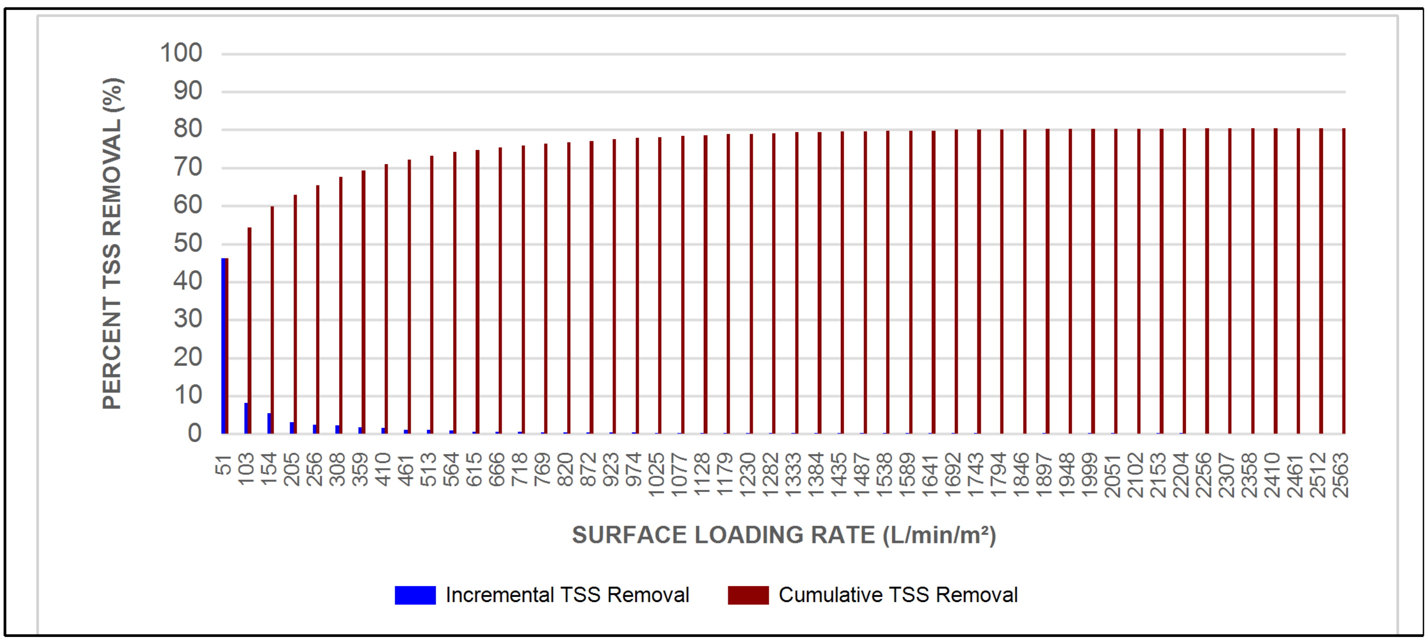
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.2	50.2	1.03	62.0	51.0	92	46.2	46.2
2	9.4	59.6	2.05	123.0	103.0	87	8.2	54.3
3	6.8	66.4	3.08	185.0	154.0	81	5.5	59.9
4	4.0	70.4	4.10	246.0	205.0	76	3.0	62.9
5	3.4	73.8	5.13	308.0	256.0	72	2.4	65.4
6	3.4	77.2	6.15	369.0	308.0	67	2.3	67.6
7	2.7	79.9	7.18	431.0	359.0	63	1.7	69.3
8	2.8	82.7	8.20	492.0	410.0	58	1.6	70.9
9	2.0	84.7	9.23	554.0	461.0	57	1.1	72.1
10	1.9	86.6	10.25	615.0	513.0	57	1.1	73.2
11	1.6	88.2	11.28	677.0	564.0	56	0.9	74.1
12	1.0	89.2	12.30	738.0	615.0	56	0.6	74.6
13	1.2	90.4	13.33	800.0	666.0	56	0.7	75.3
14	1.1	91.5	14.35	861.0	718.0	55	0.6	75.9
15	0.7	92.2	15.38	923.0	769.0	55	0.4	76.3
16	0.7	92.9	16.41	984.0	820.0	55	0.4	76.7
17	0.8	93.7	17.43	1046.0	872.0	55	0.4	77.1
18	0.7	94.4	18.46	1107.0	923.0	54	0.4	77.5
19	0.7	95.1	19.48	1169.0	974.0	54	0.4	77.9
20	0.4	95.5	20.51	1230.0	1025.0	54	0.2	78.1
21	0.5	96.0	21.53	1292.0	1077.0	55	0.3	78.4
22	0.4	96.4	22.56	1353.0	1128.0	56	0.2	78.6
23	0.4	96.8	23.58	1415.0	1179.0	56	0.2	78.8
24	0.2	97.0	24.61	1476.0	1230.0	57	0.1	78.9
25	0.2	97.2	25.63	1538.0	1282.0	58	0.1	79.0

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 (%)
26	0.4	97.6	26.66	1599.0	1333.0	58	0.2	79.3
27	0.2	97.8	27.68	1661.0	1384.0	59	0.1	79.4
28	0.2	98.0	28.71	1723.0	1435.0	58	0.1	79.5
29	0.2	98.2	29.73	1784.0	1487.0	56	0.1	79.6
30	0.1	98.3	30.76	1846.0	1538.0	54	0.1	79.7
31	0.2	98.5	31.78	1907.0	1589.0	52	0.1	79.8
32	0.1	98.6	32.81	1969.0	1641.0	50	0.1	79.8
33	0.4	99.0	33.84	2030.0	1692.0	49	0.2	80.0
34	0.2	99.2	34.86	2092.0	1743.0	47	0.1	80.1
35	0.0	99.2	35.89	2153.0	1794.0	46	0.0	80.1
36	0.0	99.2	36.91	2215.0	1846.0	45	0.0	80.1
37	0.2	99.4	37.94	2276.0	1897.0	44	0.1	80.2
38	0.0	99.4	38.96	2338.0	1948.0	43	0.0	80.2
39	0.1	99.5	39.99	2399.0	1999.0	41	0.0	80.2
40	0.1	99.6	41.01	2461.0	2051.0	40	0.0	80.3
41	0.0	99.6	42.04	2522.0	2102.0	39	0.0	80.3
42	0.1	99.7	43.06	2584.0	2153.0	38	0.0	80.3
43	0.1	99.8	44.09	2645.0	2204.0	38	0.0	80.4
44	0.0	99.8	45.11	2707.0	2256.0	37	0.0	80.4
45	0.0	99.8	46.14	2768.0	2307.0	36	0.0	80.4
46	0.0	99.8	47.16	2830.0	2358.0	35	0.0	80.4
47	0.0	99.8	48.19	2891.0	2410.0	34	0.0	80.4
48	0.0	99.8	49.22	2953.0	2461.0	34	0.0	80.4
49	0.0	99.8	50.24	3014.0	2512.0	33	0.0	80.4
50	0.0	99.8	51.27	3076.0	2563.0	32	0.0	80.4
Estimated Net Annual Sediment (TSS) Load Reduction =								80 %

RAINFALL DATA FROM ST CATHARINES AP 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

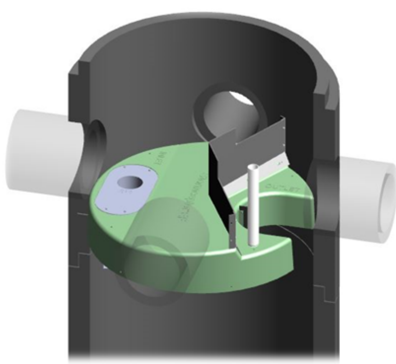
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

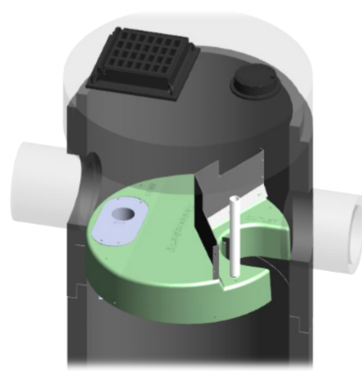
DESIGN FLEXIBILITY

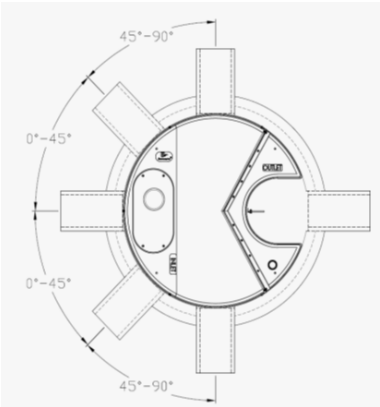
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.

Stormceptor® FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33

Site Name:	Montrose Rd - 13+380

Drainage Area (ha):	0.59
% Imperviousness:	86.60

Runoff Coefficient 'c': 0.81

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	17.03
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	78
EF6	84
EF8	88
EF10	90
EF12	91

Recommended Stormceptor EF Model:	**EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**84**
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 waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

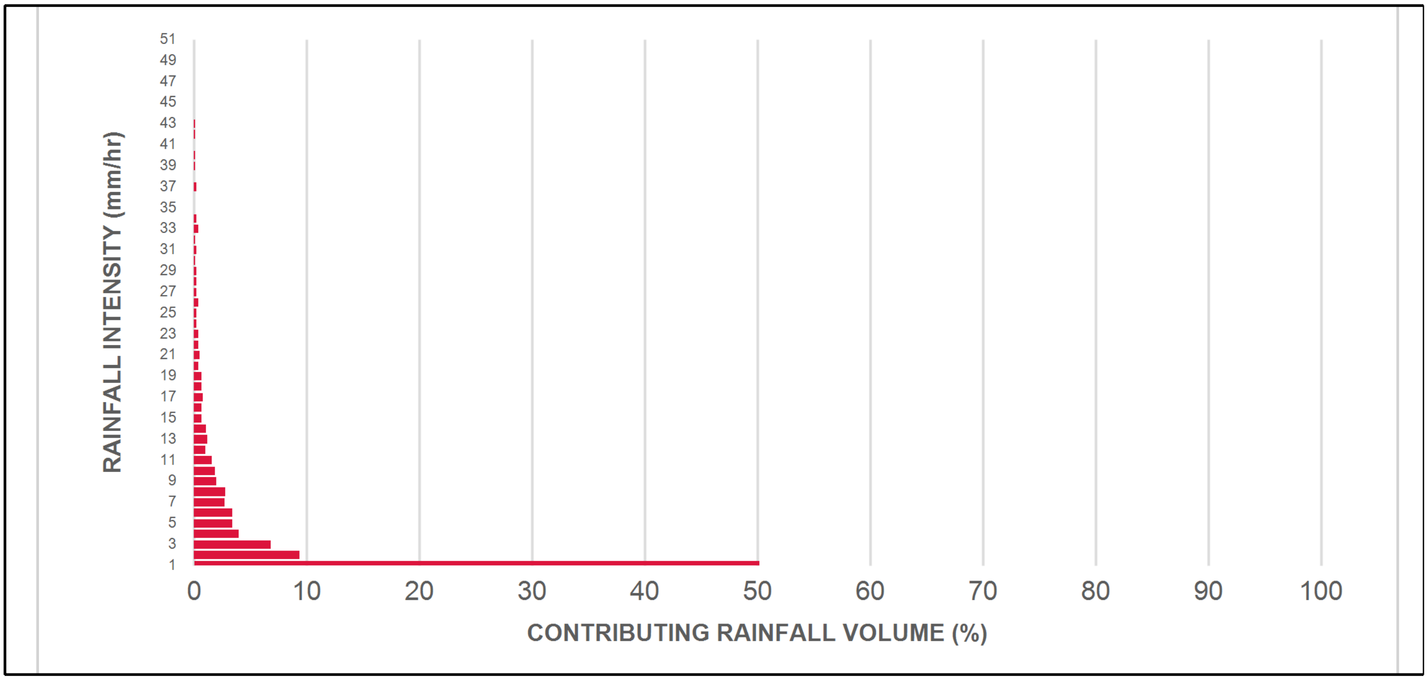
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

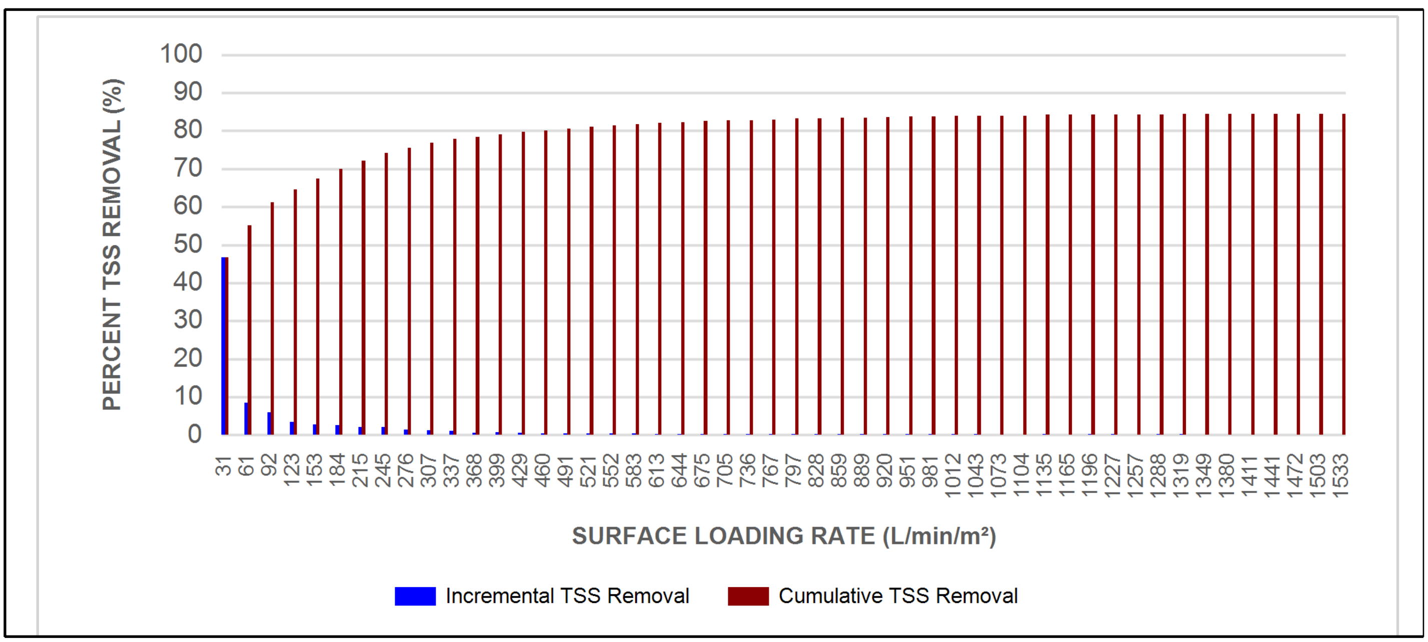
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.2	50.2	1.34	81.0	31.0	93	46.7	46.7
2	9.4	59.6	2.69	161.0	61.0	91	8.6	55.2
3	6.8	66.4	4.03	242.0	92.0	88	6.0	61.2
4	4.0	70.4	5.38	323.0	123.0	85	3.4	64.6
5	3.4	73.8	6.72	403.0	153.0	81	2.8	67.4
6	3.4	77.2	8.07	484.0	184.0	78	2.7	70.0
7	2.7	79.9	9.41	565.0	215.0	75	2.0	72.1
8	2.8	82.7	10.75	645.0	245.0	72	2.0	74.1
9	2.0	84.7	12.10	726.0	276.0	70	1.4	75.5
10	1.9	86.6	13.44	807.0	307.0	67	1.3	76.8
11	1.6	88.2	14.79	887.0	337.0	64	1.0	77.8
12	1.0	89.2	16.13	968.0	368.0	62	0.6	78.4
13	1.2	90.4	17.48	1049.0	399.0	59	0.7	79.1
14	1.1	91.5	18.82	1129.0	429.0	58	0.6	79.7
15	0.7	92.2	20.16	1210.0	460.0	57	0.4	80.1
16	0.7	92.9	21.51	1291.0	491.0	57	0.4	80.5
17	0.8	93.7	22.85	1371.0	521.0	57	0.5	81.0
18	0.7	94.4	24.20	1452.0	552.0	57	0.4	81.4
19	0.7	95.1	25.54	1533.0	583.0	56	0.4	81.8
20	0.4	95.5	26.89	1613.0	613.0	56	0.2	82.0
21	0.5	96.0	28.23	1694.0	644.0	56	0.3	82.3
22	0.4	96.4	29.57	1774.0	675.0	56	0.2	82.5
23	0.4	96.8	30.92	1855.0	705.0	56	0.2	82.7
24	0.2	97.0	32.26	1936.0	736.0	55	0.1	82.8
25	0.2	97.2	33.61	2016.0	767.0	55	0.1	83.0

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 (%)
26	0.4	97.6	34.95	2097.0	797.0	55	0.2	83.2
27	0.2	97.8	36.30	2178.0	828.0	55	0.1	83.3
28	0.2	98.0	37.64	2258.0	859.0	55	0.1	83.4
29	0.2	98.2	38.98	2339.0	889.0	55	0.1	83.5
30	0.1	98.3	40.33	2420.0	920.0	54	0.1	83.6
31	0.2	98.5	41.67	2500.0	951.0	54	0.1	83.7
32	0.1	98.6	43.02	2581.0	981.0	54	0.1	83.7
33	0.4	99.0	44.36	2662.0	1012.0	54	0.2	83.9
34	0.2	99.2	45.71	2742.0	1043.0	55	0.1	84.0
35	0.0	99.2	47.05	2823.0	1073.0	55	0.0	84.0
36	0.0	99.2	48.40	2904.0	1104.0	55	0.0	84.0
37	0.2	99.4	49.74	2984.0	1135.0	56	0.1	84.2
38	0.0	99.4	51.08	3065.0	1165.0	56	0.0	84.2
39	0.1	99.5	52.43	3146.0	1196.0	56	0.1	84.2
40	0.1	99.6	53.77	3226.0	1227.0	57	0.1	84.3
41	0.0	99.6	55.12	3307.0	1257.0	57	0.0	84.3
42	0.1	99.7	56.46	3388.0	1288.0	58	0.1	84.3
43	0.1	99.8	57.81	3468.0	1319.0	58	0.1	84.4
44	0.0	99.8	59.15	3549.0	1349.0	58	0.0	84.4
45	0.0	99.8	60.49	3630.0	1380.0	59	0.0	84.4
46	0.0	99.8	61.84	3710.0	1411.0	59	0.0	84.4
47	0.0	99.8	63.18	3791.0	1441.0	57	0.0	84.4
48	0.0	99.8	64.53	3872.0	1472.0	56	0.0	84.4
49	0.0	99.8	65.87	3952.0	1503.0	55	0.0	84.4
50	0.0	99.8	67.22	4033.0	1533.0	54	0.0	84.4
							Estimated Net Annual Sediment (TSS) Load Reduction =	**84 %**

RAINFALL DATA FROM ST CATHARINES AP 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

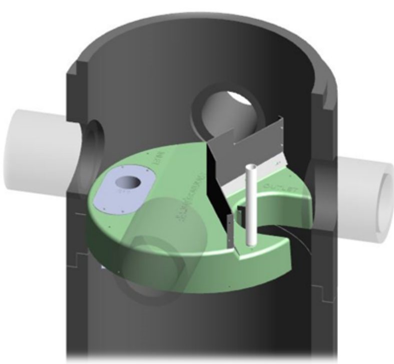
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

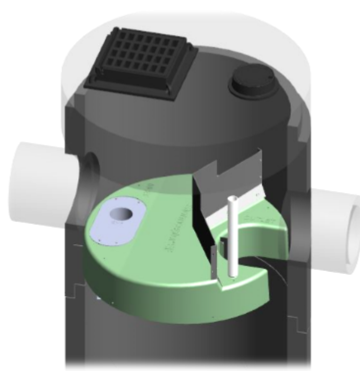
DESIGN FLEXIBILITY

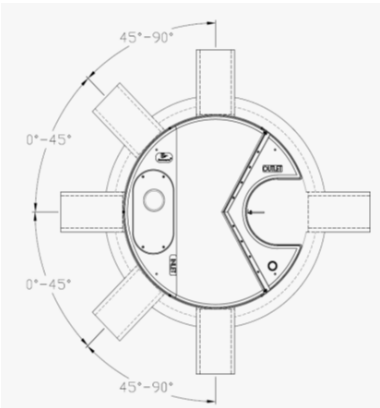
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33
Site Name:	Biggar Rd - Sta. 4+450
Drainage Area (ha):	0.71
% Imperviousness:	76.60
Runoff Coefficient 'c':	0.75
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	18.99
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	77
EF6	84
EF8	87
EF10	90
EF12	91

Recommended Stormceptor EF Model: EF4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 77

Water Quality Runoff Volume Capture (%): > 90

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 waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

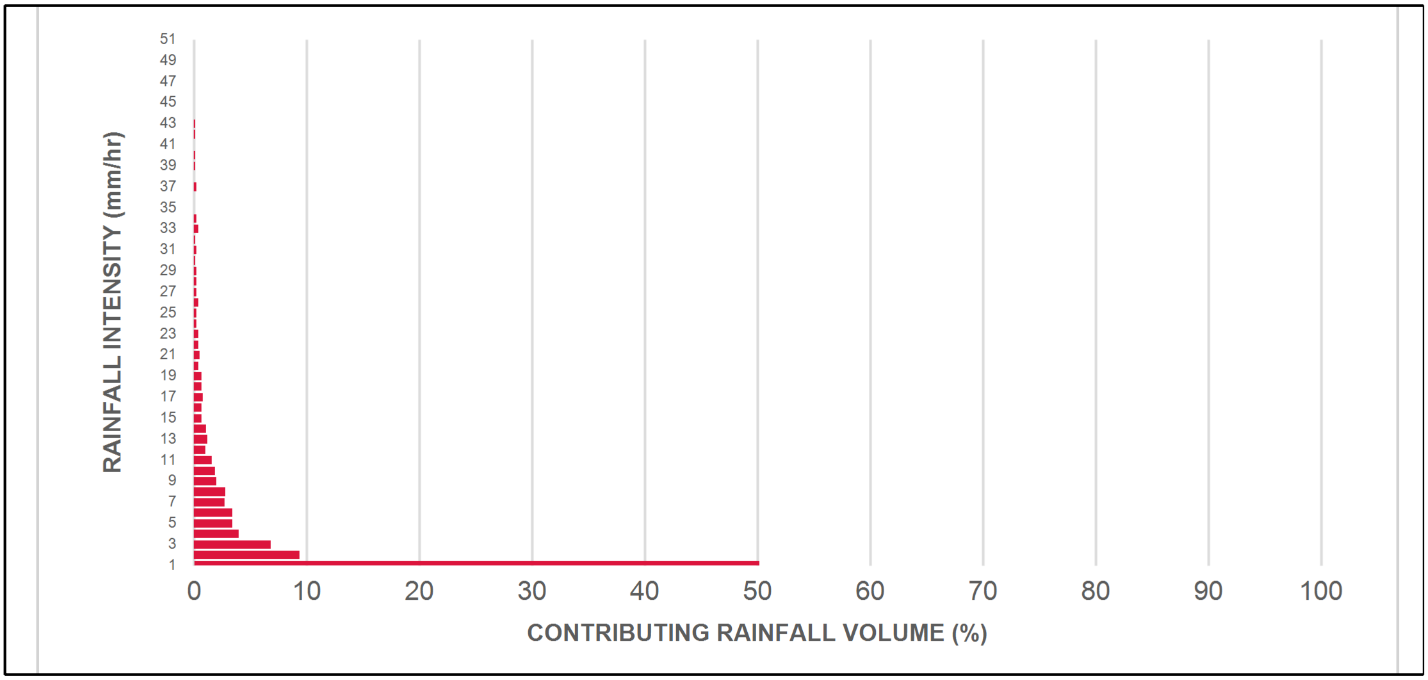
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

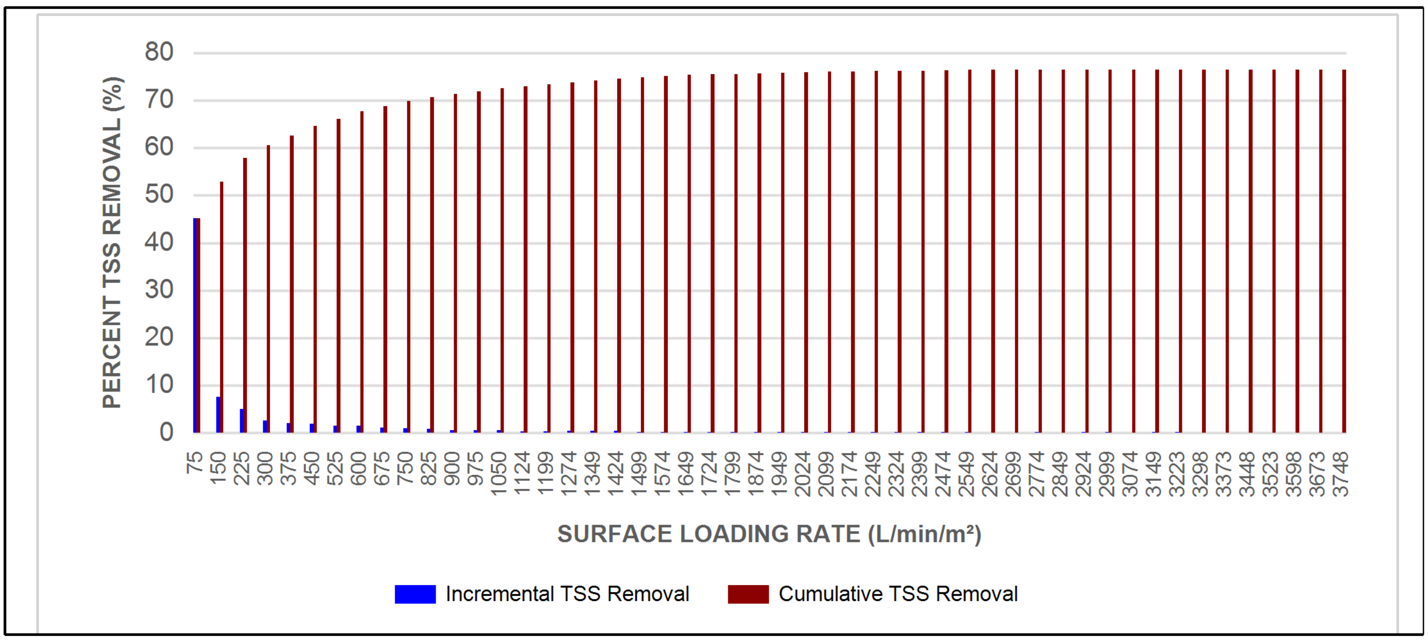
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.2	50.2	1.50	90.0	75.0	90	45.2	45.2
2	9.4	59.6	3.00	180.0	150.0	81	7.7	52.8
3	6.8	66.4	4.50	270.0	225.0	74	5.0	57.9
4	4.0	70.4	6.00	360.0	300.0	67	2.7	60.6
5	3.4	73.8	7.50	450.0	375.0	61	2.1	62.6
6	3.4	77.2	9.00	540.0	450.0	58	2.0	64.6
7	2.7	79.9	10.50	630.0	525.0	57	1.5	66.1
8	2.8	82.7	11.99	720.0	600.0	56	1.6	67.7
9	2.0	84.7	13.49	810.0	675.0	56	1.1	68.8
10	1.9	86.6	14.99	900.0	750.0	55	1.1	69.8
11	1.6	88.2	16.49	990.0	825.0	55	0.9	70.7
12	1.0	89.2	17.99	1079.0	900.0	55	0.5	71.3
13	1.2	90.4	19.49	1169.0	975.0	54	0.7	71.9
14	1.1	91.5	20.99	1259.0	1050.0	55	0.6	72.5
15	0.7	92.2	22.49	1349.0	1124.0	56	0.4	72.9
16	0.7	92.9	23.99	1439.0	1199.0	57	0.4	73.3
17	0.8	93.7	25.49	1529.0	1274.0	57	0.5	73.8
18	0.7	94.4	26.99	1619.0	1349.0	58	0.4	74.2
19	0.7	95.1	28.49	1709.0	1424.0	58	0.4	74.6
20	0.4	95.5	29.99	1799.0	1499.0	55	0.2	74.8
21	0.5	96.0	31.49	1889.0	1574.0	53	0.3	75.1
22	0.4	96.4	32.98	1979.0	1649.0	50	0.2	75.3
23	0.4	96.8	34.48	2069.0	1724.0	48	0.2	75.5
24	0.2	97.0	35.98	2159.0	1799.0	46	0.1	75.5
25	0.2	97.2	37.48	2249.0	1874.0	44	0.1	75.6

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 (%)
26	0.4	97.6	38.98	2339.0	1949.0	42	0.2	75.8
27	0.2	97.8	40.48	2429.0	2024.0	41	0.1	75.9
28	0.2	98.0	41.98	2519.0	2099.0	39	0.1	76.0
29	0.2	98.2	43.48	2609.0	2174.0	38	0.1	76.0
30	0.1	98.3	44.98	2699.0	2249.0	37	0.0	76.1
31	0.2	98.5	46.48	2789.0	2324.0	36	0.1	76.1
32	0.1	98.6	47.98	2879.0	2399.0	35	0.0	76.2
33	0.4	99.0	49.48	2969.0	2474.0	33	0.1	76.3
34	0.2	99.2	50.98	3059.0	2549.0	33	0.1	76.4
35	0.0	99.2	52.48	3149.0	2624.0	32	0.0	76.4
36	0.0	99.2	53.97	3238.0	2699.0	32	0.0	76.4
37	0.2	99.4	55.47	3328.0	2774.0	31	0.1	76.4
38	0.0	99.4	56.97	3418.0	2849.0	30	0.0	76.4
39	0.1	99.5	58.47	3508.0	2924.0	28	0.0	76.5
40	0.1	99.6	59.97	3598.0	2999.0	28	0.0	76.5
41	0.0	99.6	61.47	3688.0	3074.0	28	0.0	76.5
42	0.1	99.7	62.97	3778.0	3149.0	27	0.0	76.5
43	0.1	99.8	64.47	3868.0	3223.0	26	0.0	76.5
44	0.0	99.8	65.97	3958.0	3298.0	26	0.0	76.5
45	0.0	99.8	67.47	4048.0	3373.0	25	0.0	76.5
46	0.0	99.8	68.97	4138.0	3448.0	24	0.0	76.5
47	0.0	99.8	70.47	4228.0	3523.0	24	0.0	76.5
48	0.0	99.8	71.97	4318.0	3598.0	24	0.0	76.5
49	0.0	99.8	73.47	4408.0	3673.0	23	0.0	76.5
50	0.0	99.8	74.96	4498.0	3748.0	22	0.0	76.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**77 %**

RAINFALL DATA FROM ST CATHARINES AP 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

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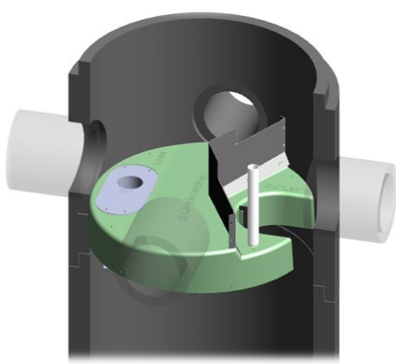
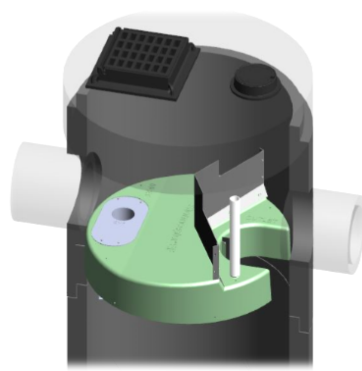
DESIGN FLEXIBILITY

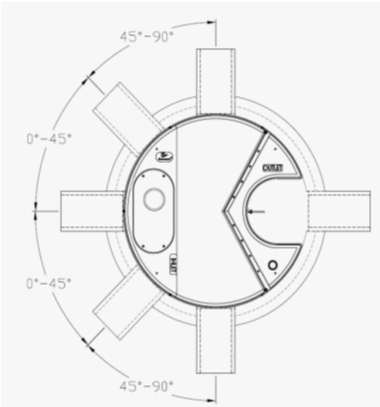
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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

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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
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	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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/05/2021

Province:	Ontario
City:	Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
NCDC Rainfall Station Id:	7287
Years of Rainfall Data:	33
Site Name:	Biggar Rd - Sta. 4+440
Drainage Area (ha):	0.58
% Imperviousness:	76.60

Runoff Coefficient 'c': 0.75

Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	15.51
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Montrose Rd, Biggar Rd/Lyons Creek Rd MCEA
Project Number:	46023
Designer Name:	Alireza Zareie
Designer Company:	Parsons Inc.
Designer Email:	Alireza.zareie@parsons.com
Designer Phone:	514-475-6694
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	79
EF6	85
EF8	88
EF10	90
EF12	91

Recommended Stormceptor EF Model:	**EF4**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**79**
Water Quality Runoff Volume Capture (%):	**> 90**

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 waterways.

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.

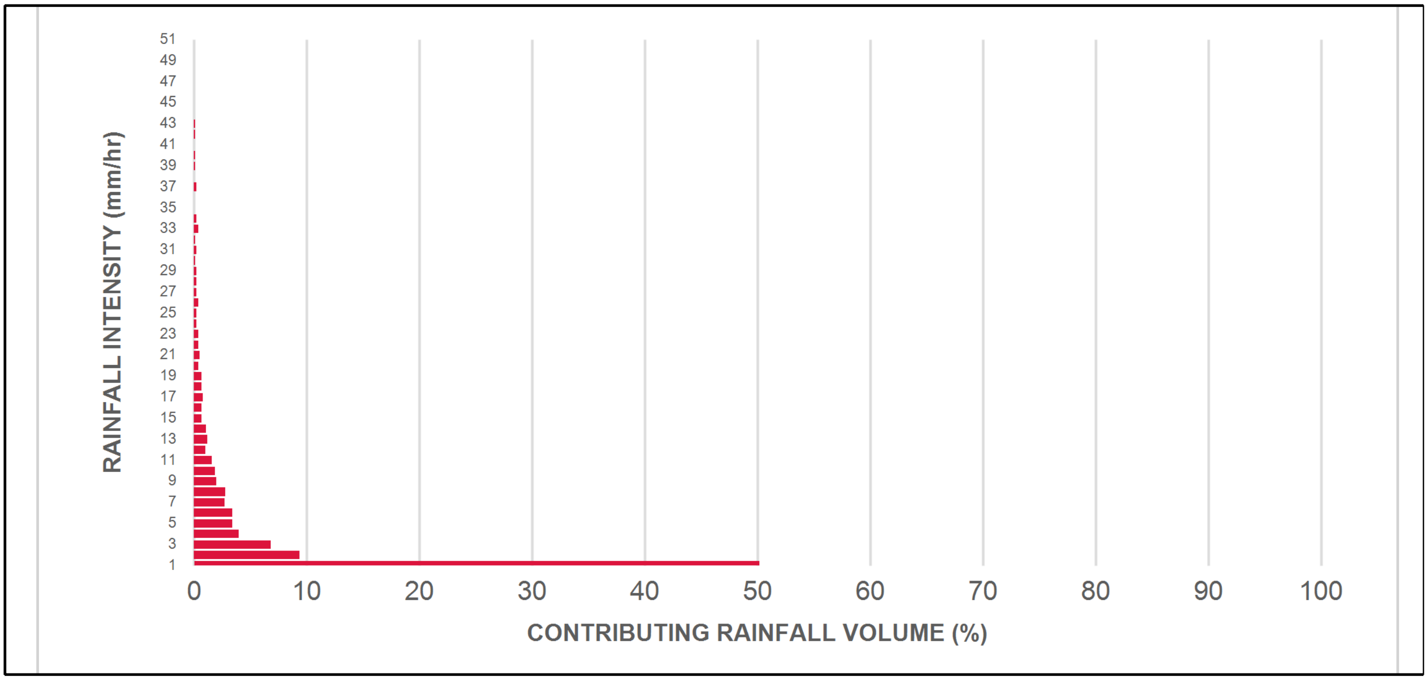
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

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 (%)
1	50.2	50.2	1.22	73.0	61.0	91	45.7	45.7
2	9.4	59.6	2.45	147.0	122.0	85	8.0	53.6
3	6.8	66.4	3.67	220.0	184.0	78	5.3	59.0
4	4.0	70.4	4.90	294.0	245.0	72	2.9	61.9
5	3.4	73.8	6.12	367.0	306.0	67	2.3	64.1
6	3.4	77.2	7.35	441.0	367.0	62	2.1	66.2
7	2.7	79.9	8.57	514.0	429.0	58	1.6	67.8
8	2.8	82.7	9.80	588.0	490.0	57	1.6	69.4
9	2.0	84.7	11.02	661.0	551.0	57	1.1	70.5
10	1.9	86.6	12.25	735.0	612.0	56	1.1	71.6
11	1.6	88.2	13.47	808.0	674.0	56	0.9	72.5
12	1.0	89.2	14.70	882.0	735.0	55	0.6	73.0
13	1.2	90.4	15.92	955.0	796.0	55	0.7	73.7
14	1.1	91.5	17.15	1029.0	857.0	55	0.6	74.3
15	0.7	92.2	18.37	1102.0	919.0	54	0.4	74.7
16	0.7	92.9	19.60	1176.0	980.0	54	0.4	75.0
17	0.8	93.7	20.82	1249.0	1041.0	55	0.4	75.5
18	0.7	94.4	22.05	1323.0	1102.0	55	0.4	75.9
19	0.7	95.1	23.27	1396.0	1164.0	56	0.4	76.3
20	0.4	95.5	24.50	1470.0	1225.0	57	0.2	76.5
21	0.5	96.0	25.72	1543.0	1286.0	58	0.3	76.8
22	0.4	96.4	26.95	1617.0	1347.0	58	0.2	77.0
23	0.4	96.8	28.17	1690.0	1408.0	59	0.2	77.2
24	0.2	97.0	29.39	1764.0	1470.0	56	0.1	77.4
25	0.2	97.2	30.62	1837.0	1531.0	54	0.1	77.5

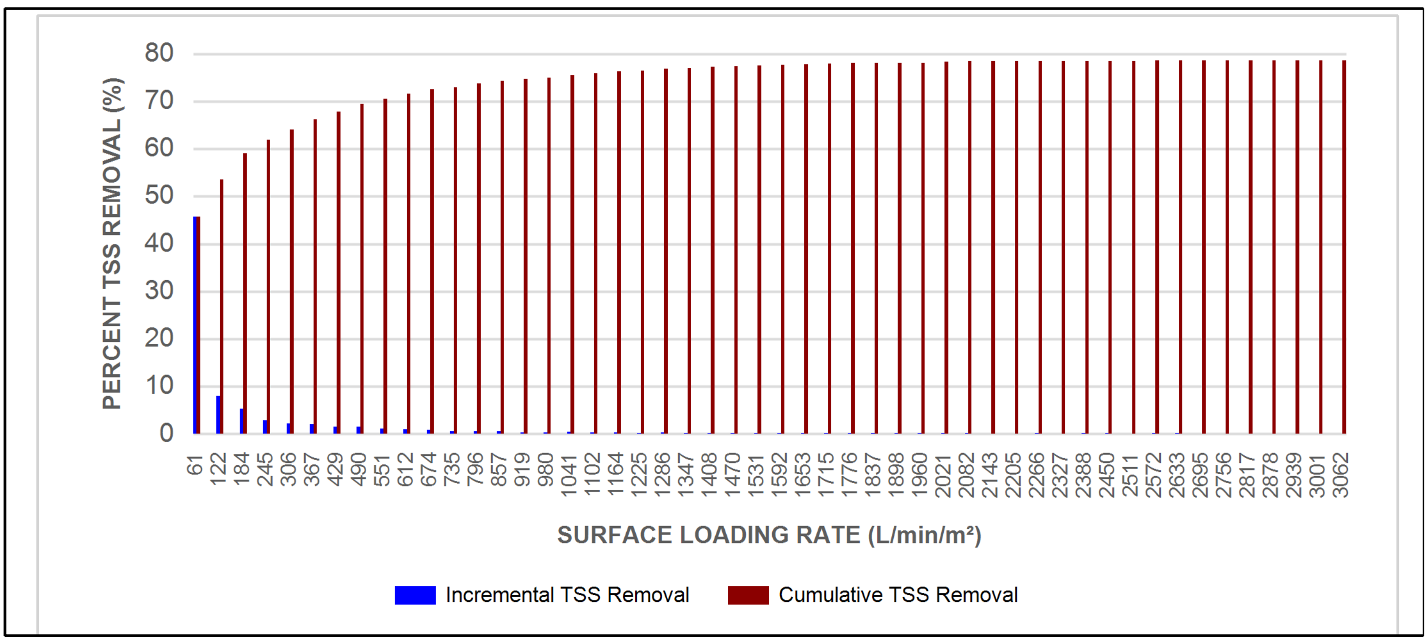
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.4	97.6	31.84	1911.0	1592.0	52	0.2	77.7
27	0.2	97.8	33.07	1984.0	1653.0	50	0.1	77.8
28	0.2	98.0	34.29	2058.0	1715.0	48	0.1	77.9
29	0.2	98.2	35.52	2131.0	1776.0	47	0.1	78.0
30	0.1	98.3	36.74	2205.0	1837.0	45	0.0	78.0
31	0.2	98.5	37.97	2278.0	1898.0	44	0.1	78.1
32	0.1	98.6	39.19	2352.0	1960.0	42	0.0	78.1
33	0.4	99.0	40.42	2425.0	2021.0	41	0.2	78.3
34	0.2	99.2	41.64	2499.0	2082.0	40	0.1	78.4
35	0.0	99.2	42.87	2572.0	2143.0	39	0.0	78.4
36	0.0	99.2	44.09	2646.0	2205.0	38	0.0	78.4
37	0.2	99.4	45.32	2719.0	2266.0	37	0.1	78.5
38	0.0	99.4	46.54	2792.0	2327.0	36	0.0	78.5
39	0.1	99.5	47.77	2866.0	2388.0	35	0.0	78.5
40	0.1	99.6	48.99	2939.0	2450.0	34	0.0	78.5
41	0.0	99.6	50.22	3013.0	2511.0	33	0.0	78.5
42	0.1	99.7	51.44	3086.0	2572.0	32	0.0	78.6
43	0.1	99.8	52.67	3160.0	2633.0	32	0.0	78.6
44	0.0	99.8	53.89	3233.0	2695.0	32	0.0	78.6
45	0.0	99.8	55.12	3307.0	2756.0	31	0.0	78.6
46	0.0	99.8	56.34	3380.0	2817.0	30	0.0	78.6
47	0.0	99.8	57.56	3454.0	2878.0	30	0.0	78.6
48	0.0	99.8	58.79	3527.0	2939.0	28	0.0	78.6
49	0.0	99.8	60.01	3601.0	3001.0	28	0.0	78.6
50	0.0	99.8	61.24	3674.0	3062.0	28	0.0	78.6
Estimated Net Annual Sediment (TSS) Load Reduction =								**79 %**

Stormceptor® EF Sizing Report

RAINFALL DATA FROM ST CATHARINES AP 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

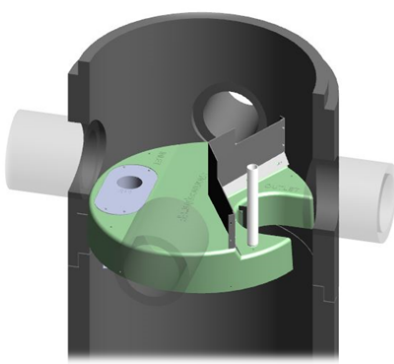
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

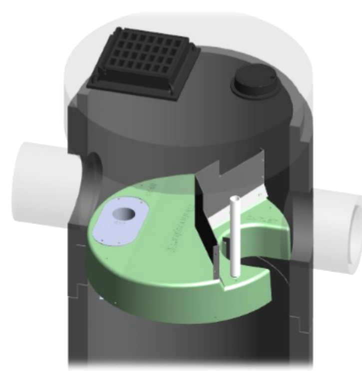
DESIGN FLEXIBILITY

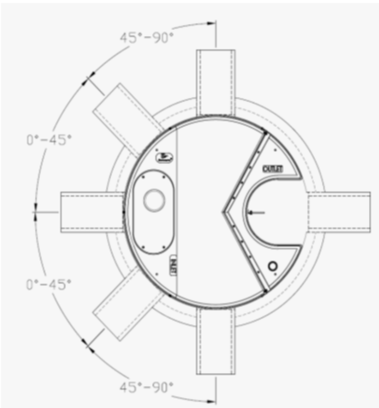
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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
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*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
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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

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STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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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.

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3.1 GENERAL

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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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.