Functional Servicing and Stormwater Management Report

Alma Subdivision

Township of Mapleton, Wellington County, Ontario

Submitted to:
Exact Construction Ltd.
685 St. David Street North
Fergus, Ontario N1M 2K6

Submitted by:
GEI Consultants Canada Ltd.
650 Woodlawn Road West, Block C, Unit 2
Guelph, Ontario N1K 1B8
519-824-8150

June 2026
Project No. 2401042

Issues and Revisions Registry

Identification	Date	Description of Issued and/or Revision
1st Submission	September 2024	1st ZBA Submission
2nd Submission	June 2026	2nd ZBA Submission

PREPARED BY:
GEI Consultants



Jay Boily, P.Eng.
Land Development Engineer

PREPARED BY:
GEI Consultants



Helen Peng, P.Eng.
Water Resources Engineer

CHECKED BY:
GEI Consultants



Andrea Reed, P.Eng.
Senior Land Development Engineer

Statement of Conditions

This Report/Study (the “Work”) has been prepared at the request of, and for the exclusive use of Exact Construction Ltd., and its affiliates (the “Intended User”). No one other than the Intended User has the right to use and rely on the Work without first obtaining the written authorization of GEI Consultants Canada Ltd. GEI Consultants Canada Ltd. expressly excludes liability to any party except the Intended User for any use of, and/or reliance upon, the work.

Neither possession of the Work, nor a copy of it, carries the right of publication. All copyright in the Work is reserved to GEI Consultants Canada Ltd. The Work shall not be disclosed, produced, or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of GEI Consultants Canada Ltd. and Exact Construction Ltd.

Table of Contents

1 Introduction 1

1.1 Background 1
1.2 Site Description 1
1.2.1 Land Use 1
1.2.2 Topography 1
1.2.3 Soils 2
1.2.4 Groundwater 2
1.3 Development Proposal 3
1.3.1 Site Grading 3
1.3.2 Streets 3
1.3.3 Water Supply 4
1.3.4 Fire Water Supply 4
1.3.5 Wastewater Treatment and Disposal 4
1.3.6 Storm Sewers 4

2 Hydraulic Analysis (HEC-RAS Updates) 6

1. Overview 6
2. Cross-Sections and Geometry 6
3. Terrain Update 7
4. Design Flow Data 7
5. Hydraulic Parameters 7
6. Boundary Conditions 8
7. Hydraulic Results – Water Surface Elevations 8
8. Floodplain Delineation 9
9. Summary 9

3 Stormwater Management (SWM) Design 11

3.1 Design Criteria 11
3.2 Existing Conditions 11
3.3 Proposed Conditions 12
3.3.1 Stormwater Management Overview 14
3.3.1.1 Lot Level Controls 14
3.3.1.2 Conveyance Controls 15
3.3.1.3 End of Pipe Facilities 15
3.4 Proposed Stormwater Management Facility 15
3.4.1 Water Quality 15
3.4.2 Extended Detention 15
3.4.3 Quantity Storage 16
3.4.4 Forebay Design 16
3.4.4.1 Sediment Cleanout Frequency 17
3.4.5 Emergency Spillway 17
3.4.6 Thermal Mitigation 17
3.4.7 Post- to Pre- Flow Comparison 18

4 Existing Northerly and North-Easterly Swales 19

5 Water Balance 21

6 Sediment and Erosion Control Plan 22

7 Conclusions and Recommendations 23

7.1 Stormwater Management Design 23
7.2 Hydraulic Analysis 23
7.3 Wastewater Treatment and Disposal 23
7.4 Water Supply 24
7.5 Site Grading 24

Tables

Table 3.1: Cross-Section Inventory by Scenario 6
Table 3.2: Design Storm Events and Peak Flow Summary (River 1, Reach 1) 7
Table 3.3: Manning's n Roughness Coefficients 8
Table 3.4: Downstream Boundary Conditions by Storm Profile 8
Table 3.5: Comparison of Water Surface Elevations – Hazel (Transposition) Event 8
Table 4.1: Pre-development VO Drainage Areas 12
Table 4.2: Pre-Development Condition Flow Rates 12
Table 4.3: Post-Development Input Parameters 13
Table 4.4: Storage Volume Summary 16
Table 4.5 Forebay Design Summary 17
Table 4.6: Pre and Post-development Flow Summary 18
Table 4.1 Comparison of Northerly Swale Flooding Depths Under Existing and Proposed Conditions 19
Table 4.2 Comparison of North-Easterly Swale Flooding Depths Under Existing Conditions 20
Table 5.1 Monthly Water Balance Summary 21

Figures

Figure 1 Key Plan Following Report
Figure 2 Draft Plan of Subdivision Following Report
Figure 3 Existing Conditions Drainage Area Plan Appendix B
Figure 4 Post-Development Drainage Area Plan Appendix B
Figure 5 Preliminary Storm Sewer Drainage Area Plan Appendix D

Drawings (Under Separate Cover)

1. Existing Conditions and Removals Plan
2. Conceptual Servicing Plan
3. Conceptual Grading Plan 1 of 3
4. Conceptual Grading Plan 2 of 3
5. Conceptual Grading Plan 3 of 3
6. Conceptual Stormwater Management Plan
7. Conceptual Erosion and Sediment Control Plan

Appendices

A. Geotechnical Investigation
B. Hydraulic Modelling
C. Stormwater Data Analysis
D. Preliminary Storm Sewer Design Sheet

1 Introduction

1.1 Background

GEI Consultants Canada Ltd. (GEI) was retained by Exact Construction Ltd. (the "Owner"), to prepare a Functional Servicing and Stormwater Management Report (FSSWMR) in support of a Zoning By-Law Amendment (ZBA) and Draft Plan of Subdivision (DPS) application for a proposed subdivision development consisting of 14 single-family estate style residential lots, a proposed extension of a municipal right-of-way (Church Street), a park block and a stormwater management block.

The purpose of this report is to provide site-specific information for the Township's review with respect to infrastructure required to support the proposed development.

Ther Draft Plan of Subdivision was prepared by Van Harten Land Surveyors and Engineers and dated June 2, 2026. Existing Conditions and Topographical Survey was also provided by Van Harten Land Surveyors and Engineers, as completed on September 9, 2022.

1.2 Site Description

1.2.1 Land Use

The 8.01 ha site (the site) is located at 31 Church Street in the Hamlet of Alma, Township of Mapleton. The site is bound by existing residential properties and Church Street to the north, Peel Street (Wellington Road 17) and existing residential lands to the west, existing former Canadian Pacific Railway corridor and farmland to the south and existing woodlot and agricultural lands to the east. Figure 1 illustrates the site location.

The site is currently a vacant agricultural field with treed areas located along the south, east and northeast portions of the site. The former railway corridor runs across the southerly portion of the site and is mainly covered in dense trees. The site is connected to Peel Street at the westerly portion of the property and existing Church Street at the north portion of the property.

The external lands to the north and west of the site have been developed for residential use consisting mostly of estate style single family housing.

1.2.2 Topography

Existing ground elevations across the site range from approximately 447 metres above sea level at the northwesterly portion of the site, Peel Street, to approximately 437.50 metres at the north-easterly end of the site.

Runoff generated from the site currently sheetflows to the existing swale crossing the north-easterly portion of the site. The existing north-easterly drainage swale collects drainage from the majority of the Hamlet of Alma and surrounding farm fields and it continues in the southeasterly direction to the existing wooded area and wetland area located external of the

site. The existing swale and external downstream wetland are regulated by the Grand River Conservation Authority (GRCA).

A rear yard swale crosses the property at the northerly portion of the site. This swale collects drainage from the existing lots fronting Peel Street and the part of the lots on Church Street, backing onto the subject site. The rear yard swale discharges to the existing culvert and roadside ditch system on Alexander Street.

The existing site features are shown on the Existing Conditions and Removals Plan prepared by GEI.

1.2.3 Soils

CMT Engineering Inc. completed a Geotechnical Investigation of the site in 2020. Based on the CMT investigation, the topsoil depth on site ranges from 360 mm to 410 mm with an average depth of 377 mm.

Subsurface soils are mainly composed of clayey silt in the upper 6 to 8 metre layers of the site. A confined sand layer is present directly below the clayey silt layer at a depth of 7.8 metres below the existing ground elevation at the easterly end of the site per Borehole 2. Silt is present directly below the clayey silt layer at a depth of 7.4 metres and 5.9 metres at the central and westerly portions of the site, per Boreholes 1 and 3, respectively.

The Geotechnical Investigation is included in Appendix A.

1.2.4 Groundwater

A Scoped Hydrogeological Assessment and Supplementary Groundwater Level Monitoring was completed by Hydrogeology Consulting Services (HCS) in 2022 and updated in 2026. Based on the HCS monitoring information, groundwater level measurements range from 0.05 to 2.48 metres below existing ground surface.

It is noted that the groundwater level measurement of 0.05 metre below the existing ground surface at Borehole 2 is interpreted to represent a perched groundwater table rather than a regional water table due to the location of the monitoring well filter screen in the confining sand layer. The existing sand layer which is located below the clayey silt layer at Borehole 2, approximately 7.8 metres below the existing ground elevation, indicates a pressurized, artesian type of condition.

In addition, the HCS study states that Boreholes 1 and 3 are screened in a confined saturated silt deposit at depths of 5.89 and 7.37 metres below the existing ground surface, respectively, and that the measured water levels do not indicate that a shallow groundwater table is encountered. The HCS Study concludes that “the near surface soils underlaying the subject property are low permeability clayey-silt deposits that do not contain significant groundwater and do not represent an aquifer”. Furthermore, the HCS study mentions that subsurface agricultural tiles may be installed to drain the perched groundwater layer.

Hydraulic conductivity rates range from less than 1 x 10-8 m/sec for the clayey silt soils found at Borehole 3, to 2.5 x 10-4 m/sec for the deeper sandy soils found at Borehole 2. It is expected that low volumes of precipitation infiltrate through the clayey silt material on site to contribute to the deeper overburden groundwater regime.

The Hydrogeological Assessment and Supplementary Groundwater Level Monitoring is included with the ZBA/DPS submission.

1.3 Development Proposal

The proposed development generally consists of 14 single-family estate style residential lots all serviced with private wells and septic systems. The development also includes the extension of the existing municipal right-of-way (Church Street), a park block, and a stormwater management block. Figure 2 illustrates the proposed Draft Plan of Subdivision prepared by Van Harten Surveyors and Engineers.

Road connections to existing municipal rights-of-ways will be provided by extending Church Street from its current terminus at Alexander Street in a westerly direction to connect to Peel Street.

1.3.1 Site Grading

The preliminary site grading for the proposed residential lots, municipal right-of-way and stormwater management pond is shown on the Conceptual Grading Plans prepared by GEI.

Existing road elevations are being maintained at the current Church Street terminus and Peel Street connections. The internal road network will form a low point at the entrance to the stormwater management pond which will provide for the major overland flow route from the development to be conveyed overland via the internal municipal right-of-way to the proposed stormwater management pond. The preliminary grading of the stormwater management pond has been designed to provide an outlet for the minor and major storm events to the existing swale which crosses the north-easterly portion of the property.

The proposed development will match into the existing property line elevations. The internal roadways are proposed to be graded with slopes ranging from 0.5% to 5%, while lots are generally proposed to be graded with slopes ranging from 2% to 6% per the per Township of Mapleton Development Standards. 3:1 transition slopes are proposed in rear yard areas to match into the existing property boundary elevations.

1.3.2 Streets

The Church Street extension will be constructed as an urban cross section complete with concrete curb and gutter. The Township of Mapleton 20 metre urban cross section will be used in the development of the site per Township of Mapleton Standard Drawing No. 101.

Concrete sidewalks, with a 1.5 metre width, will be constructed on both sides of each street.

1.3.3 Water Supply

The Hamlet of Alma does not have a municipal water supply system, and as such, water supply to each of the proposed residential lots will be provided by individual drilled wells on each lot. An analysis of the local aquifer's ability to supply water at a sufficient rate was completed as part of the Hydrogeological Assessment prepared by HCS. Based on the analysis, there is ample supply available to meet the needs of the subdivision.

The locations of wells for each lot will be determined at detailed design, when more information about building footprints and positioning on lots is known. A 15 m minimum setback will be provided from septic systems.

1.3.4 Fire Water Supply

Per the Town Standards and discussions with the Mapleton Fire Department, a 37500 US gallon fire water supply tank will be installed for the development. The tank will be located such that the pumper apparatus can park within 7.3 m of the outlet pipe, and so that the fire truck can access the tank without reversing. The top of the outlet pipe shall be 0.76 m from ground level. The tank has been provisionally placed in the park block, however further discussions about fire water supply requirements and tank location will take place at detailed design.

1.3.5 Wastewater Treatment and Disposal

Wastewater servicing for the proposed development will be provided by a private septic system located on each lot. A Predictive Nitrate Impact Assessment and Pathogen Migration Assessment are provided in the Scoped Hydrogeological Assessment prepared by HCS. The locations of septic systems on each lot will be determined at detailed design when more information is available about building footprints and positioning on the lots. The sizes of the proposed lots will allow for all required setbacks to be maintained for the septic systems.

1.3.6 Storm Sewers

The storm sewer system for the proposed development will be sized to convey the 5-year design storm to the proposed stormwater management facility. Preliminary storm sewer sizing has been completed to size the inlet pipe into the stormwater management pond and the first run of pipe branching away from the proposed low spot in the road at Church Street in support of determining the preliminary road elevations for the development. Preliminary storm sewer calculations are included in Appendix D.

Major storm events will be conveyed overland through the municipal right-of-way to the stormwater management facility.

The stormwater management facility will outlet to the existing swale crossing the site.

150 mm diameter subdrains are proposed to be installed along the full length of the proposed curb line on both sides of the road per Township of Mapleton Development Standards Section B5.02.

Foundation drainage will be provided by sump-pump discharge to a 150 mm diameter storm service lateral for each lot.

2 Hydraulic Analysis (HEC-RAS Updates)

1. Overview

The Grand River Conservation Authority (GRCA) provided an existing HEC-RAS model for the study area, which served as the basis for the updated hydraulic analysis. The GRCA model lacked precise cross-section locations relative to the subject property; accordingly, GEI reviewed and updated the model to accurately characterize existing conditions.

Two model scenarios were developed within the updated framework:

- **BS-Scenario – GEI (Baseline – Alma Subdivision – GEI):** Reproduced GRCA model with cross-section locations assigned consistent with the original HEC-2 documentation. This scenario serves as the reference for comparison.
- **EX Scenario – GEI (Existing – Alma Subdivision – GEI):** Additional cross-sections were introduced at approximately 20–30 m intervals to improve hydraulic resolution. Cross-section geometry was updated using 50 cm resolution raster terrain data (Skywatch) processed through RAS Mapper. All other model parameters were consistent with the GRCA Baseline.

Both scenarios were simulated for the regulatory Hurricane Hazel (Transposition) storm event, consistent with GRCA floodplain mapping standards.

2. Cross-Sections and Geometry

In the GRCA Baseline scenario (BS-Scenario – GEI), cross-section stations range from RS 1177 (downstream) to RS 1631 (upstream), reproduced at approximately 40–50 m spacing from the original GRCA model. For the GEI Existing scenario (EX Scenario – GEI), cross-sections were supplemented to RS 1150–RS 1631 at 20–30 m intervals. All original cross-section geometries in the BS-Scenario – GEI were retained without modification to maintain consistency with the GRCA reference model. The final cross-section layout for both scenarios is shown in Appendix B.

Table 2.1 summarizes the cross-sections included in each scenario.

Table 2.1: Cross-Section Inventory by Scenario

River Station (RS)	BS-Scenario – GEI	EX Scenario – GEI
1631	✓	✓
1605	—	✓
1592	✓	✓
1575	—	✓
1547	✓	✓
1500	—	✓
1497	✓	✓

1475	—	✓
1455	✓	✓
1400	—	✓
1385	—	✓
1325	—	✓
1285	✓	✓
1250	—	✓
1200	—	✓
1180	—	✓
1177	✓	✓

3. Terrain Update

Cross-section elevations for the GEI Existing scenario (EX Scenario – GEI) were extracted from 50 cm resolution LiDAR tiles obtained via Skywatch, mosaicked into a continuous surface, and processed in RAS Mapper.

While GRCA Baseline scenario (BS-Scenario – GEI) cross-section geometries were retained from the original GRCA model without modification.

4. Design Flow Data

Design flows were adopted directly from the GRCA-supplied model. Four storm profiles were simulated as summarized in Table 2.2. The Hazel (Transposition) event governs floodplain delineation.

Table 2.2: Design Storm Events and Peak Flow Summary (River 1, Reach 1)

Storm Event	Return Period	Peak Flow – River 1, Reach 1 (m^3/s)
2-Year	2-year	1.64
5-Year	5-year	2.68
100-Year	100-year	7.54
Hazel (Transposition)	**Regional**	**8.58**

5. Hydraulic Parameters

Manning's roughness coefficients were adopted from the GRCA model and applied uniformly across both scenarios, as presented in Table 2.3. No calibration adjustments were made.

Table 2.3: Manning's n Roughness Coefficients

Zone	Manning's n
Left Overbank (LOB)	0.035
Main Channel	0.055
Right Overbank (ROB)	0.035

6. Boundary Conditions

A known water surface elevation was applied as the downstream boundary condition for all storm profiles, as specified in the original GRCA model. The downstream boundary was set at RS 1150 (EX Scenario – GEI). Flow was specified at the upstream-most cross-section (RS 1631) via a flow change location. Table 2.4 summarizes the applied boundary conditions.

Table 2.4: Downstream Boundary Conditions by Storm Profile

Profile	Flow (m^3/s)	Known WS Elevation (m)	Source
2-Year	1.64	436.60	GRCA Model
5-Year	2.68	436.74	GRCA Model
100-Year	7.54	437.01	GRCA Model
Hazel (Transposition)	**8.58**	**437.04**	**GRCA Model**

7. Hydraulic Results – Water Surface Elevations

Simulated water surface elevations (WSEL) for the Hazel (Transposition) event (regulatory) are compared between the GRCA Baseline (BS-Scenario – GEI) and GEI Existing (EX Scenario – GEI) models at all cross-sections in Table 2.5. Full results are provided in Appendix B.

Table 2.5: Comparison of Water Surface Elevations – Hazel (Transposition) Event

River Station	BS-Scenario – GEI WSEL (m)	EX Scenario – GEI WSEL (m)	ΔWSEL (m)
1631	442.05	442.10	+0.05
1605	441.96	—	—
1592	441.59	441.59	0.00
1575	441.32	—	—
1547	441.26	441.17	-0.09
1500	441.06	—	—
1497	440.61	440.72	+0.11
1475	440.40	—	—
1455	440.24	439.95	-0.29

1400	440.18	—	—
1385	439.69	—	—
1325	438.87	—	—
1285	438.56	438.52	-0.04
1250	438.33	—	—
1200	437.87	—	—
1180	437.70	—	—
1177	437.26	437.26	—

WSEL differences between the scenarios range from 0.00 m to 0.29 m across the modeled reach. The largest difference occurs at RS 1455, where the EX Scenario – GEI WSEL is 0.29 m lower than the BS-Scenario – GEI. At RS 1497, an increase of 0.11 m is observed in the EX Scenario, while RS 1547 shows a decrease of 0.09 m. At RS 1631, a minor increase of 0.05 m is noted, and RS 1285 shows a small decrease of 0.04 m. No difference is observed at RS 1592, and RS 1177 remains unchanged between scenarios.

Differences in the upper reach (RS 1497–RS 1631) are minimal. Overall, hydraulic behavior is consistent between the two scenarios.

8. Floodplain Delineation

The regulatory floodplain was delineated using WSEL results from the EX-Scenario – GEI for the Hazel (Transposition) event, intersected with the 50 cm terrain model in RAS Mapper. The updated floodplain extent reflects the refined cross-section spacing and terrain data, with minor localized differences relative to the previously available GRCA mapping.

The updated floodplain is presented in Figure FP-1 provided in Appendix B.

9. Summary

The hydraulic analysis for the Alma Subdivision subject site incorporated the following updates to the GRCA-provided HEC-RAS model:

- GRCA Baseline scenario (BS-Scenario – GEI) reproducing the original GRCA model with existing cross-section geometry and parameters;
- GEI Existing scenario (EX Scenario – GEI) with additional cross-sections at 20–30 m intervals and updated geometry from 50 cm Skywatch LiDAR terrain;
- Consistent Manning's n roughness coefficients and GRCA-specified downstream boundary conditions applied across all profiles; and
- Simulation of four design storm events, with the Hazel (Transposition) event governing floodplain delineation.

WSEL differences between the GRCA Baseline (BS-Scenario – GEI) and GEI Existing (EX Scenario – GEI) scenarios are minor and within expected model sensitivity. The updated

floodplain boundary provides an improved representation of flood conditions at the subject property and forms the basis for subsequent flood risk assessment.

Complete HEC-RAS model results and the Floodplain Drawing (FP-1) are included in Appendix B.

3 Stormwater Management (SWM) Design

3.1 Design Criteria

The proposed development will be designed to meet the Township of Mapleton, Grand River Conservation Authority (GRCA), and Ontario Ministry of Transportation (MTO) Design Guidelines, and the related standards of the Province of Ontario as set out in the Ministry of the Environment (MOE) 2003 Stormwater Management Planning and Design (SWMPD) Manual.

The following design criteria is applicable to the subject site:

- Post-development peak flows from the site for all storm events (up to and including the 100-year storm event) shall be controlled to the corresponding peak flow rates resulting from pre-development conditions;
- "Enhanced" level of control based on MOE (2003) Guidelines (80% Total Suspended Solids removal);
- Major storm flows are to be routed overland to an appropriate outlet;
- The 25 mm 4-hour Chicago storm is stored and released over a 24-hour period for erosion control;
- Mount Forest IDF data is to be used for analysis; and
- Hydrologic modelling is performed using Visual OTTHYMO.

3.2 Existing Conditions

For pre-development conditions analysis purposes, the site was modelled as three drainage catchments. The pre-development condition drainage catchments are shown on Figure 3. Catchments external to the site discharging to the existing northerly and north-easterly swales crossing the property are discussed in Section 4.0 of this report.

The description of the three pre-development areas is listed below:

- Catchment 100 (7.88 hectares, 0% impervious) represents the bulk general developable area of the site. Runoff generated from Catchment 100 sheetflows overland in the easterly direction to the existing swale crossing the north-easterly property boundary of the site.

- Catchment 101 (0.13 hectares, 0% impervious) represents the existing swale area crossing the north-easterly portion of the site. The existing swale continues downstream of the site in the easterly direction to the existing wooded and wetland area and is regulated by the GRCA.

- Catchment 102 (0.08 hectares, 0% impervious) represents the lands owned by the Presbyterian Church. Runoff generated from Catchment 102 sheetflows overland in

the easterly direction to Catchment 100, ultimately discharging to the existing swale crossing the north-easterly property boundary of the site.

For all pre-development drainage areas, a CN number of 79 was used based on the existing soil type of Hydrologic Soil Group C and land cover use of “pasture/lawn”. Catchments were modelled as NasHYD in Visual OTTHYMO (VO). The time of concentration for each drainage area was calculated using the Airport Method.

Table 3.1 lists the catchments under pre-development conditions.

Table 3.1: Pre-development VO Drainage Areas

Catchment	Drainage Area (ha)	VO Model ID	CN	Tp (hr)
100	7.88	1	79	0.64
101	0.13	2	79	0.32
102	0.08	3	79	0.15

As per the Township of Mapleton’s guidelines, the 4-hour Chicago distribution storm was used to size the required SWM storage volume and design the flow control measures.

Table 3.2 lists the flow rates discharging from each catchment under pre-development conditions. Detailed modelling results are provided in Appendix C.

Table 3.2: Pre-Development Condition Flow Rates

Storm Event	Catchment 100 (m^3/s)	Catchment 101 (m^3/s)	Catchment 102 (m^3/s)	Total Flow (m^3/s)
2-yr	0.106	0.003	0.002	0.109
5-yr	0.180	0.005	0.004	0.184
10-yr	0.237	0.006	0.005	0.242
25-yr	0.316	0.008	0.007	0.323
50-yr	0.373	0.009	0.008	0.382
100-yr	0.438	0.011	0.010	0.448

3.3 Proposed Conditions

For post-development analysis purposes, the site was modelled as six drainage catchments. The post-development drainage catchments are shown on Figure 4 and described below:

- Catchment 200 (6.15 hectares, 50% impervious) includes the proposed Church Street extension and the majority of the single-family estate type lots. Runoff generated from Catchment 200 will be directed to the proposed stormwater management pond.

- Catchment 201 (0.91 hectares, 50% impervious) represents the proposed stormwater management pond block. The stormwater management pond will outlet to the existing swale crossing the north-easterly portion of the site.

- Catchment 202 (0.45 hectares, 0% impervious) represents the existing swale area crossing the north-easterly portion of the site. The existing swale continues downstream of the site in the easterly direction to the existing wooded and wetland area and is regulated by the GRCA.

- Catchment 203 (0.43 hectares, 0% impervious) represents the proposed 3:1 transition slope to match existing elevations at the southerly property boundary for Lots 1 to 8. Runoff generated from the transition slope will sheetflow along the property line in the easterly direction and will discharge to the existing swale located downstream of the site.

- Catchment 204 (0.17 hectares, 0% impervious) represents a portion of the 3:1 transition slope located at the rear of lots 11 to 13 as well as the existing northerly swale that collects runoff from the existing lots fronting Peel Street and Church Street. Runoff from Catchment 204 will continue to flow through the existing roadside ditches and culverts and will outlet to the existing swale crossing the property at the north-easterly end (Catchment 202).

- Catchment 205 (0.08 hectares, 0% impervious) represents the lands owned by the Presbyterian Church. Runoff generated from Catchment 205 sheetflows overland in the easterly direction to Catchment 200, ultimately discharging to the proposed stormwater management pond.

Catchments external to the site discharging to the existing northerly and north-easterly swales crossing the property are discussed in Section 4.0 of this report.

The post-development drainage area characteristics were determined and summarized in Table 3.3 below. Catchments 203-205 were modelled as NasHYD in Visual OTTHYMO (VO) as the imperviousness of the catchments did not exceed 40%. The detailed calculations are provided in Appendix C.

Table 3.3: Post-Development Input Parameters

Drainage ID	Total Area (ha)	Outlet Location	Land Use Type	VO Model ID	VO Model Command
200	6.15	SWM Pond	Residential	200	STANDHYD
201	0.91	SWM Pond	SWM Block	201	STANDHYD
202	0.45	Existing Swale	Swale/Lawn	202	NASHYD

Drainage ID	Total Area (ha)	Outlet Location	Land Use Type	VO Model ID	VO Model Command
203	0.43	Existing Swale	Lawn	203	NASHYD
204	0.17	Existing Swale	Lawn	204	NASHYD
205	0.08	SWM Pond	Lawn	205	NASHYD

3.3.1 Stormwater Management Overview

In line with current practices and guidelines, the stormwater management approach for the Alma Subdivision is designed as a “treatment train” to remove sediments and any absorbed contaminants prior to the discharge of runoff from the development to the receiving outlets. The “treatment train” approach will include a combination of lot level, conveyance and end-of-pipe best management practices and is proposed to filter and remove sediments from stormwater runoff prior to discharging to the existing swale located at the north-easterly portion of the site.

3.3.1.1 Lot Level Controls

Stormwater management practices recommended for providing lot level controls on this site are as follows:

Roof Drainage to Ground Surface

The lots will drain to the street. The roof runoff will be filtered across the grassed surface. The runoff for any event large enough to generate flow to the sewer system will be adequately filtered by the grass.

Rear Yard Swales

The grading of the lots will be to current Township of Mapleton Development Standards. Where practical, the length of the rear lot swales between catch basins will be increased to extend the contact time with the grassed surfaces.

To promote more infiltration on the lots and in the swales, it is recommended that the average depth of graded topsoil be 300 mm.

Foundation Drainage

Foundation drainage will be via sump pumps discharging to a proposed storm sewer lateral for each lot.

3.3.1.2 Conveyance Controls

Conveyance controls will be achieved through municipal maintenance of the storm sewer system. The regular cleanout of the manholes and catchbasin sumps will remove the heavier sediments deposited from the runoff during storm events.

3.3.1.3 End of Pipe Facilities

The end-of-pipe component consists of the proposed stormwater management pond located near the north-easterly edge of the property, adjacent to the existing swale. The proposed stormwater management facility will outlet to the existing swale and has been designed as a wet pond complete with a forebay and a 2.20 m deep permanent pool to provide the required water quality controls. The proposed stormwater management facility will have a reverse draw outlet for the 4-hour 25mm storm event (quality storm) to draw cooler water from the deeper parts of the pond, prior to outletting to the existing swale. The proposed outlet structure is designed to provide extended detention of the required water quality storage volumes as per the MOE 2003 Stormwater Management Planning and Design Manual.

3.4 Proposed Stormwater Management Facility

3.4.1 Water Quality

The proposed stormwater management facility has been designed to function as a wet pond. From Table 3.2 of the MOE Stormwater Management Planning and Design Manual, 2003, in order to provide enhanced water quality treatment, a wet pond facility requires 176 m³/ha of storage volume for a contributing drainage area that is 49% impervious. 40 m³/ha of the required storage volume is extended detention volume, while the remaining 136 m³/ha is permanent pool. Based on a contributing drainage area of 7.07 hectares and a requirement of 136 m^3/ha of permanent pool, the required permanent pool storage is 962 m^3.

The proposed stormwater management pond has been designed with a 1.0 metre deep permanent pool for the forebay and 2.20 metre deep permanent pool for the main cell, which provides a combined permanent pool volume of 1679 m³.

3.4.2 Extended Detention

Extended detention volume is calculated based on the runoff volume (939 m^3) generated by the 4-hour 25 mm design storm event based on VO modelling. The outlet structure has been designed to provide a 24-hour detention of the required extended detention volume, which corresponds to a release rate of 0.013 m³/s.

From the design of the stormwater management pond, a storage volume of 939 m³ corresponds to a ponding depth of approximately 0.33 metres. The outlet structure has been designed with a 110 mm diameter orifice, which will control the extended detention volume to the required release rate.

As established with the Township's Criteria, stormwater management facilities are required to provide extended detention of the 25 mm rainfall event for a minimum of 24 hours. Since the

water surface area provided the SWM pond varies as the extended detention volume is drawn down, detention times for the SWM pond facility was calculated based on *equation 4.11* of the MOE SWMPD Manual (2003) as shown below.

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_O}$$

Where:

A_o = Cross-sectional area of orifice
C_2 = Slope co-efficient from the area-depth linear regression
C_3 = Intercept from the area-depth linear regression
h = Maximum water elevation above center-line of orifice
t = Extended detention time

The drawdown time of this orifice and the extended detention volume has been calculated as 31.7 hours, which meets the minimum drawdown time requirement.

3.4.3 Quantity Storage

The functional characteristics based on the provided storage volumes and controls for each of the proposed SWM facilities were coded into the post-development VO model in order to estimate the peak flow rates and storage volumes required. Detailed stage-storage-discharge information for the proposed SWM facility is provided in Appendix C. The VO model detailed outputs are provided in Appendix C and the results of the analysis are summarized in Table 3.4 below.

Table 3.4: Storage Volume Summary

Control	Peak Flow (m^3/s)	Storage Volume (m^3)	Storage Elevation (m)
Extended Detention	0.013	939	437.63
2 Year	0.085	967	437.87
5 Year	0.161	1287	437.95
10 Year	0.226	1498	438.00
25 Year	0.301	1783	438.07
50 Year	0.350	1987	438.12
100 Year	0.396	2232	438.18

3.4.4 Forebay Design

The proposed stormwater management facility has been designed with one sediment forebay located at the pond inlet. The sediment forebay is 1.0 m deep and has been designed per the MOE Stormwater Management Planning and Design Manual guidelines. The full sediment forebay sizing information has been included in Appendix C.

Table 3.5 summarizes the required and provided parameters within the sediment forebay design.

Table 3.5 Forebay Design Summary

Proposed Forebay Length (m)	Proposed Forebay Width (m)	Proposed Length to Width Ratio	Minimum Required Settling Length (m)	Minimum Required Dispersion Length (m)	Minimum Required Bottom Width (m)	Proposed Forebay Bottom Width (m)
37.0	18.0	2:1	14.5	13.0	1.8	4.5

3.4.4.1 Sediment Cleanout Frequency

The required forebay cleanout interval was calculated to be approximately 17 years, based on the estimated TSS loading derived from the contributing drainage area and its imperviousness. This interval represents the time required for sediment accumulation to reduce the effective forebay storage volume by 50%.

3.4.5 Emergency Spillway

The SWM pond has a proposed spillway at an invert elevation of 438.30 m with a provided height of 0.50 m between the spillway invert and the top of the pond at 438.80 m. With a weir bottom width of 15.0 m and 10:1 side slopes, the spillway can convey the larger of the uncontrolled 100-year (1.455 m^3/s) or the Regional inflow (0.99 m^3/s) with a max flow depth of 0.15 m. This flow depth is within the total provided flow depth of 0.50 m meaning that the proposed spillway provides adequate flow capacity, while still providing a minimum 0.30 m of freeboard. Detailed calculations can be found in Appendix C.

3.4.6 Thermal Mitigation

Thermal mitigation management practices have been implemented into the design of the proposed stormwater management facility prior to discharge to the existing swale located at the north-easterly portion of the site. The MOE Stormwater Management Planning and Design Manual, 2003 and the Data Synthesis and Design Considerations for Stormwater Thermal Mitigations Measures, Sustainable Technologies Evaluation Program 2019 have been used to design the reverse draw outlet structure and deep pool to provide the required thermal mitigation measures for the pond. It is noted that pond outflow temperatures will decrease at elevations starting at 0.5 m below the permanent pool level with more significant temperatures reductions at a depth of at least 1.2 m below the permanent pool level. Deep draw outlets can reduce the inflow temperature by as much as 3 to 5 degrees Celsius with the most effective outlet depth being at least 2 m below the permanent pool level.

The proposed stormwater management facility has been designed with a reverse draw from the deep pool portion of the facility. The reverse draw has been designed for the 4-hour 25 mm storm event to allow cooler water to be discharged from the pond under the quality storm event per the MOE Stormwater Management Planning and Design Manual guidelines.

The reverse draw outlet will intake water from the bottom sump of the pond and has a 110 mm diameter pipe.

Storm events exceeding the 25 mm rainfall depth will be discharged through the proposed DICB structures located above the pond's extended detention level. Flow from the DICBs will be directed to the control manhole, where the outlet orifices regulate discharges for the 2- to 100-year storm events.

In addition to the reverse draw from the deep pool portion of the proposed stormwater management facility, it is recommended that the landscape design of the pond includes plantings along the permanent pool, outlet structure and pond banks that help shade the pond and mitigate the thermal impacts of the development on the existing swale.

3.4.7 Post- to Pre- Flow Comparison

Table 3.6 summarizes the comparison of pre and post-development flows from the site.

Table 3.6: Pre and Post-development Flow Summary

Event	Pre-development Flow (m^3/s)	Post-Development Flow (m^3/s)
2 Year	109	85
5 Year	184	161
10 Year	242	226
25 Year	323	301
50 Year	382	350
100 Year	448	396

Therefore, the post-development flow rates discharging from the site during the 2 to 100-year design storm events are less than the pre-development flow rates from the site.

4 Existing Northerly and North-Easterly Swales

Northerly Swale

A rear yard swale crosses the site at the northerly portion of the property. This swale collects drainage from portions of the adjacent lots fronting Peel Street and Church Street for a total drainage area of 0.780 ha and discharges to the existing roadside ditch and culvert system on Alexander Street. The existing rear yard swale is proposed to be re-graded within the limits of the subdivision to accommodate the proposed lot layout and subdivision grading.

The proposed grading of the swale is shown on the Conceptual Grading Plans.

As part of the first FSR submission, a preliminary MIDUSS model was constructed illustrating the drainage catchments to the existing rear yard swale along with channel computations for the existing and proposed swale cross sections. The existing and proposed swale cross sections are shown on the Conceptual Stormwater Management Plan.

The catchment area draining to the existing rear yard swale is described below:

- Catchment 4000 (0.780 hectares, 50% impervious) represents the existing residential lots fronting Peel Street and Church Street adjacent to the site. Runoff from these lots is conveyed by the existing rear yard swale located at the northerly portion of the site. The existing swale discharges to the existing roadside ditch and culvert system on Alexander Street.

The existing and proposed condition flooding depths in the swale have been completed in the previous design submission and are shown below Table 4.1.

Table 4.1 Comparison of Northerly Swale Flooding Depths Under Existing and Proposed Conditions

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional Storm
Existing Conditions Flooding Depth (m)	0.10	0.11	0.11	0.12	0.13	0.13	0.09
Proposed Conditions Flooding Depth (m)	0.07	0.08	0.08	0.09	0.10	0.10	0.06

North-Easterly Swale

The existing swale crossing the north-easterly property boundary will generally not be impacted by the development. Development will not encroach on the channel or the floodplain. The existing capacity of the swale is considered adequate and increased capacity will not be needed as a result of the development as stormwater management

practices will attenuate peak flows. The stormwater management facility outlet, which will outflow to the swale. The outlet will be designed to mitigate any potential stream instability and erosion impacts. Further information will be provided at detailed design.

Section 2 of this report provides hydraulic analysis of the north-easterly swale. The updated floodplain is shown on GEI's drawings and no development is proposed within the updated floodplain.

Previously, a preliminary MIDUSS model was prepared illustrating the drainage catchments to the existing swale. The catchment areas draining to the existing swale are described below:

- Catchment 1000 (64.54 hectares, 5% impervious) represents the existing farmland area located northwest of Peel Street and Simpson Road intersection. Runoff generated from this catchment discharges overland to the existing culvert crossing Peel Street to the southern farm field, Catchment 2000.
- Catchment 2000 (11.17 hectares, 2% impervious) represents the existing farm field located south of Peel Street, west of the Hamlet of Alma. Runoff from this catchment discharges overland to the existing network of roadside ditches and culverts in Alma, Catchment 3000.
- Catchment 3000 (53.62 hectares, 50% impervious) represents the majority of the developed portion of the Hamlet of Alma. Runoff from this catchment is conveyed via the existing network of roadside ditches and culverts in Alma, ultimately discharging to the existing swale.

The existing flooding depths in the swale as determined previously and are shown below in **Table 4.2**.

Table 4.2 Comparison of North-Easterly Swale Flooding Depths Under Existing Conditions

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional Storm
Existing Conditions Flooding Depth (m)	1.08	1.15	1.18	1.22	1.25	1.27	1.22

5 Water Balance

The monthly recharge volumes for the site are summarized in Table 5.1. Complete Monthly Water Balance calculations are provided in Appendix C.

Table 5.1 Monthly Water Balance Summary

Month	Existing Recharge Volume (m^3)	Proposed Recharge Volume (m^3)	Proposed Recharge Volume Change (%)
Jan	339	245	72%
Feb	169	123	72%
Mar	85	61	72%
Apr	2,157	1,300	60%
May	5,077	3,141	62%
Jun	2,539	1,908	75%
Jul	1,269	1,318	104%
Aug	635	979	154%
Sep	317	724	228%
Oct	159	478	302%
Nov	1,424	1,020	72%
Dec	716	512	72%
Total	**14,886**	**11,810**	**79%**

Under existing conditions, the annual recharge volume for the site is 14,886 m^3/year. The proposed development provides a total recharge of 11,810 m^3 annually, which is 3,076 m^3/year less than existing conditions and corresponds to an 21% decrease in annual recharge volume.

The water balance deficit will be mitigated with the implementation of lot-level low impact development (LID) techniques such as infiltration features. The design of the lot-level LIDs will be prepared at the detailed design stage.

6 Sediment and Erosion Control Plan

Primary sediment control will be achieved with the installation of Type 2 sediment fence around the property boundary. The silt fence will eliminate the opportunity for waterborne sediments to be transported from the site.

Temporary rock check dams will be installed in rear and side yard swales after the initial grading has been completed to slow the flow rates and promote the settlement of water borne sediments before they reach the silt fences and ponds.

Upon completion of the grading, any area not subject to active construction within 30 days will be topsoiled and seeded as per OPSS 572.

The stormwater management facility will be graded and shaped at the start of any construction or pre-grading activity and will be used as a temporary sediment basin. Sizing of the sediment basin is provided on the Conceptual Erosion and Sediment Control Plan. A temporary hickenbottom outlet structure will be installed for the sediment basin. Upon completion of area grading and servicing works, the sediment basin will be cleaned of sediment, the temporary Hickenbottom structure will be removed, and the final stormwater management outlet structures will be constructed. A silt fence will be placed around the outlet structures to restrict the movement of sediment during the remainder of the construction period.

Once catch basins have been installed, the grates will be wrapped in filter cloth. This will be maintained until all building and landscaping has been completed.

Inspection and maintenance of all silt fencing and the sediment pond will start after installation is complete. These features will be inspected on a weekly basis or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the facility found to need repair.

Monthly reports on the condition of the sediment and erosion control measures will be submitted to the Township of Mapleton and the Grand River Conservation Authority.

Once construction has been substantially completed, the silt fence will be removed from within the pond, any accumulated sediment will be removed and the landscaping and planting of the ponds will be completed.

After construction of the complete development, erosion will not occur and sediment transport will be minimal. The stormwater management facility will provide all sediment removal.

7 Conclusions and Recommendations

Based on our investigations, we conclude the following:

7.1 Stormwater Management Design

A stormwater management pond has been designed to provide quantity, quality, and erosion control for the Alma subdivision. The facility will be designed to provide quantity control for storm events up to and including the 100-year storm event in accordance with the Township of Mapleton and GRCA SWM Guidelines.

7.2 Hydraulic Analysis

The updated hydraulic assessment for the Alma Subdivision was completed using a refined HEC-RAS model based on the original GRCA dataset, which was provided in HEC-2 format and subsequently converted to a 1D HEC-RAS model. This converted model represents the BS Scenario – GEI. Subsequent model updates, including the addition of cross-sections at 20–30 m spacing and incorporation of 50 cm resolution LiDAR terrain, define the EX Scenario – GEI and improve representation of channel and overbank geometry within the study reach.

Comparison between the GRCA Baseline (BS Scenario – GEI) and Existing Conditions (EX Scenario – GEI) models shows that WSEL differences are localized and generally small, ranging from 0.00 m to 0.29 m. The largest difference occurs at RS 1455, where the EX Scenario – GEI WSEL is 0.29 m lower than the baseline. Minor increases are observed at RS 1497 (+0.11 m) and RS 1631 (+0.05 m), while small decreases occur at RS 1547 (-0.09 m) and RS 1285 (-0.04 m). No change is observed at RS 1592 and RS 1177. These variations are attributed to refined cross-section spacing and updated terrain, while flow inputs, roughness, and boundary conditions remain unchanged. WSEL differences in the upper reach (RS 1497–RS 1631) are minimal.

The EX Scenario – GEI results were used to delineate the regulatory Hurricane Hazel (Transposition) floodplain. The updated floodplain extent reflects minor adjustments relative to the GRCA mapping, primarily in areas influenced by revised cross-section geometry.

The resulting floodplain mapping forms the basis for defining floodplain limits and assessing flood constraints for the Alma Subdivision within this report. The floodplain extent is shown on Figure FP-1 provided in Appendix B.

7.3 Wastewater Treatment and Disposal

Sanitary servicing for the proposed development will be provided by a private septic system located on each lot. A Predictive Nitrate Impact Assessment and Pathogen Migration Assessment are provided in the Scoped Hydrogeological Assessment prepared by HCS. The sizes of the proposed lots will allow for all required setbacks to be maintained for the septic systems.

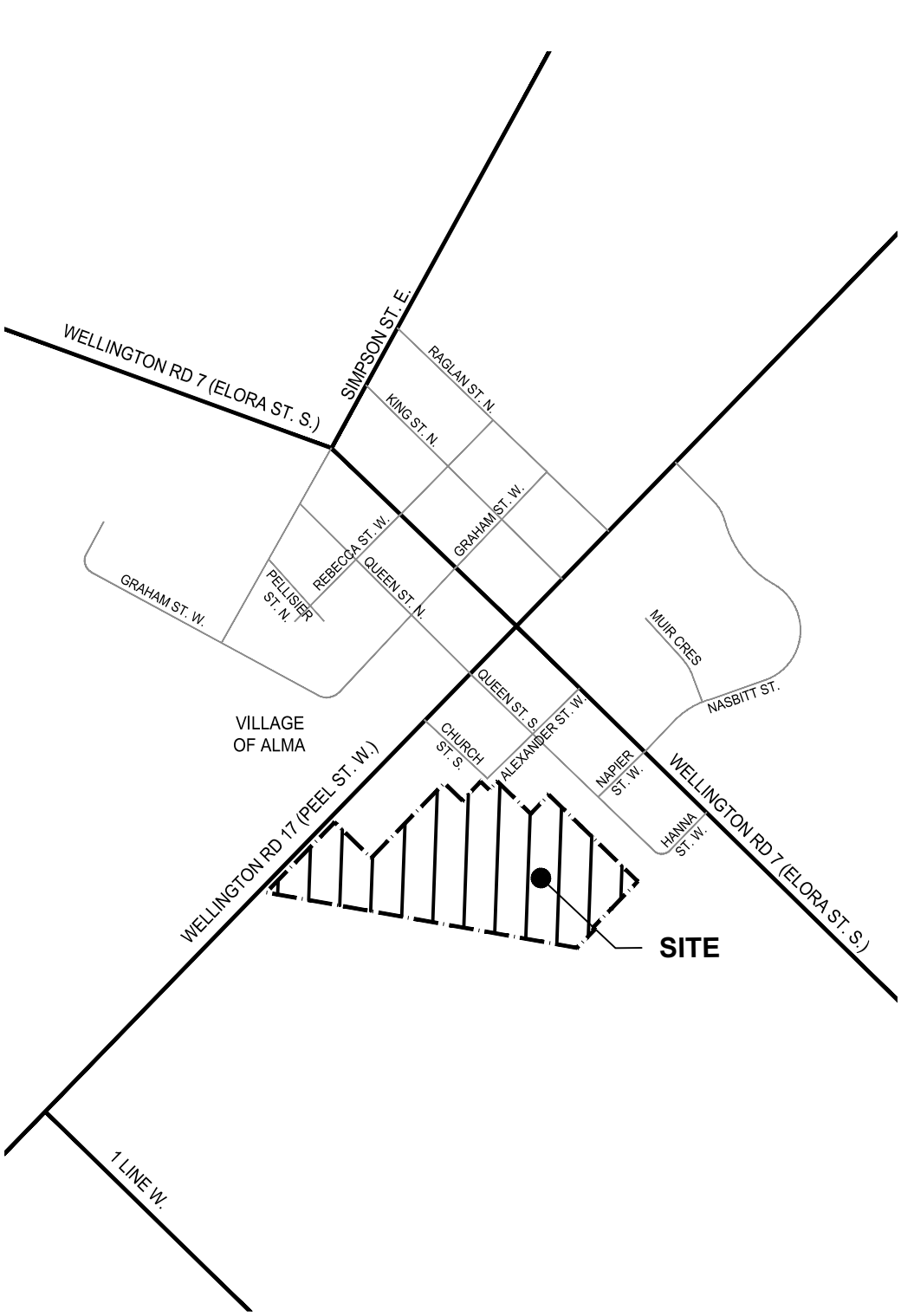
7.4 Water Supply

The Hamlet of Alma does not have a municipal water supply system, and as such, water supply to each of the proposed residential lots will be provided by individual drilled wells on each lot. An analysis of the local aquifer's ability to supply water at a sufficient rate was completed as part of the Hydrogeological Assessment prepared by HCS. Based on the analysis, there is ample supply available to meet the needs of the subdivision.

7.5 Site Grading

The preliminary site grading for the proposed residential lots, municipal right-of-way and stormwater management pond is shown on the Conceptual Grading Plans prepared by GEI. Existing road elevations are being maintained at the current Church Street terminus and Peel Street connections. The internal road network will form a low point at the entrance to the stormwater management pond which will provide for the major overland flow route from the development to be conveyed overland via the internal municipal right-of-way to the proposed stormwater management pond. The preliminary grading of the stormwater management pond has been designed to provide an outlet for the minor and major storm events to the existing swale which crosses the north-easterly portion of the property.

120139
ALMA SUBDIVISION
TOWNSHIP OF MAPLETON



KEY PLAN
Figure No. 1

GEI Consultants Canada

2401042 (120139)
MAY 2026
Scale: 1:2000 | NAD 1983 UTM Zone 17N

DRAFT PLAN OF SUBDIVISION OF

ALL OF LOTS 1-8,10,11,25-32 AND PART OF LOTS 9 & 33 PART OF CHURCH STREET, ALEXANDER STREET, NAPIER STREET, AND HANNAH STREET

CLOSED BY BY-LAW NO. 2023-022 REGISTERED AS INSTRUMENT WC700139

VILLAGE OF ALMA

REGISTERED PLAN 134

AND

PART OF LOT 1, CONCESSION 1 WEST OF GRAND RIVER

GEOGRAPHIC MUNICIPALITY OF PILKINGTON

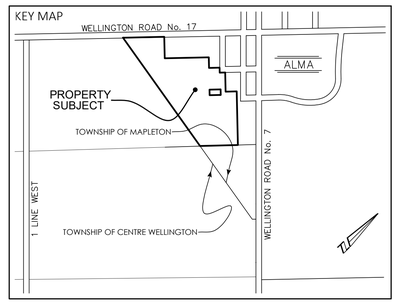
TOWNSHIP OF MAPLETON

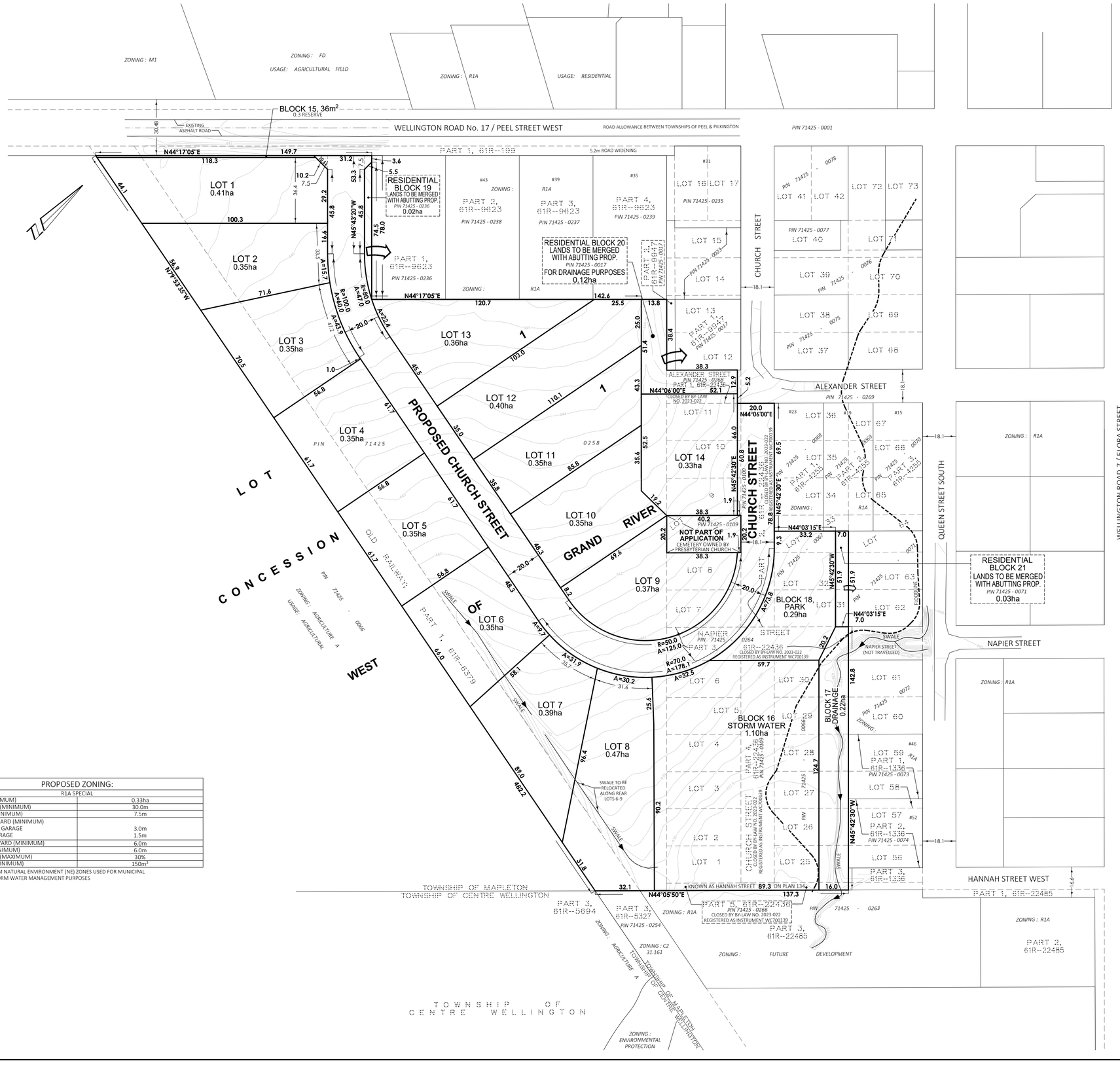
COUNTY OF WELLINGTON

SCALE 1 : 1000

0 10 20 40 60 meters

VAN HARTEN SURVEYING INC.





PROPOSED ZONING:	
R1A SPECIAL	
• LOT AREA (MINIMUM)	0.33ha
• LOT FRONTAGE (MINIMUM)	30.0m
• FRONT YARD(MINIMUM)	7.5m
• INTERIOR SIDE YARD (MINIMUM)	
- NO ATTACHED GARAGE	3.0m
- ATTACHED GARAGE	1.5m
• EXTERIOR SIDE YARD (MINIMUM)	6.0m
• REAR YARD (MINIMUM)	6.0m
• LOT COVERAGE (MAXIMUM)	30%
• FLOOR AREA (MINIMUM)	150m²

NO SETBACK FROM NATURAL ENVIRONMENT (NE) ZONES USED FOR MUNICIPAL DRAINAGE OR STORM WATER MANAGEMENT PURPOSES

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLOCKS	AREA (hectares)	
LOTS	1-14	5.18	
ADDITIONAL RESIDENTIAL BLOCKS	19, 20, 21	0.17	
		5.35	TOTAL
BLOCKS			
0.3 RESERVES	15	0.004	
STORMWATER MANAGEMENT	16	1.10	
DRAINAGE	17	0.22	
PARK	18	0.29	
ROADS		1.07	
		2.68	TOTAL
		8.03	SUBDIVISION TOTAL

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a, b, c, d, e, f, g, j AND i ARE AS SHOWN ON THE DRAFT PLAN OF SUBDIVISION

i) sand and gravel

k) individual septic and water

OWNER'S CERTIFICATE

I AUTHORIZE JEFFREY BUISMAN OF VAN HARTEN SURVEYING TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

DATE: JUNE 2, 2026

KEVIN VANLEEUWEN
I HAVE AUTHORITY TO BIND THE CORPORATION
EXACT CONSTRUCTION LTD.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

DATE: JUNE 2, 2026

JEFFREY EDWARD BUISMAN
ONTARIO LAND SURVEYOR

PINS 71425-0066, 71425-0067, 71425-0100, 71425-0103, 71425-0258, 71425-0264, 71425-0266 AND PIN 71425-0268

OWNER: EXACT CONSTRUCTION LTD.

V.1	JANUARY 13/21
V.2	JANUARY 22/21
V.3	MARCH 29/21
V.4	APRIL 8/21
V.5	JANUARY 7/22
V.6	JANUARY 11/22
V.7	JANUARY 19/22
V.8	APRIL 28/23
V.9	OCTOBER 04/23
V.10	OCTOBER 11/23
V.11	JANUARY 23/24
V.12	AUGUST 14/24
V.13	AUGUST 22/24
V.14	SEPTEMBER 24/24
V.15	NOVEMBER 22/24
V.16	MAY 28/25
V.17	APRIL 30/26
V.18	JUNE 2/26

Van Harten
LAND SURVEYORS - ENGINEERS

Kitchener/Waterloo Ph: 519-742-8371 | Guelph Ph: 519-821-2763 | Orangeville Ph: 519-940-4110

www.vanharten.com info@vanharten.com

DRAWN BY: A.R.N./S.A.P. CHECKED BY: J.E.B./C.J.V. PROJECT No. 29069-20

Jun 3, 2026-9:09:07 AM
G:\PILKINGTON\CON 1 WGR\EXACT ALMA SUBDIVISION\ACAD\EXACT DRAFT PLAN SUB (18) UTM.dwg

Appendix A

Geotechnical Investigation

GEOTECHNICAL INVESTIGATION

PROPOSED RESIDENTIAL SUBDIVISION
31 CHURCH STREET
ALMA, ONTARIO

CMT Project 20-732.R01

Prepared for:

Exact Construction

December 18, 2020

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

December 18, 2020 20-732.R01

Exact Construction
8262 Wellington Road 19
R. R. 3
Fergus, Ontario
N1M 2W4

Attention: Mr. Kevin Vanleeuwen

Dear Sir:

Re: Preliminary Geotechnical Investigation
Proposed Residential Subdivision
31 Church Street
Alma, Ontario

As requested, CMT Engineering Inc. conducted a geotechnical investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements, and we thank you for allowing us to undertake this project. Should you have any questions, please do not hesitate to contact our office.

Yours truly,

Brittany Brown

Brittany Brown, C.Tech., rcji

ks

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

2.0 EXISTING SITE CONDITIONS 1

3.0 FIELD AND LABORATORY PROCEDURES 1

4.0 SUBSOIL CONDITIONS 2

4.1. Topsoil 3
4.2. Clayey Silt 3
4.3. Sand 3
4.4. Silt 3
4.5. Groundwater 3

5.0 DISCUSSION AND RECOMMENDATIONS 4

5.1. Serviceability and Ultimate Limit Pressure 5
5.2. Seismic Site Classification 6
5.3. Soil Design Parameters 6
5.4. Site Preparation 7
5.4.1. Topsoil Stripping/Vegetation Removal 7
5.4.2. Removal/Relocation of Existing Services 8
5.4.3. Site Grading/Structural Fill 8
5.5. Foundation Subgrade Preparation 10
5.6. Slab-on-Grade/Modulus of Subgrade Reaction 11
5.7. Excavations 11
5.8. Construction Dewatering Considerations 12
5.9. Service Pipe Bedding 13
5.10. Perimeter Building Drainage, Foundation Wall Backfill and Trench Backfill 14
5.11. Pavement Design/Drainage 15
5.12. Septic System T-Time 18
5.13. Radon 18
5.14. Excess Soil Management 18

6.0 SITE INSPECTION 19

7.0 LIMITATIONS OF THE INVESTIGATION 20

Drawing 1 - Site Location Map
Drawing 2 - Site Plan Showing Borehole Locations

Appendix A - Borehole Logs
Appendix B - Grain Size Analyses
Appendix C - Well Records

1.0 INTRODUCTION

The services of CMT Engineering Inc. (CMT Inc.) were retained by Mr. Kevin Vanleeuwen of Exact Construction to conduct a preliminary geotechnical and hydrogeological investigation for the proposed residential subdivision to be located at 31 Church Street, Alma, Ontario. The hydrogeological study was completed by Hydrogeology Consulting Services (HCS) and will be provided under separate cover. The location of the site is shown on Drawing 1.

It is understood that the project will comprise the construction of a residential subdivision, although no site plan has been provided at this time. It is assumed that the development will include the construction of new road(s) and approximately twenty (20) residential homes with associated driveways. Drilled water wells and septic systems will likely service the new residences.

The purpose of the geotechnical investigation was to assess the existing soil and groundwater conditions encountered in the boreholes/monitoring wells. Included in the assessment are the soil classification and groundwater observations, as well as comments and recommendations regarding geotechnical resistance (bearing capacity); serviceability limit states (anticipated settlement); dewatering considerations; site classification for seismic site response; recommendations for site grading, site servicing, excavations and backfilling; recommendations for slab-on-grade construction; pavement design/drainage; soil design properties; and a summary of the laboratory results.

The recommendations provided in this report are solely based on the information obtained in the boreholes advanced on the subject site.

2.0 EXISTING SITE CONDITIONS

The existing site currently comprises vacant agricultural land, previously used for crop production. The site is bounded by Peel Street West (Wellington Road 17) to the west, residential properties to the north and east, and a former CNR rail line to the south. The general site topography slopes gently towards the eastern extent of the site.

3.0 FIELD AND LABORATORY PROCEDURES

The field investigation was conducted on December 11, 2020 and comprised the advancement of three (3) boreholes with monitoring wells (referenced as Boreholes 1 to 3), using a Geoprobe 7822DT drillrig operated by employees of CMT Drilling Inc. Boreholes 1 and 2 were advanced to depths of approximately 9.14 m (30.0 ft) below the ground surface, while Borehole 3 was advanced to a depth of approximately 7.62 m (25.0 ft).

Standard penetration testing (SPT) and sampling was carried out in all boreholes using 38 mm inside diameter split spoon sampling equipment and an automatic hammer, in accordance with ASTM D 1586 "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". SPT soil sampling was generally conducted at 0.76 m (2.5 ft) to 1.52 m (5.0 ft) intervals to approximately 5.18 m (17.0 ft). Macro core (MC5) direct push sampling was conducted between the SPT samples conducted below 3.66 m (12.0 ft), and continuously below 5.18 m (17.0 ft) to borehole termination.

Technical staff from CMT Inc. observed the drilling operation and collected and logged the recovered soil samples. A small portion of each sample was placed in a sealed, marked jar for moisture content determinations. Representative samples from the boreholes at the following depths were submitted to the CMT Inc. laboratory in St. Clements, Ontario for grain size analyses:

- Borehole 1 - depth 1.52 m to 2.13 m (5.0 ft to 7.0 ft)
- Borehole 2 - depth 7.62 m to 9.14 (25.0 ft to 30.0 ft)
- Borehole 3 - depth 6.10 m to 7.62 m (20.0 ft to 25.0 ft)

The borehole logs are provided in Appendix A and the grain size analyses are provided in Appendix B.

The ground surface elevations at the borehole locations were surveyed by CMT Inc. personnel following the completion of drilling. The top of the existing water well (A299778) was used as a temporary benchmark, with an assumed elevation of 100.00 m. A geodetic benchmark elevation was not available at this time, although the geodetic elevations of the boreholes can be updated if that information becomes available. The ground surface elevations at the borehole locations ranged from approximately 101.75 m at the west extent of the site to approximately 92.78 m at the east extent. Although the site appears to be relatively flat, the overall topography differs by approximately 9.0 m from west to east. The locations of the boreholes are shown on Drawing 2.

4.0 SUBSOIL CONDITIONS

The soils encountered in the boreholes are described briefly below and a more detailed stratigraphic description is provided on the borehole logs in Appendix A. The following paragraphs have been simplified into terms of major soil strata. The soil boundaries indicated have been inferred from non-continuous samples and observations of sampling and drilling resistance and typically represent transitions from one soil type to another rather than exact planes of geological change. Further, the subsurface conditions are anticipated to vary between and beyond the borehole locations.

4.1. Topsoil

Loose, dark brown, silty topsoil was encountered at the surface of all three boreholes, ranging in thickness from approximately 360 mm to 410 mm (average 377 mm). The topsoil thickness is anticipated to vary throughout the site. Materials noted as topsoil in this report were classified based on visual and textural evidence. Testing of organic content or for other nutrients was not carried out.

4.2. Clayey Silt

Brown, grey, and grey-brown clayey silt, with some sand to sandy and trace to some gravel was encountered underlying the topsoil in all three boreholes and was considered to be the predominant soil type encountered on the site. Occasional seams of wet to saturated silty sand were noted throughout the clayey silt. The soils were considered to be soft to hard, with SPT N-values ranging from 3 to 45 blows per 0.3 m (average 20 blows per 0.3 m). The clayey silt was considered to be drier than the plastic limit to about the plastic limit, with moisture contents ranging from 11.1% to 17.8% (average 13.4%).

4.3. Sand

Compact, brown sand with trace silt and clay was encountered underlying the clayey silt in Borehole 2. The sand was considered wet, with a moisture content of about 12.2%.

4.4. Silt

Loose to compact, grey silt with trace sand and clay was encountered in the lower extents of Boreholes 1 and 3 underlying the clayey silt. The silt was considered moist to wet, with moisture contents ranging from about 14.8% to 22.0% (average 19.0%).

4.5. Groundwater

A total of three (3) monitoring wells were installed on December 11, 2020 as part of the hydrogeological study carried out by HCS. The water levels were measured by HCS on December 14, 2020.

The reported elevations of groundwater in the monitoring wells, as well as the ground surface and bottom of borehole elevations, are provided in the following table:

Borehole/ Monitoring Well No.	Ground Surface Elevation (m)	Approximate Elevation of Water in Monitoring Well (m) Dec. 14, 2020	Approximate Depth of Water in Monitoring Well (m) Dec. 14, 2020	Bottom of Monitoring Well Elevation (m)
BH 1	97.43	90.03	7.40	88.88
BH 2	92.78	92.72	0.06	83.70
BH 3	101.75	100.49	1.26	94.96

It should be noted that groundwater levels (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume.

The high groundwater levels and wet soil conditions encountered could make some excavations difficult. It should be expected that caving or sloughing of the excavation walls will occur. As such, it is recommended to keep foundations at least one footing width (0.5 m minimum) above the static water level, if applicable.

Recommendations with respect to dewatering conditions are provided in Section 5.8 of this report.

5.0 DISCUSSION AND RECOMMENDATIONS

It is understood that the project will comprise the construction of a residential subdivision. Although no site plan has been provided at this time, it is assumed that the development will include the construction of new road(s) and approximately twenty (20) residential homes with associated driveways. Drilled water wells and septic systems will likely service the new residences. Utilizing the information gathered during the preliminary geotechnical investigation and assuming that the borehole information is representative of the subsoil conditions throughout the site, the following comments and recommendations are provided.

This section of the report provides CMT Inc.'s interpretation of the factual geotechnical data obtained during the investigation and is intended for the guidance of the owner and design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors bidding on or undertaking the

work should make their own independent interpretation of the factual subsurface information provided as it affects their proposed construction means and methods, equipment selection, scheduling, pricing, and the like.

5.1. Serviceability and Ultimate Limit Pressure

Based on the information obtained from the boreholes, the following table provides the estimated geotechnical reaction at the Serviceability Limit State (SLS) and the factored geotechnical resistance at the Ultimate Limit State (ULS) at the various elevations, including soil type:

Borehole No.	Ground Surface Elevation (m)	SLS kPa (psf)	ULS kPa (psf)	Estimated Highest Founding Elevation (m)	Depth to Highest Founding Elevation (m)	Soil Type
BH 1	97.43	75 (1,500)	112 (2,250)	97.02 to 95.60	0.41	Clayey Silt
		200 (4,000)	300 (6,000)	95.60 to 90.06	1.83	Clayey Silt
		75 (1,500)	112 (2,250)	90.06 to 88.29 (termination)	7.37	Silt
BH 2	92.78	150 (3,000)	225 (4,500)	91.71 to 83.64 termination	1.07	Clayey Silt/Sand
BH 3	101.75	100 (2,000)	150 (3,000)	100.99 to 100.23	0.76	Clayey Silt
		200 (4,000)	300 (6,000)	100.23 to 95.86	1.52	Clayey Silt
		75 (1,500)	112 (2,250)	95.86 to 94.13 (termination)	5.89	Silt

The proposed founding elevations and required bearing capacities were not available at the time of report preparation. Based on the data provided in the table above, suitable founding elevations for the proposed residences with conventional foundations designed with a bearing capacity of 75 kPa (1,500 psf) at SLS and 112 kPa (2,250 psf) at ULS range from depths of about 0.41 m to 1.07 m below the existing ground surface.

Should footings be designed to be constructed at elevations higher than the elevations indicated in the table above, then structural fill will be required in order to achieve the design grades for the proposed foundations. The serviceability limit pressure for good quality granular structural fill placed and compacted in accordance with Section 5.4.3 of this report is estimated to be at least 150 kPa (3,000 psf) at SLS and 225 kPa (4,500 psf) at ULS. Alternatively, lean mix concrete fill could be used. It is imperative that the

founding soils be assessed at the time of construction by qualified geotechnical personnel in order to confirm their founding suitability.

If wet to saturated soil conditions are encountered during excavation, it may be necessary to widen the footings or install a granular drainage layer to provide a suitable base for the foundations. This will depend on the bearing capacity required for the founding strata. If required, the granular drainage layer must conform to the requirements listed in Section 9.14.4 of the OBC 2012.

It is recommended that structural foundation drawings be cross-referenced with site servicing drawings to ensure that service pipes do not conflict with building foundations (including the zone of influence down and away from the footings).

With respect to the Serviceability Limit State (SLS), the total and differential footing settlements are not expected to exceed the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

All exterior foundations must be provided with a minimum of 1.2 m of soil cover or equivalent thermal insulation (sufficient thermal insulation is required to protect all footings and slab-on-grades during construction until such a time that the structure is heated) in order to provide protection against frost action.

5.2. Seismic Site Classification

The site classification for seismic response in Table 4.1.8.4 of the 2012 Ontario Building Code relates to the average properties of the upper 30 m of strata. The information obtained in the geotechnical field investigation was gathered from the upper 7.62 m to 9.14 m of strata. Based on the information gathered in the geotechnical field investigation, the site classification for seismic site response would be considered Site Class D (stiff soils) for structures founded on the soils at the recommended founding elevations provided in Section 5.1 of this report as well as structures founded on structural fill placed in accordance with Section 5.4.3 of this report. The structural engineer responsible for the design of the structure should review the earthquake loads and effects.

5.3. Soil Design Parameters

The following table provides the estimated soil design parameters for imported granular fill, as well as the existing native soils encountered on-site. It should be noted that earth pressure coefficients (Ka, Kp, Ko) provided are for flat ground surface conditions and will differ for areas with slopes or embankments.

The estimated soil design parameters can be utilized for the design of perimeter shoring, foundations and retaining walls, lateral earth pressure calculations, as required:

Soil Type	Soil Density (kg/m^3)	Friction Angle (Degree)	Coefficient of Active Pressure (K_a)	Coefficient of Passive Pressure (K_p)	Coefficient of At-Rest Pressure (K_o)	Coefficient of Friction (μ)	Cohesion (Undrained) (kPa)
Imported Granular 'A'/ Granular 'B' (OPSS 1010)	2,100	34°	0.28	3.54	0.44	0.45	0
Clayey Silt	1,850	30°	0.33	3.00	0.50	0.38	10 - 20
Sand	1,850	33°	0.29	3.39	0.46	0.43	0
Silt	1,750	30°	0.33	3.00	0.50	0.38	0

5.4. Site Preparation

The site preparation for the proposed residential subdivision is anticipated to comprise the stripping of topsoil, removal or relocation of any existing services, and site grading to achieve the design grades.

5.4.1. Topsoil Stripping/Vegetation Removal

All existing topsoil and vegetation (including roots and all loose/disturbed soils associated with the roots) must be removed from within any proposed building envelopes, driveways and roads to expose approved competent subgrade soils. The topsoil may be used in landscaped areas where some settlement can be tolerated; otherwise, it should be properly disposed of off-site.

The volume of topsoil removed during the stripping process is also relative to the equipment utilized for the stripping process as well as the moisture conditions at the time of stripping. If an excavator with a smooth bucket is utilized for stripping, there would generally be less potential for topsoil to become intermixed with the underlying relatively loose subsoil and therefore less concern of over-excavation to remove all topsoil. If the topsoil is stripped with wheeled equipment or bulldozers, then there is an increased potential for the topsoil and subsoil to become intermixed, subsequently requiring additional excavation to remove all topsoil. This is further influenced by rutting which can occur during wet conditions.

5.4.2. Removal/Relocation of Existing Services

Any existing servicing that may be located within the proposed building envelopes must be removed/relocated. This includes any existing field tiles that are expected to be present. Any piping that is left in place that is no longer active must be completely sealed with watertight mechanical covers, concrete or grout at termination points to prevent the migration of soils into pipe voids, which may result in potential settlement. All existing trench backfill material associated with any existing buried pipes must be subexcavated and the subsequent excavation must be backfilled with approved soils placed in accordance with Section 5.4.3 of this report.

The monitoring wells that have been installed as part of the hydrogeological study must be decommissioned by a Ministry of the Environment, Conservation and Parks (MECP) licensed well contractor with a Class 1, Class 2 or Class 3 license in accordance with Reg. 903. CMT Drilling Inc. would be pleased to provide these services when required.

5.4.3. Site Grading/Structural Fill

Following the removal of topsoil and any unsuitable bearing soils, the exposed subgrade soils must be proof-rolled, and any soft or unstable areas must be subexcavated and replaced with approved fill materials.

Any fill materials required to achieve the design site grades should be placed according to the following procedures:

- Should the native subgrade soils at the design founding elevation in the proposed building envelopes comprise wet soils, then a granular drainage layer, constructed in accordance with Section 9.14.4 of the current Ontario Building Code (OBC) may be required. Alternatively, a lean mix concrete mud mat may be placed overlying the subgrade soils to provide a stable base;

- Prior to placement of any structural fill or bulk fill, the subgrade must be prepared large enough to accommodate a 1:1 slope commencing a distance of 1.0 m beyond the outside edge of the proposed foundations down to the approved competent founding soils;

- Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.3 m (12") in depth for granular soils, such as the sand and gravel encountered on-site (recommended fill material) and 0.2 m (8") in depth for clayey silt (not recommended for this application), or the capacity of the compactor (whichever is less);

- Approved imported granular fill materials (OPSS 1010 Type III Granular 'B' recommended for this application) can be compacted utilizing adequate heavy vibratory smooth drum or padfoot compaction equipment;

- Fine-grained silt and clay soils (not recommended) must be compacted utilizing adequate heavy padfoot vibratory compaction equipment;

- Approved fill materials must be at suitable moisture contents (at or near to the optimum moisture content as determined by laboratory Proctor testing) to achieve the specified compaction. Soil moisture will also be dependent on weather conditions at the time of construction. Granular soils may require the addition of water in order to achieve the specified compaction;

- Approved structural fill materials that will support structures (including townhome foundations, retaining walls, interior slab-on-grades, sidewalks, large expansive exterior slabs and decks) must be compacted to a minimum of 100% standard Proctor maximum dry density (SPMDD). The native clayey silt soils are generally not recommended for use as structural fill as they can be subject to excess void space and potential settlement if not properly placed and compacted;

- Approved bulk fill (foundation wall backfill, bulk fill under slab-on-grades that will not support footings or heavy point loading, bulk fill for driveways and roads) must be compacted to a minimum 95% SPMDD. It would be expected that the existing on-site native soils, free of any deleterious materials, would be suitable for use as bulk fill; however, depending on the time of year and weather conditions when construction takes place, soils may require air-drying or the addition of water in order to achieve the specified density;

- Granular 'B' subbase and Granular 'A' base materials for any proposed new roads must be compacted to 100% SPMDD.

Due to the fine-grained nature of some of the native soils encountered throughout the boreholes, they will be easily disturbed and subject to strength losses, making travel on this material somewhat difficult with conventional rubber-tired construction equipment such as dump trucks and even smooth drum vibratory compactors. Conditions should be expected to worsen if the subgrade soils are in a wet condition. Therefore, it is recommended that construction traffic be minimized, where possible, from driving on the subgrade soils. Depending on the time of year, it may be required to construct a haul road utilizing a Granular 'B' base.

5.5. Foundation Subgrade Preparation

The fine-grained native soils encountered throughout the boreholes are sensitive to change in moisture content and can become loose/soft if the soils are subjected to additional water or precipitation, as well as severe drying conditions. The soils could also be easily disturbed if traveled on during construction. Once they become disturbed, they are no longer considered adequate for the support of foundations.

To ensure and protect the integrity of the founding soils during construction operations, the following is recommended:

- During construction, the subgrade should be sloped to a sump (as required) located outside the footprint of any foundations (if feasible) in the excavation to promote surface drainage of rainwater or seepage and the collected water should be pumped out of the excavation. It is critical that all water be controlled (not allowed to pond) and that the subgrade and foundation preparation commence in dry conditions;

- It is possible that some of the subgrade soils at the design founding elevation in the proposed building envelopes comprise wet soils, in which case a granular drainage layer, constructed in accordance with Section 9.14.4 of the current Ontario Building Code (OBC), may be required. Alternatively, a lean mix concrete mud mat may be poured over top of the subgrade soils to provide a stable base;

- Construction equipment travel and foot traffic on the founding soils should be minimized;

- If construction is to be undertaken during subzero weather conditions, the founding native soils and fill materials must be maintained above freezing;

- Prior to placing concrete for the footings, the founding soils must be cleaned of all disturbed or caved materials;

- The foundation formwork and concrete should be installed as soon as practical following the excavation, inspection and approval of the founding soils. The longer that the excavated soils remain open to weather conditions and groundwater seepage, the greater the potential for construction problems to occur;

- If it is expected that the founding soils will be left open to exposure for an extended period of time, it is recommended that a 75 mm concrete mud slab be poured in order to protect the structural integrity of the founding soils.

5.6. Slab-on-Grade/Modulus of Subgrade Reaction

Prior to the placement of the granular base for slab-on-grade construction, the subgrade soils should be proof-rolled. Any soft or weak zones in the subgrade should be subexcavated and backfilled with approved fill materials (see Sections 5.4.3 and 5.10 of this report).

The following table provides the estimated modulus of subgrade reaction (k) for imported granular fill, as well as the native soils encountered on-site:

Soil Type	Modulus of Subgrade Reaction (k)
Imported Granular 'A'/ Granular 'B' (OPSS 1010)	81,000 kN/m^3 (300 lb/in^3)
Clayey Silt	40,700 kN/m^3 (150 lb/in^3)
Sand	61,000 kN/m^3 (225 lb/in^3)
Silt	33,900 kN/m^3 (125 lb/in^3)

Floor slabs can be founded on a minimum thickness of 100 mm (4") of coarse, clean granular material containing not more than 10% of material that will pass a 4 mm sieve in accordance with the current OBC. The use of 19 mm clear crushed stone assists in creating a moisture barrier by reducing/preventing capillary rise of moisture from the subgrade. Compactive effort is required to consolidate the clear stone. The 19 mm clear crushed stone should meet the physical property and gradation requirements of OPSS 1004.

It is recommended that areas of extensive exterior slab-on-grade be constructed with a Granular 'B' subbase (450 mm) and a Granular 'A' base (150 mm), as well as incorporating subdrains, to promote rapid drainage and reduce the effects of frost heaving. This is particularly critical at barrier-free access points and at the location of out-swinging doors. Alternatively, structural frost slabs could be designed and constructed, or sufficient thermal insulation could be provided, at all door entrances and areas of barrier-free access.

5.7. Excavations

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 2 Soils - In general, the native clayey silt encountered in the boreholes, in a drained state (not wet or saturated), would be classified as Type 2 soils under Reg 213/91. Type 2 soils must be sloped from within 1.2 m (4.0 ft) of the bottom of the excavation with a slope having a minimum gradient of 1 horizontal to 1 vertical. Soils underlain by Type 3 or Type 4 soils that are exposed in the excavation must be treated accordingly as Type 3 or Type 4 soils (see below). Soils in a saturated condition (if encountered) must be treated as Type 4 soils, addressed below.

Type 3 Soils - In general, the existing silt and sand encountered in the boreholes, as well as any fill soils which may be encountered in a drained state (not wet or saturated), would be classified as Type 3 soils under Reg 213/91. The Type 3 soils must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. All saturated soils encountered must be treated as Type 4 soils, as described below.

Type 4 Soils - In general, any wet to saturated soils (if encountered) would be classified as Type 4 soils under Reg 213/91. Type 4 soils must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical.

If it is not practical to excavate according to the above requirements, then a trench support system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized. When using a temporary trench support system consisting of trench boxes to reduce the lateral extent of the excavations, it should be noted that the support system is intended primarily to protect workers as opposed to controlling lateral soil movement. Any voids between the excavation walls and the support system should be immediately filled to reduce the potential for loss of ground and to provide support to existing adjacent utilities and structures, and it is recommended that the excavation be carried out in short sections, with the support system installed immediately upon excavation completion.

Sloughing of the excavation walls should be expected when excavating into non-cohesive or wet to saturated soils. As such, it may be necessary to increase the width of the excavation to accommodate sloughing soils.

5.8. Construction Dewatering Considerations

Wet to saturated soils were observed in the lower extent of the boreholes. Also, occasional wet seams were encountered. It should be noted that groundwater levels (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. As such, provisions for site dewatering should be part of the site development and construction process.

Seepage control requirements during construction will depend upon the area of work on the site, the depth of the excavations, the time of year, the amount of precipitation and the control of surface water. As required, seepage should generally be adequately controlled

using conventional construction dewatering techniques such as pumping from sump pits. However, if heavy seepage occurs, it may be necessary to increase the number of pumps during construction.

Dewatering should be performed in accordance with OPSS 517 and the control of water must be in accordance with OPSS 518. It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. Collected water should discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures must be installed at the discharge point of the dewatering system to avoid any potential adverse impacts on the environment.

5.9. Service Pipe Bedding

The existing native soils that are free of any organics or deleterious materials, are generally considered suitable for indirect support of the site service pipes. Relatively high groundwater levels were observed in several of the boreholes and should instability due to wet soil conditions be encountered, it may be necessary to increase the thickness of the granular base and utilize 19 mm clear stone to create an adequate supporting base for the service pipes and/or manholes. Pipe embedment, cover and backfill for both flexible and rigid pipes should be in accordance with all current and applicable OPSD, OPSS and OBC standards and guidelines and as follows.

Flexible Pipes – The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.030 and 803.031. The trench excavations should be symmetrical with respect to the centre-line of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, then the pipe bedding should consist of 19 mm clear stone (meeting OPS Specifications) wrapped completely in a geotextile fabric such as Terrafix 270 or equivalent.

Rigid Pipes - In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes, except that the minimum bedding depth below a rigid pipe should be 0.15*D* (where *D* is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

Any service pipes that are not provided with sufficient frost coverage must be protected with the necessary equivalent thermal insulation. The general contractor is responsible to protect service piping from damage by heavy equipment.

5.10. Perimeter Building Drainage, Foundation Wall Backfill and Trench Backfill

Foundations constructed within wet soils as noted in the boreholes may be subject to flooding in the event of a power failure or equipment malfunction. Therefore, it would be recommended that foundations be constructed at least one footing width (minimum 0.5 m) above the static water level, if applicable. Groundwater elevations (perched and regional water tables) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year and should be expected to fluctuate.

It is expected that the proposed residences will have basements, and as such, a perimeter drainage system will be required. The drainage system should be installed at the founding elevation and be constructed with positive drainage into a sump pit or other suitable outlet that provides positive drainage away from the structure. It is recommended that sump pumps be equipped with a battery backup (in the event if a power outage). It is also recommended that a capped cleanout port(s) be extended up to the ground surface elevation to provide future access (if required). Rainwater leaders must not be connected to the perimeter drainage system. Foundation wall and slab-on-grade dampproofing and/or waterproofing must conform to current OBC regulations (as required).

In order to assist in maintaining dry buildings with respect to surface water seepage, it is recommended that exterior grades around the buildings be sloped down and away at a 2% gradient or more, for a distance of at least 1.5 m. Any surface discharge rainwater leaders must be constructed with solid piping that discharges with positive drainage at least 1.5 m away from the building foundations and/or beyond external slab-on-grades such as sidewalks and accessibility ramps to a drainage swale or appropriate storm drainage system.

In order to reduce the effects of surficial frost heave in areas that will be hard surfaced, it is recommended that the exterior foundation backfill consist of free-draining granular material such as imported sand or Granular 'B' Type I or Type III (OPSS 1010), with a maximum aggregate size not exceeding 100 mm, and that it extends a minimum lateral distance of 600 mm out from the foundation walls and/or beyond perimeter sidewalks and entranceway slabs. It is critical that particles greater than 100 mm in diameter are not in contact with the foundation wall to prevent point loading and overstressing. The backfill material used against the foundation walls must be placed so that the allowable lateral capacities of the foundation walls are not exceeded. Where only one side of a foundation wall will be backfilled, and the height of the wall is such that lateral support is required, or where the concrete strength has not been achieved, the wall must be braced or laterally supported prior to backfilling. In situations where both sides of the wall are backfilled, the backfill should be placed in equal lifts, not exceeding 200 mm differential on each side during backfill operations and the backfill should be compacted to a minimum of 98% SPMDD.

It is recommended that frost tapers be constructed (refer to OPSD 3101.150 for typical details) in order to minimize differential frost action between the foundation wall backfill and the paved driveways. The frost taper must be constructed utilizing the OPSS 1010 granular material that is used for the foundation wall backfill.

The native soils, free of any organics or deleterious materials, are generally considered suitable for reuse as trench backfill and bulk fill in the driveways and roads; however, some of the soils may require air-drying or the addition of water in order to achieve the specified compaction. Air-drying cannot typically be achieved during winter construction; therefore, depending on the time of year that construction takes place, it may be more feasible to utilize an imported granular fill for this project (keeping in mind that frost tapers, as noted above, would be recommended to minimize differential frost heave).

Backfilling operations should be carried out with the following minimum requirements:

- Adequate heavy padfoot vibratory compaction equipment should be used for the compaction and to break down any large blocky pieces of soil;

- Loose lift thicknesses should not exceed 0.3 m (12") for granular soils or 0.2 m (8") for clayey silt soils or the capacity of the compactor (whichever is less);

- The soils must be at suitable moisture contents to achieve compaction to a minimum 95% SPMDD in non-structural bulk fill areas. Service trenches excavated within the zone of influence of footings for structures must be compacted to a minimum of 100% SPMDD;

- It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure that compaction requirements are achieved;

- Service trench backfill materials may consist of approved excavated soils with no particles greater than 100 mm and no topsoil or other deleterious materials;

- If construction operations are undertaken in the winter, strict consideration should be given to the condition of the backfill material to make certain that frozen material is not used.

5.11. Pavement Design/Drainage

Any soils containing organics or other deleterious material must be subexcavated from within the proposed driveways and roads. It is recommended to either subexcavate any existing loose subgrade materials or provide further consolidation with vibratory compaction equipment in order to prepare a proper, stable subgrade. Prior to placement of the granular base, the subgrade must be proof-rolled, and any soft or unstable areas

should be subexcavated and replaced with suitable drier materials. The subgrade should be graded smooth (free of depressions) and properly crowned to ensure positive drainage, with a minimum grade of 3% toward the drainage outlet or curb line. When service pipes are installed, pipe bedding and backfilling should be undertaken as indicated in Sections 5.9 and 5.10 of this report.

Rapid drainage of the pavement structure is critical to ensure long-term performance. As such, it is recommended to install subdrains for this project (provided gravity drainage to a suitable outlet can be provided). Subdrains should be designed and installed in accordance with OPSS 405 and OPSD 216.021. If Granular 'A' bedding (OPSS 1010) is utilized, the subdrains should be equipped with a factory installed filter sock. If 19 mm clear stone (OPSS 1004) is utilized as bedding for the subdrain (recommended for this application), then the bedding must be wrapped completely with geotextile filter fabric such as Terrafix 270R (or equivalent) and a factory installed filter sock is not required. Installation of rigid subdrains allows for better grade control and less potential for damage during installation or service. Positive drainage through grade control of subdrains is critical, as improperly installed subdrains can turn drainage systems into reservoirs, which can fuel frost action. The subdrains will hasten the removal of water, thereby reducing the risk and effects of frost heaving and load transfer in saturated conditions. It is suggested that subdrains be installed at regular intervals (to be designed based on layout of catch basins and storm sewers) through paved driveways and parking areas. It is also recommended to install subdrains through any areas that cannot tolerate differential frost heave such as accessibility ramps/sidewalks. The subdrains should be installed in a 0.3 m (1.0 ft) by 0.3 m (1.0 ft) trench in the subgrade and bedded approximately 50 mm (2") above the bottom of the trench. The subgrade must be prepared with positive drainage to the subdrains and the subdrains must be installed with positive drainage into a catch basin structure or other suitable outlet.

The native clayey silt subgrade soils are highly sensitive to change in moisture content and can become loose or soft if the soils are subject to inclement weather and seepage or severe drying. Furthermore, the subgrade soils could be easily disturbed if traveled on during construction. As such, where this material will be exposed, it is recommended that the granular subbase be placed immediately upon completion of the subgrade preparation to protect the integrity of the subgrade soils.

Should wet conditions be encountered during construction, site assessments may be required to determine what options can be undertaken to construct a modified pavement structure. These options may include subexcavation of loose/soft soils, increasing the thickness of the granular base, the use of reinforcing geotextiles or geogrids, or a combination of all.

It is expected that the new road(s) and driveways will experience mostly light traffic (personal vehicles) and some heavy traffic (moving trucks, delivery trucks, and maintenance vehicles).

Based on the anticipated vehicle loading and frost-susceptibility of the subgrade soils, the following pavement design is provided:

Material	Recommended Thickness for Light Traffic	Recommended Thickness for Heavy Traffic
Asphaltic Concrete	HL3 - 40 mm (1.5") HL4 or HL8 - 50 mm (2.0")	HL3 - 50 mm (2.0") HL4 or HL8 - 62.5 mm (2.5")
Granular 'A' Base (OPSS 1010)	150 mm (6.0")	150 mm (6.0")
Granular 'B' Subbase (OPSS 1010)	450 mm (18.0")	450 mm (18.0")

The granular base and subbase materials must conform to the physical property and gradation requirements of OPSS 1010 and must be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to a minimum 92.0% Marshall maximum relative density, in accordance with OPSS 1150 and OPSS 310.

Construction joints in the surface and binder asphalt must be offset a minimum of 150 mm to 300 mm (6" to 12") from construction joints in the binder asphalt so that longitudinal joints do not coincide.

Should any new asphalt be joined into existing asphalt, it is recommended that the existing asphalt be sawcut in a straight line prior to being milled to a depth of 40 mm and a width of 150 mm as per OPSD 509.010. It is recommended that a tackcoat in conformance with OPSS 308 be applied to the edge and surface of all milled asphalt prior to placement of new asphalt.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed within a reasonable time following placement of the binder asphalt, it is recommended that the catch basin lids are set at a lower elevation or apertures provided to allow surface water to drain into the catch basins and not accumulate around the catch basins. The strength of the pavement structure relies on all of the components to be in place in order to provide the design strength; therefore, it is strongly recommended that the surface asphalt be placed shortly after placement of the binder asphalt so as to avoid undue stress on the binder asphalt by not having the complete pavement structure in place.

It should be noted that, currently, asphalt mixes tend to be more flexible and, as such, there is a tendency for damage to occur from vehicles turning their steering wheels or applying excessive brake pressure. The condition is further intensified during hot weather. In high traffic areas or areas subjected to frequent turning of heavy vehicles, it is recommended that rigid Portland cement pavement be considered.

5.12. Septic System T-Time

A grain size analysis was performed on a representative sample of the native soil, as it is expected that new septic systems will be part of the proposed residential development. The following table provides the sample location, depth, corresponding estimated T-Time as well as soil type:

Borehole No.	Depth (m)	Estimated Percolation Rate (T) (min/cm)	Soil Type
1	1.52 – 2.13	50	Clayey, sandy silt, trace gravel (ML)

CMT Engineering Inc. would be pleased to provide septic system designs once information on the proposed residences is available.

5.13. Radon

According to information provided by Health Canada, radon is a radioactive gas that is naturally formed through the breakdown of uranium in soil, rock and water. When radon escapes the earth in the outdoors, it mixes with fresh air, resulting in concentrations that are too low to be of concern. However, when radon enters an enclosed space, such as a building, high concentration of radon can accumulate and become a health concern. Health Canada indicates that most buildings and homes have some level of radon in them. Unfortunately, it is not possible to predict before construction whether or not a new building will have high radon levels as radon can only be detected by radon measurement devices, which would be installed in a building, post construction. Section 9.13.4.1 Soil Gas Control of the current 2012 Ontario Building Code (OBC) states that *"Where methane or radon gases are known to be a problem, construction shall comply with the requirements for soil gas control in MMAH Supplementary Standard SB-9, Requirements for Soil Gas Control"*.

5.14 Excess Soil Management

Generally if surplus soils are to be exported off-site, it will be necessary to perform chemical analysis of the soils. Chemical analysis was **not** undertaken as part of this geotechnical investigation. Should chemical analysis tests be required, the required tests vary and will be dependent on the disposal site utilized by general contractor.

Most commonly, the soils are tested for the following:

- Sodium Absorption Ratio (SAR) as per O. Reg. 153/04 as amended by R511.
- Chemical analysis including:
  - F1 – F4, VOC's, BTEX as per O. Reg 153/04;
  - SVOC as per O. Reg 153/04 as amended by R511; and
  - Metals / inorganics as per O. Reg 153/04 amended by R511.

The chemical analysis results are then compared to Ontario Regulation 153/04 - as amended by O.Reg. 511 – April 15, 2011 Standards = [Suite] – ON-511-T1/T2-SOIL-RPI.

If soils are transported to a landfill facility, additional chemical testing in accordance with Ontario Regulation 347, Schedule 4, as amended to Ontario Regulation 558/00, dated March 2001, Toxicity Characteristic Leaching Procedure (TCLP) will be required.

When transporting soils off-site, the following is recommended:

- All chemical analyses and environmental assessment reports must be fully disclosed to the receiving site owners/authorities, whom must agree to receive the material;
- An environmental consultant must confirm the land use at the receiving site is compatible to receive the material;
- An environmental consultant must monitor the transportation and placement of the materials to ensure that the material is placed appropriately at the pre-approved site; and
- The excess materials may not be transported to a site that has previously had a Record of Site Condition (RSC) filed, unless the material meets the criteria outlined in the RSC.

It should be noted that landfill sites will generally only accept laboratory test results that have been completed within 30 days of exporting. Therefore, it is recommended that provisions for chemical analysis be included in the tender documents. It should also be noted that the laboratory testing generally takes five (5) working days to process with a regular turnaround time.

6.0 SITE INSPECTION

Qualified geotechnical personnel should supervise excavation inspections as well as compaction testing for structural filling, site grading and site servicing. This will ensure that footings are founded in the proper strata and that proper material and techniques are used and the specified

compaction is achieved. CMT Engineering Inc. would be pleased to review the design drawings and provide an inspection and testing program for the construction of the proposed subdivision.

7.0 LIMITATIONS OF THE INVESTIGATION

This report is intended for the Client named herein and for their Client. The report should be read in its entirety, and no portion of this report may be used as a separate entity. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

It should be noted that this report specifically addresses geotechnical aspects of the project and does not include any investigations or assessments relating to potential subsurface contamination. As such, there should be no assumptions or conclusions derived from this report with respect to potential soil or water contamination. Soil or water contamination is generally caused by the presence of xenobiotic (human-made) chemicals or other alteration processes in the natural soil and groundwater environment. If necessary, the investigation, assessment and rehabilitation of soil and water contaminants should be undertaken by qualified environmental specialists.

The samples obtained during the geotechnical investigation will be stored for a period of three months, after which time they will be disposed of unless alternative arrangements are made.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Prepared by:

Brittany Brown

Brittany Brown, C. Tech., rcji

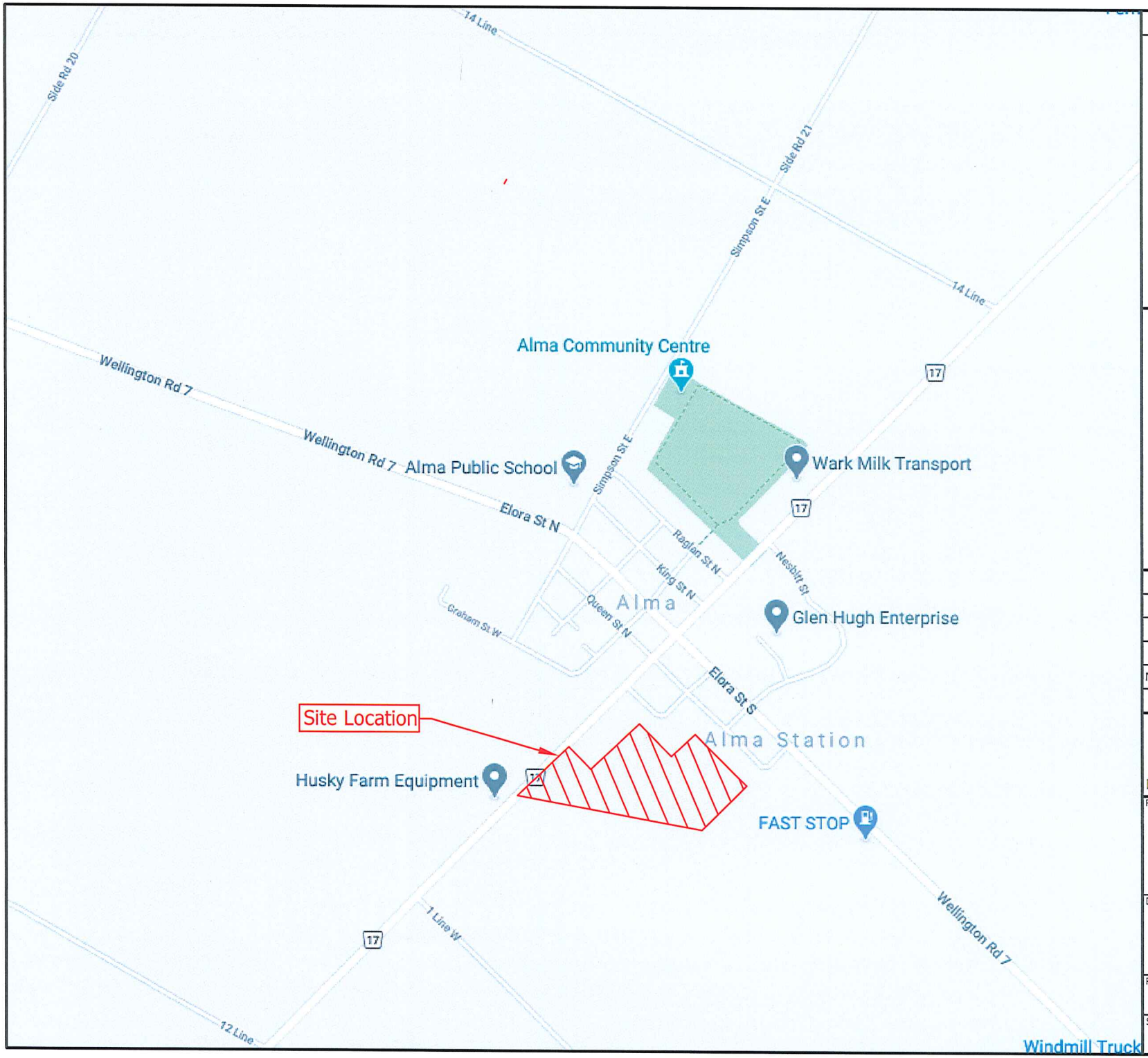
ks



Reviewed by:

Nathan Chortos, P.Eng.

Senior Geotechnical Engineer



NOTES:

Base map provided by Google.

N

NO.	DESCRIPTION	DATE

REVISIONS

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel.: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

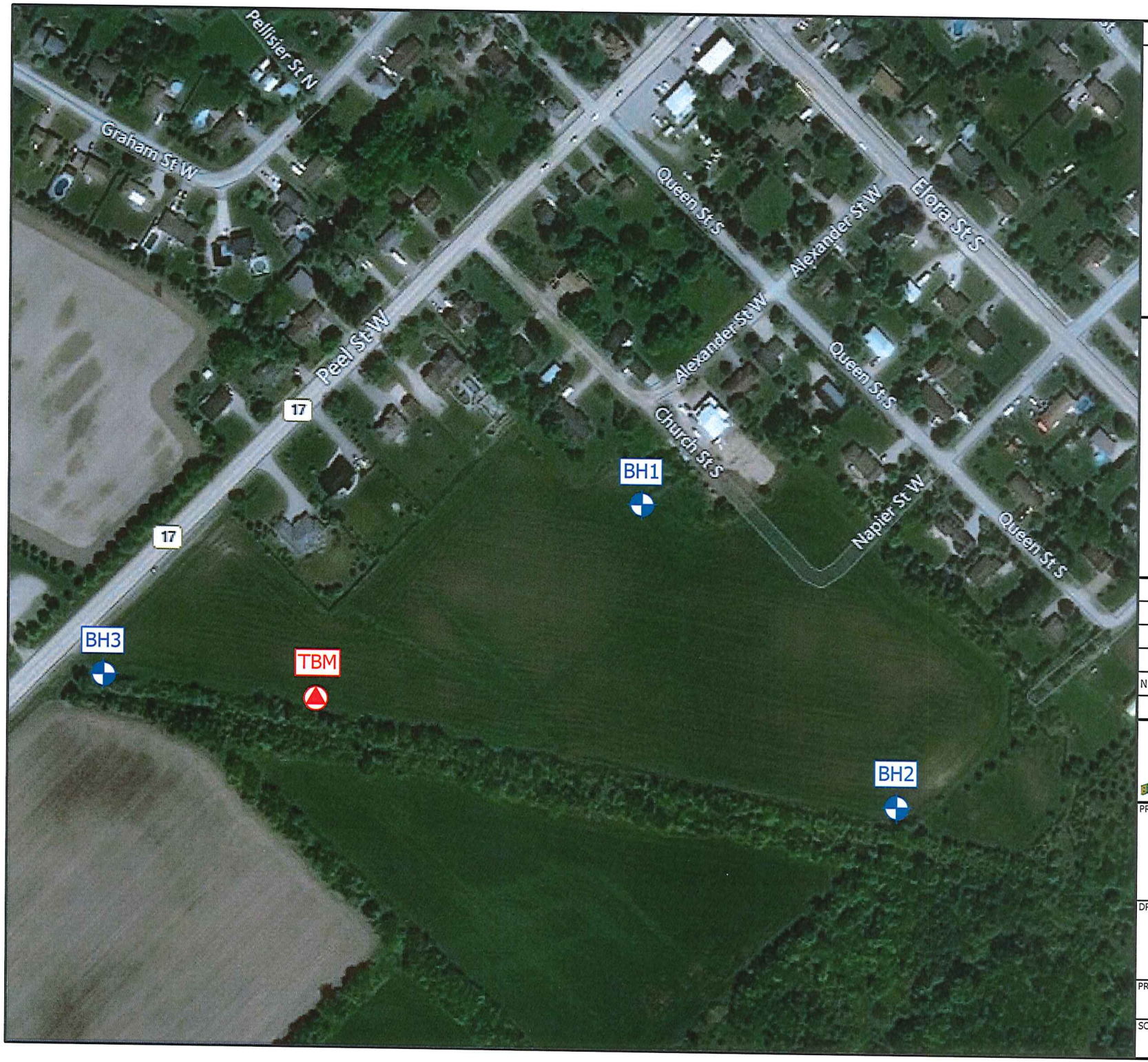
PROJECT:

Proposed Subdivision
31 Church Street
Alma, Ontario

DRAWING TITLE:

SITE LOCATION MAP

PROJECT NO.:	DATE:
20-732	December 18 2020
SCALE:	DRAWING NO.
N.T.S.	1



NOTES:

Base map provided by Bing.

Legend

CMT Borehole with Monitoring Well

Temporary Benchmark (TBM)
Top of Existing Water Well (A299778)
Assumed Elevation: 100.00 m

N

NO.	DESCRIPTION	DATE

REVISIONS

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel.: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

PROJECT:

Proposed Subdivision
31 Church Street
Alma, Ontario

DRAWING TITLE:

AERIAL VIEW SHOWING
BOREHOLE LOCATIONS

PROJECT NO.:	DATE:
20-732	December 18, 2020
SCALE: N.T.S.	DRAWING NO. 2

APPENDIX A

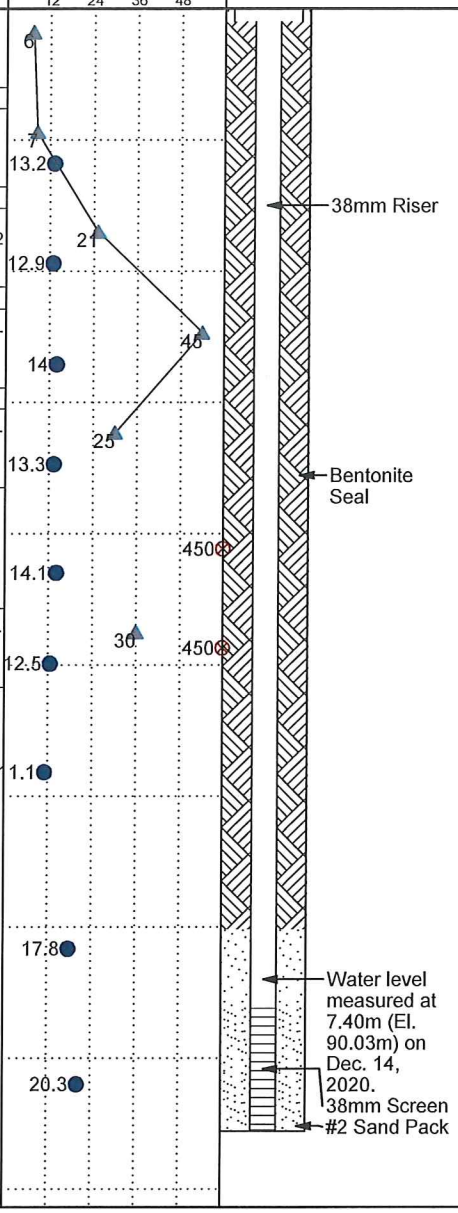
BOREHOLE LOGS

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

BOREHOLE NUMBER 1

PROJECT: Geotechnical Investigation for Proposed Subdivsion
PROJECT ADDRESS: 31 Church Street
PROJECT NUMBER: 20-732
PROJECT LOCATION: Alma, Ontario
DRILLING DATE: 20-12-11
GROUND ELEVATION: 97.43 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: BB
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: SPT/MC5

DEPTH (m)	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
	TOPSOIL: Loose, dark brown silty topsoil, moist (410 mm)	0.00, 97.43	SS 1	67	2-3-3-3 (6)
1	**CLAYEY SILT:** Firm, brown clayey silt, some sand to sandy, trace gravel, drier than the plastic limit	0.41, 97.02	SS 2	100	2-3-4-4 (7)
2	becoming stiff to hard, some sand	1.83, 95.60	SS 3	100	4-6-15-12 (21)
3			SS 4	33	13-20-25-38 (45)
4			SS 5	100	12-11-14-13 (25)
			MC5 6	100	
5	becoming grey	4.65, 92.78	SS 7	100	12-14-16-21 (30)
6	occasional wet seams encountered	5.49, 91.94	MC5 8	100	
7			MC5 9	100	
8	**SILT:** Compact, grey silt, trace clay and sand, moist	7.37, 90.06			
	becoming loose, wet	7.92, 89.51	MC5 10	100	
9	becoming compact, moist	8.69, 88.74			



Bottom of borehole at 9.14 m, Elevation 88.29 m.
Groundwater measured at approximately 7.40 m below ground surface (elevation 90.03 m) on December 14, 2020.

BOREHOLE LOG WITH WELL2 20-732.GPJ CMT_TEMPLATE_2020-05-15.GDT 21-1-7

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

BOREHOLE NUMBER 2

PROJECT: Geotechnical Investigation for Proposed Subdivsion
PROJECT ADDRESS: 31 Church Street
PROJECT LOCATION: Alma, Ontario
PROJECT NUMBER: 20-732
DRILLING DATE: 20-12-11
GROUND ELEVATION: 92.78 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: BB
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: SPT/MC5

DEPTH (m)	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE / POCKET PEN. (kPa) / MOISTURE CONTENT (%)
0	**TOPSOIL:** Loose, dark brown silty topsoil, moist (360 mm)	0.00, 92.78	SS 1	50	1-1-2-2 (3)	3
	CLAYEY SILT: Soft, brown clayey silt, some sand, trace gravel, drier than the plastic limit	0.36, 92.42				
1	becoming stiff to very stiff	1.07, 91.71	SS 2	100	1-2-7-7 (9)	9 14.7
2			SS 3	100	6-8-11-12 (19)	19 13.8
3	becoming sandy, some gravel	2.67, 90.11	SS 4	100	9-10-12-15 (22)	22 14.1
	becoming stiff, more plastic (about the plastic limit)	3.30, 89.48	SS 5	100	8-7-6-8 (13)	13 13.3
4			MC5 6	100		175 13
5			SS 7	67	7-6-7-9 (13)	13 13.1
6			MC5 8	100		14.6
7			MC5 9	100		14.1
8	**SAND:** Compact, brown sand, trace silt and clay, wet	7.82, 84.96	MC5 10	100		12.2
9						

WELL DIAGRAM: Water level measured at 0.06m (El. 92.72m) on Dec. 14, 2020. / 38mm Riser / Bentonite Seal / #2 Sand Pack / 38mm Screen

Bottom of borehole at 9.14 m, Elevation 83.64 m.
Groundwater measured at approximately 0.06 m below ground surface (elevation 92.72 m) on December 14, 2020.

BOREHOLE LOG WITH WELL2 20-732.GPJ CMT_TEMPLATE_2020-05-15.GDT 21-1-7

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

BOREHOLE NUMBER 3

PROJECT: Geotechnical Investigation for Proposed Subdivsion
PROJECT ADDRESS: 31 Church Street
PROJECT LOCATION: Alma, Ontario
PROJECT NUMBER: 20-732
DRILLING DATE: 20-12-11
GROUND ELEVATION: 101.75 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: BB
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: SPT/MC5

DEPTH (m)	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	SPT N VALUE / POCKET PEN. (kPa) / MOISTURE CONTENT (%)
	TOPSOIL: Loose, dark brown silty topsoil, moist (360 mm)	0.00, 101.75	SS 1	67	1-2-2-4 (4)	4
	CLAYEY SILT: Soft, mottled grey-brown clayey silt, some sand, trace gravel, drier than the plastic limit	0.36, 101.39				
1	becoming stiff	0.76, 100.99	SS 2	100	6-6-6-7 (12)	12 / 12.5
	becoming very stiff, brown	1.52, 100.23	SS 3	100	5-9-12-12 (21)	21 / 12.2
2			SS 4	100	13-15-16-20 (31)	31 / 450 / 12.9
3			SS 5	100	9-12-18-20 (30)	30 / 450 / 13.1
4			MC5 6	100		12.8
	becoming hard, grey, about the plastic limit	4.22, 97.53				
5	(-5.03 m) wet silty sand seam encountered		SS 7	100	8-29-16-18 (45)	45 / 250 / 11.5
	(-5.49 m) saturated silty sand seam encountered		MC5 8	100		17
6	**SILT:** Loose, grey silt, trace clay and sand, wet	5.89, 95.86				22
7	becoming compact, moist	7.01, 94.74	MC5 9	100		14.8

WELL DIAGRAM:
- Water level measured at 1.26m (El. 100.49m) on Dec. 14, 2020.
- Bentonite Seal
- 38mm Riser
- #2 Sand Pack
- 38mm Screen

Bottom of borehole at 7.62 m, Elevation 94.13 m.

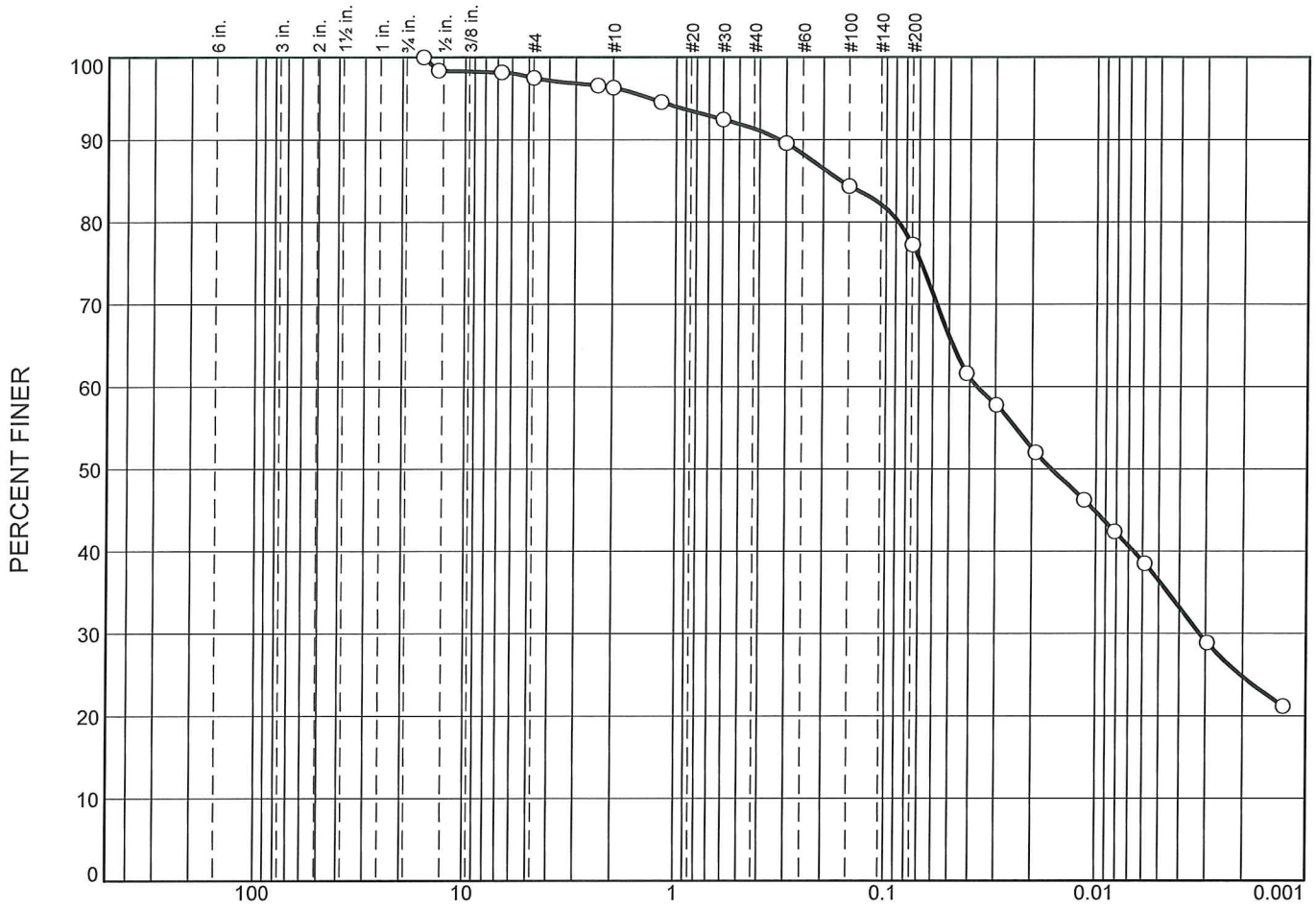
Groundwater measured at approximately 1.26 m below ground surface (elevation 100.49 m) on December 14, 2020.

BOREHOLE LOG WITH WELL2 20-732.GPJ CMT_TEMPLATE_2020-05-15.GDT 21-1-7

APPENDIX B

GRAIN SIZE ANALYSES

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.5	1.2	5.0	14.1	52.4	24.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH1	3	1.52-2.13m	clayey, sandy silt, trace gravel	ML
				Estimated Percolation Rate; T = 50 min/cm	
				Sampled by BB of CMT Engineering Inc., December 11, 2020	
				Tested by MS of CMT Engineering Inc., December 15, 2020	

CMT Engineering Inc.

St. Clements, ON

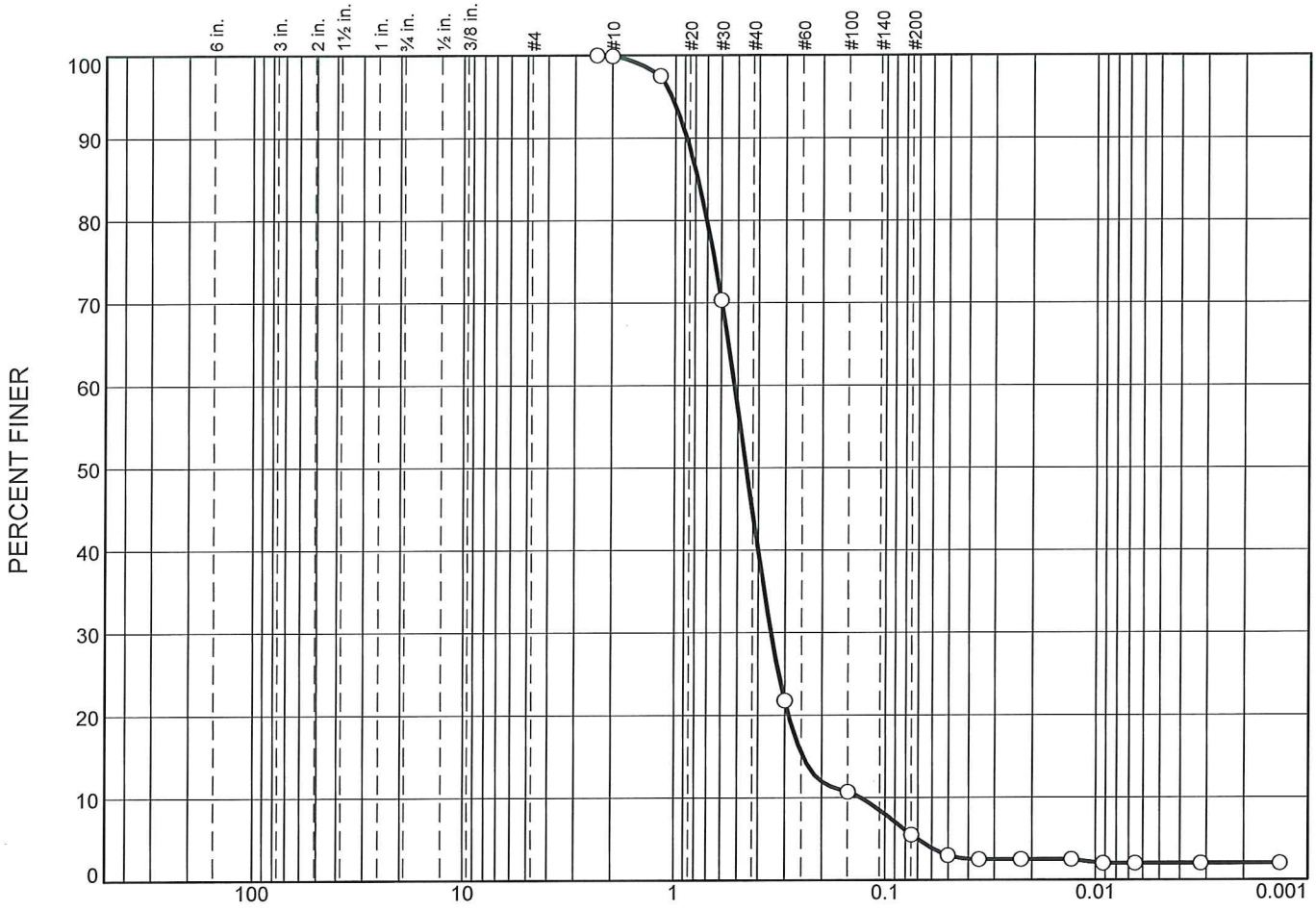
Client: Exact Construction

Project: Proposed Subdivision
31 Church Street, Alma, Ontario

Project No.: 20-732

Figure 1

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	55.4	39.0	3.5	2.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH2	10	7.62-9.14m	sand, trace silt and clay	SP-SM
				Sampled by BB of CMT Engineering Inc., December 11, 2020	
				Tested by MS of CMT Engineering Inc., December 15, 2020	

CMT Engineering Inc.

St. Clements, ON

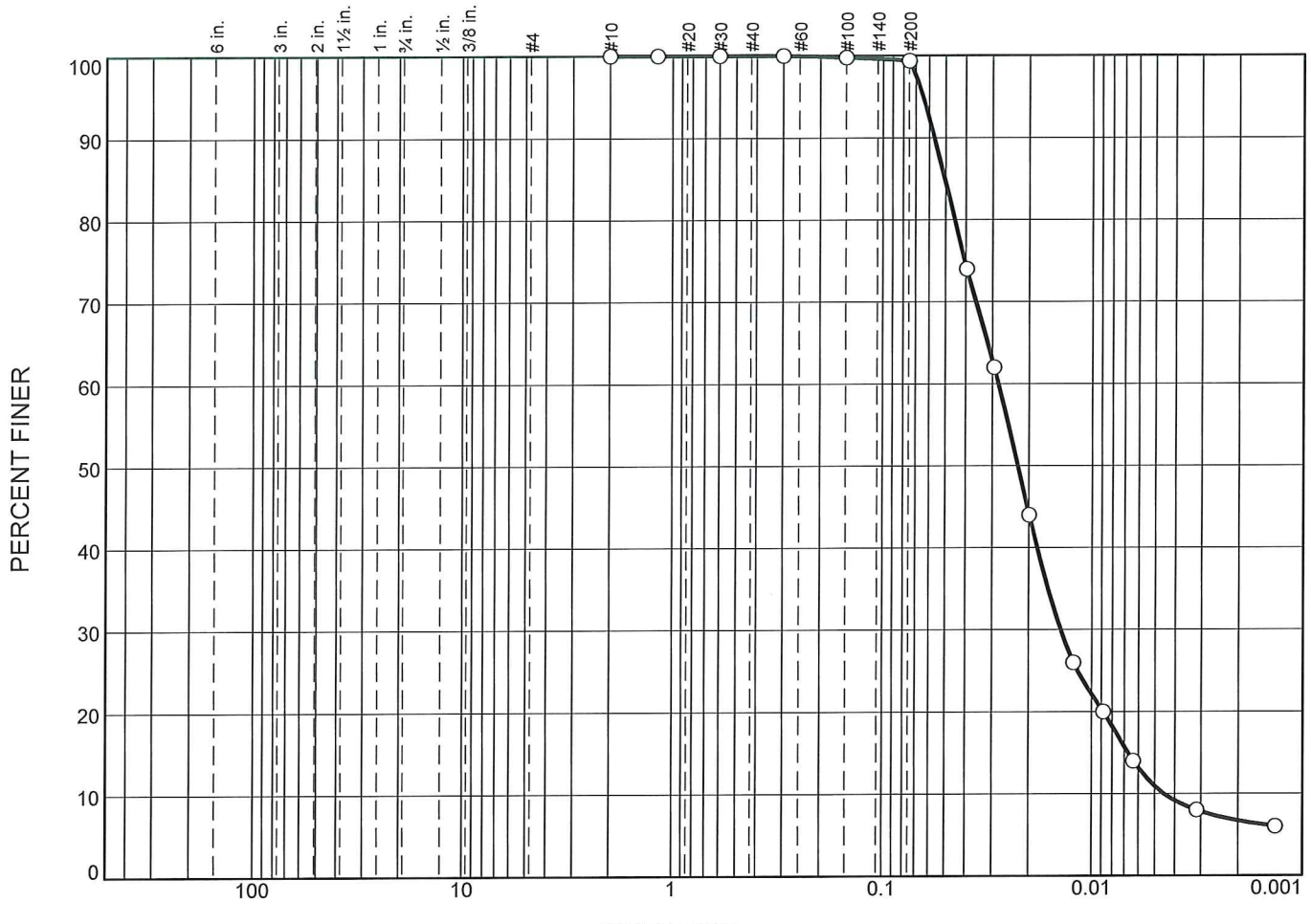
Client: Exact Construction

Project: Proposed Subdivision
31 Church Street, Alma, Ontario

Project No.: 20-732

Figure 2

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.6	92.7	6.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH3	9	6.10-7.62m	silt, trace clay and sand	ML
				Sampled by BB of CMT Engineering Inc., December 11, 2020	
				Tested by MS of CMT Engineering Inc., December 15, 2020	

CMT Engineering Inc.

St. Clements, ON

Client: Exact Construction

Project: Proposed Subdivision
31 Church Street, Alma, Ontario

Project No.: 20-732

Figure 3

APPENDIX C

WELL RECORDS

Ontario

Ministry of the Environment, Conservation and Parks

Well Record - Regulation 903

Ontario Water Resources Act

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 313249

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
VANLEEUWEN	KEVIN
Organization	**Email Address**
EXACT CONSTRUCTION	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village
	8262	WELLINGTON RD 19 RR#3	FERGUS

Country	Province	Postal Code	Telephone Number
CAN	ON	N0B2M0	

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	31	CHURCH	

Lot	Concession	County/District/Municipality

City/Town	Province	Postal Code
ALMA	Ontario	

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	540060	4841716	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 30 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Grey	Silt	Clay	Till	0	30

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	23	3/8 HOLEPLUG	0.5
23	30	#2 SAND	0.15

5. Method of Construction *

☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Boring ☐ Air percussion ☐ Diamond
☐ Jetting ☐ Driving ☐ Digging ☐ Rotary (Air) ☐ Augering ☑ Direct Push
☐ Other (specify) _____

6. Well Use *

☐ Public ☐ Industrial ☐ Cooling & Air Conditioning
☐ Domestic ☐ Commercial ☐ Not Used
☐ Livestock ☐ Municipal ☑ Monitoring
☐ Irrigation ☐ Test Hole ☐ Dewatering
☐ Other (specify) _____

7. Status of Well *

☐ Water Supply ☐ Replacement Well ☐ Test Hole
☐ Recharge Well ☐ Dewatering Well ☑ Observation and/or Monitoring Hole
☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality
☐ Abandoned, other (specify) _____
☐ Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
1.5	Plastic	0.06	-1	25

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
1.56	Plastic	10	25	30

10. Water Details

Water found at Depth (ft)	☐ Gas	Kind of water ☐ Fresh	☐ Untested	☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	30	3.5

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain _____

If flowing give rate

☐ Flowing _____ (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)														

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)													

After test of well yield, water was

☐ Clear and sand free ☐ Other (specify)

Pump intake set at (ft)	Pumping rate (GPM)	Duration of pumping hrs + min	Final water level end of pumping (ft)	Disinfected? * ☐ Yes ☑ No

Recommended pump depth (ft)	Recommended pump rate (GPM)	Well production (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☐ Yes ☐ No		2020/12/11

Comments

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
CMT DRILLING INC	7366

Business Address

Unit Number	Street Number	Street Name *
1	1011	INDUSTRIAL CRES

City/Town/Village *	Province	Postal Code *
ST CLEMENTS	ON	N0B 2M0

Business Telephone Number	Business Email Address
519-699-5775	info@cmtinc.net

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
BLACK	CHRIS	3711

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
BLACK	CHRIS	cblack@cmtinc.net

Signature		Date Submitted (yyyy/mm/dd)
Chris Black	Digitally signed by Chris Black Date: 2020.12.24 10:08:50 -05'00'	2020/12/24

17. Ministry Use Only

Audit Number

SXUO S4YK

Ontario

Ministry of the Environment, Conservation and Parks

Well Record - Regulation 903

Ontario Water Resources Act

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 313250

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
VANLEEUWEN	KEVIN
Organization	**Email Address**
EXACT CONSTRUCTION	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village
	8262	WELLINGTON RD 19 RR#3	FERGUS

Country	Province	Postal Code	Telephone Number
CAN	ON	N0B2M0	

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	31	CHURCH	

Lot	Concession	County/District/Municipality

City/Town	Province	Postal Code
ALMA	Ontario	

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	540190	4841566	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 30 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Grey	Silt	Clay		0	25
Brown	Sand			25	30

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	20	3/8 HOLEPLUG	0.43
20	30	#2 SAND	0.21

5. Method of Construction *

☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Boring ☐ Air percussion ☐ Diamond
☐ Jetting ☐ Driving ☐ Digging ☐ Rotary (Air) ☐ Augering ☑ Direct Push
☐ Other (specify) _____

6. Well Use *

☐ Public ☐ Industrial ☐ Cooling & Air Conditioning
☐ Domestic ☐ Commercial ☐ Not Used
☐ Livestock ☐ Municipal ☑ Monitoring
☐ Irrigation ☐ Test Hole ☐ Dewatering
☐ Other (specify) _____

7. Status of Well *

☐ Water Supply ☐ Replacement Well ☐ Test Hole
☐ Recharge Well ☐ Dewatering Well ☑ Observation and/or Monitoring Hole
☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality
☐ Abandoned, other (specify) _____
☐ Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
1.5	Plastic	0.06	-1	25

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
1.56	Plastic	10	25	30

10. Water Details

Water found at Depth (ft)	☐ Gas	Kind of water ☐ Fresh	☐ Untested	☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	30	3.5

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain _____

If flowing give rate

☐ Flowing _____ (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)														

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)													

After test of well yield, water was

☐ Clear and sand free ☐ Other (specify)

Pump intake set at (ft)	Pumping rate (GPM)	Duration of pumping hrs + min	Final water level end of pumping (ft)	Disinfected? *
				☐ Yes ☑ No

Recommended pump depth (ft)	Recommended pump rate (GPM)	Well production (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☐ Yes ☐ No		2020/12/11

Comments

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
CMT DRILLING INC	7366

Business Address

Unit Number	Street Number	Street Name *
1	1011	INDUSTRIAL CRES

City/Town/Village *	Province	Postal Code *
ST CLEMENTS	ON	N0B 2M0

Business Telephone Number	Business Email Address
519-699-5775	info@cmtinc.net

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
BLACK	CHRIS	3711

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
BLACK	CHRIS	cblack@cmtinc.net

Signature		Date Submitted (yyyy/mm/dd)
Chris Black	Digitally signed by Chris Black Date: 2020.12.24 10:17:17 -05'00'	2020/12/24

17. Ministry Use Only

Audit Number

J6QZ 3EYX

Ontario

Ministry of the Environment, Conservation and Parks

Well Record - Regulation 903

Ontario Water Resources Act

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 313251

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
VANLEEUWEN	KEVIN
Organization	**Email Address**
EXACT CONSTRUCTION	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village
	8262	WELLINGTON RD 19 RR#3	FERGUS

Country	Province	Postal Code	Telephone Number
CAN	ON		

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	31	CHURCH	

Lot	Concession	County/District/Municipality

City/Town	Province	Postal Code
ALAMA	Ontario	

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	539734	4841635	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 23 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Grey	Silt	Clay		0	15
Grey	Silt			15	23

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	16	3/8 HOLEPLUG	0.34
16	23	#2 SAND	0.15

5. Method of Construction *

☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Boring ☐ Air percussion ☐ Diamond
☐ Jetting ☐ Driving ☐ Digging ☐ Rotary (Air) ☐ Augering ☑ Direct Push
☐ Other (specify) _____

6. Well Use *

☐ Public ☐ Industrial ☐ Cooling & Air Conditioning
☐ Domestic ☐ Commercial ☐ Not Used
☐ Livestock ☐ Municipal ☑ Monitoring
☐ Irrigation ☐ Test Hole ☐ Dewatering
☐ Other (specify) _____

7. Status of Well *

☐ Water Supply ☐ Replacement Well ☐ Test Hole
☐ Recharge Well ☐ Dewatering Well ☑ Observation and/or Monitoring Hole
☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality
☐ Abandoned, other (specify) _____
☐ Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
1.5	Plastic	0.06	-1	18

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
1.56	Plastic	10	18	23

10. Water Details

Water found at Depth (ft)	☐ Gas	Kind of water ☐ Fresh	☐ Untested	☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	23	3.5

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain _____

If flowing give rate

☐ Flowing _____ (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)														

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)													

After test of well yield, water was

☐ Clear and sand free ☐ Other (specify)

Pump intake set at (ft)	Pumping rate (GPM)	Duration of pumping hrs + min	Final water level end of pumping (ft)	Disinfected? * ☐ Yes ☑ No

Recommended pump depth (ft)	Recommended pump rate (GPM)	Well production (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☐ Yes ☐ No		2020/12/11

Comments

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
CMT DRILLING INC	7366

Business Address

Unit Number	Street Number	Street Name *
1	1011	INDUSTRIAL CRES

City/Town/Village *	Province	Postal Code *
ST CLEMENTS	ON	N0B 2M0

Business Telephone Number	Business Email Address
519-699-5775	info@cmtinc.net

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
BLACK	CHRIS	3711

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
BLACK	CHRIS	cblack@cmtinc.net

Signature		Date Submitted (yyyy/mm/dd)
Chris Black	Digitally signed by Chris Black Date: 2020.12.24 10:45:08 -05'00'	2020/12/24

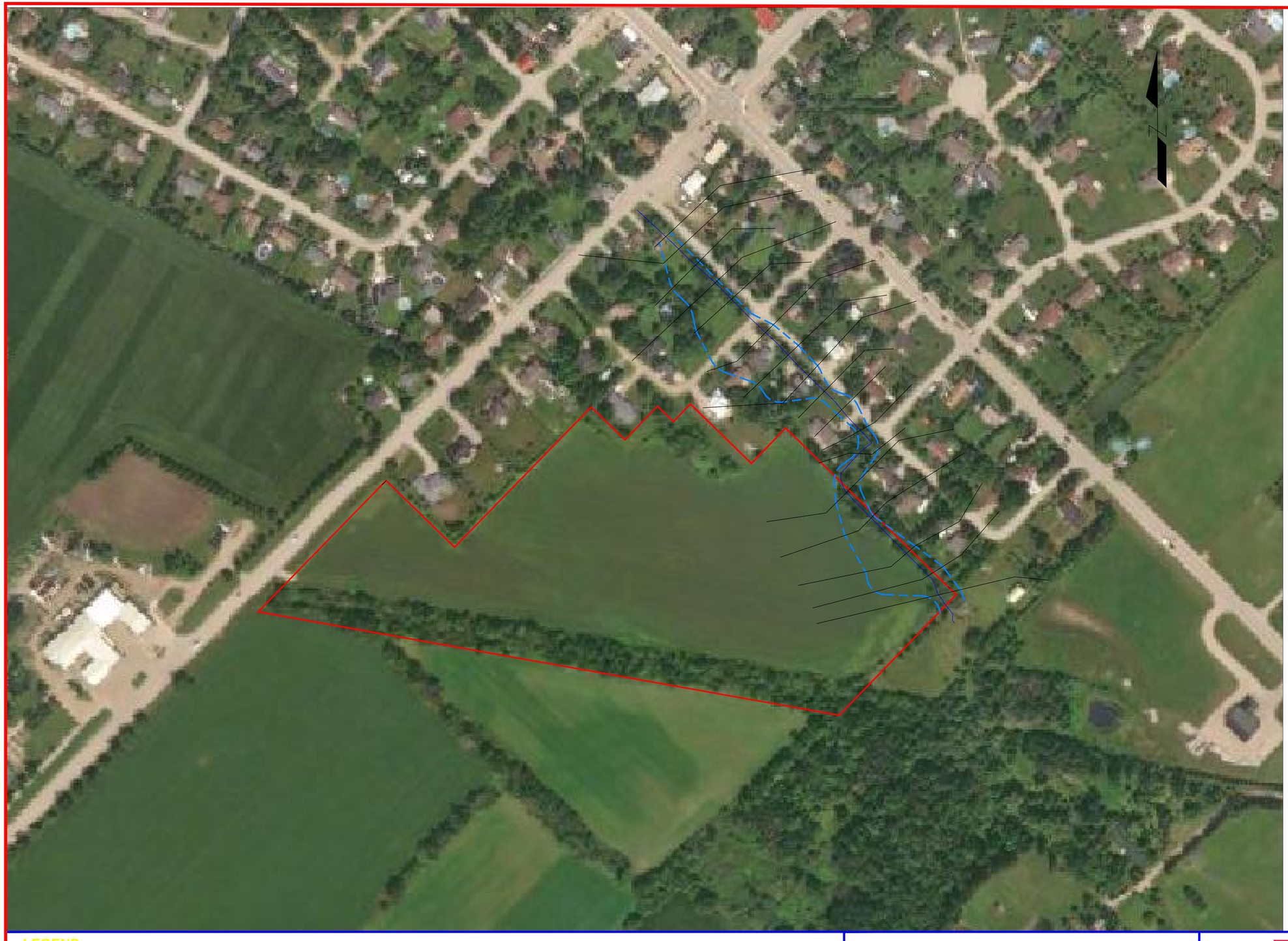
17. Ministry Use Only

Audit Number

4JQV AM7M

Appendix B

Hydraulic Analysis



LEGEND:

- STUDY AREA
- RIVER 1 - REACH 1
- BASELINE REGULATORY FLOODPLAIN LIMIT
- HEC-RAS CROSS SECTION

EXACT CONSTRUCTION
ALMA SUBDIVISION

GEI Consultants

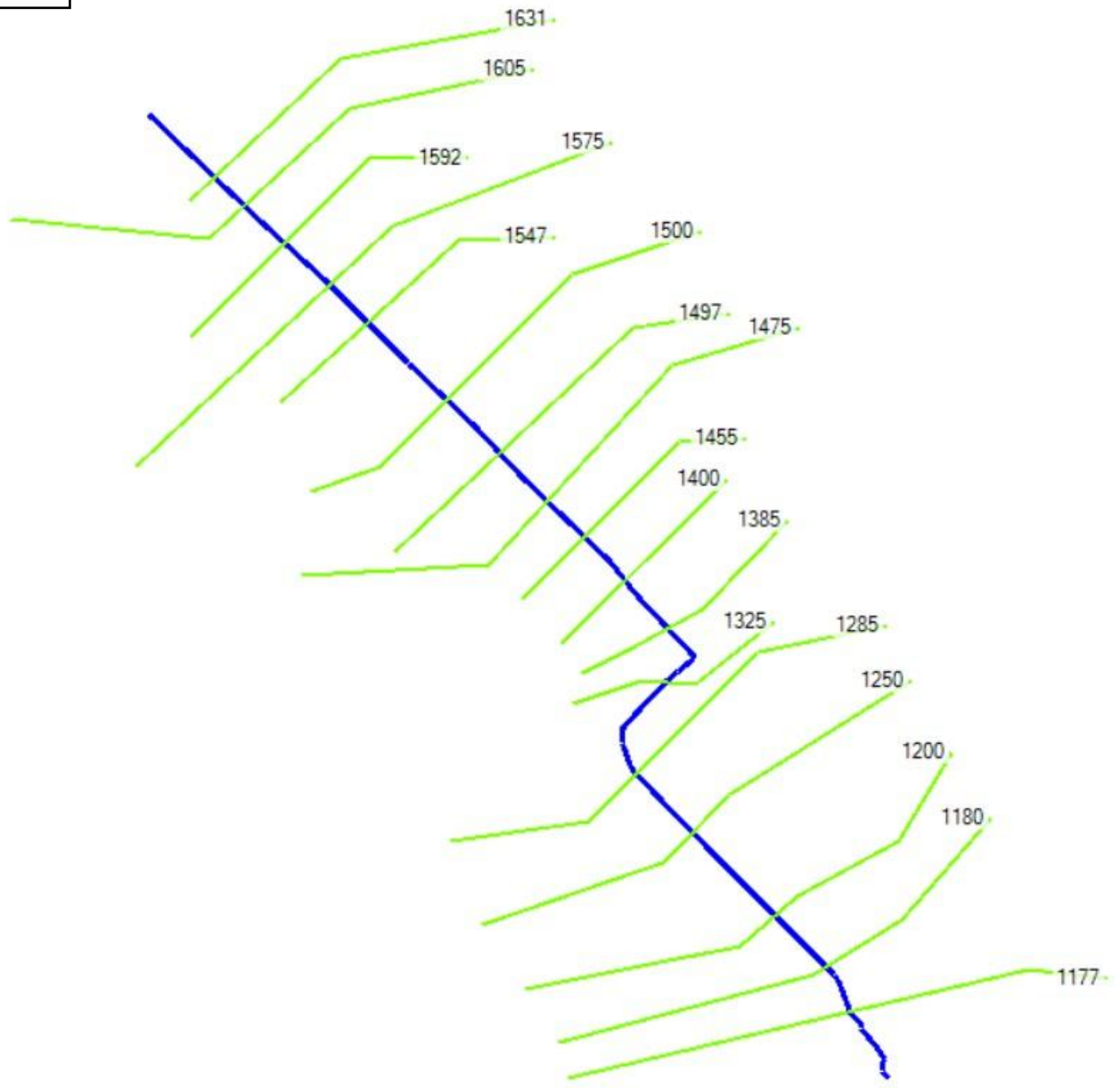
FLOODPLAIN

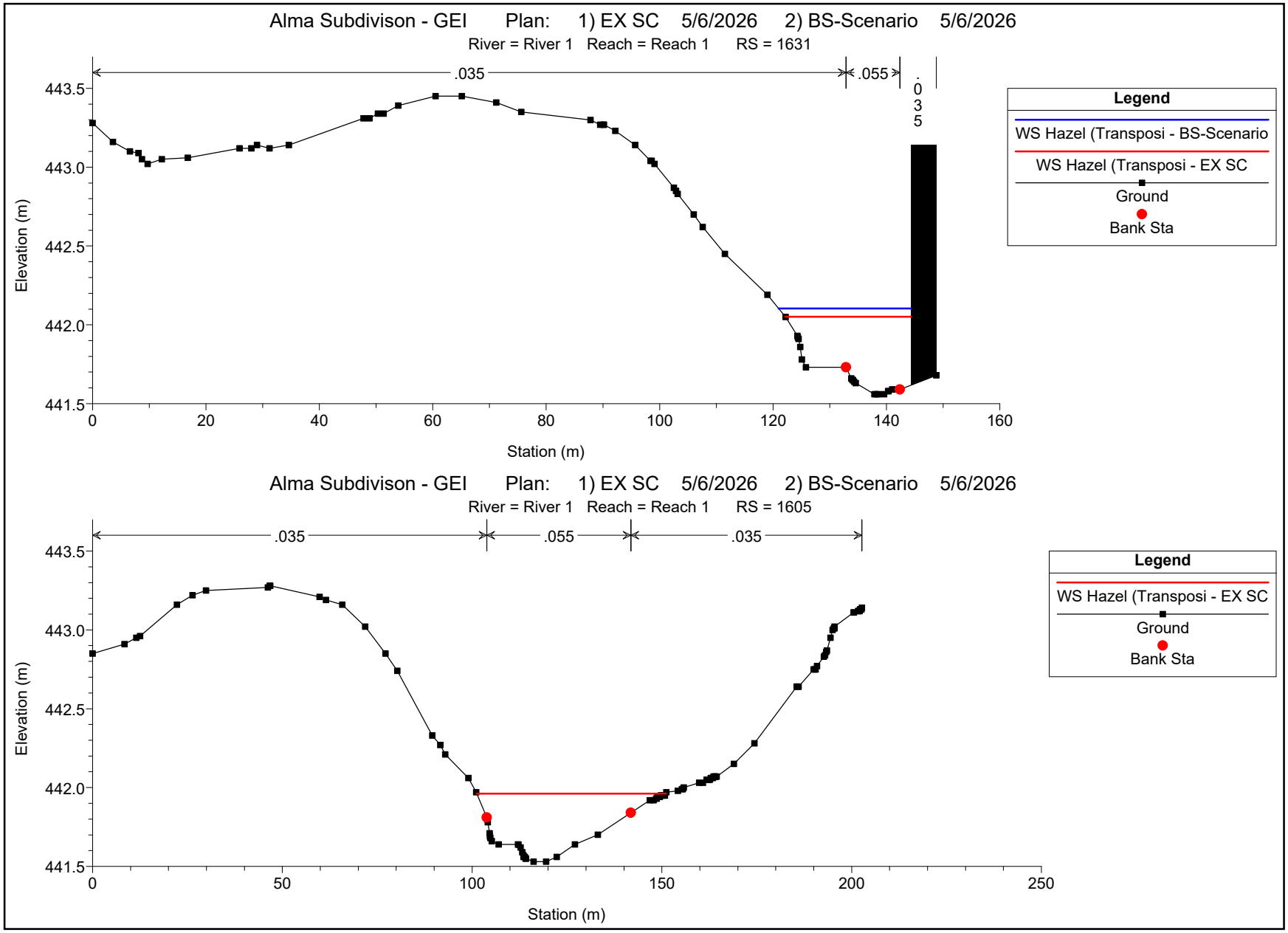
2401042	Feb 2026	FP-1

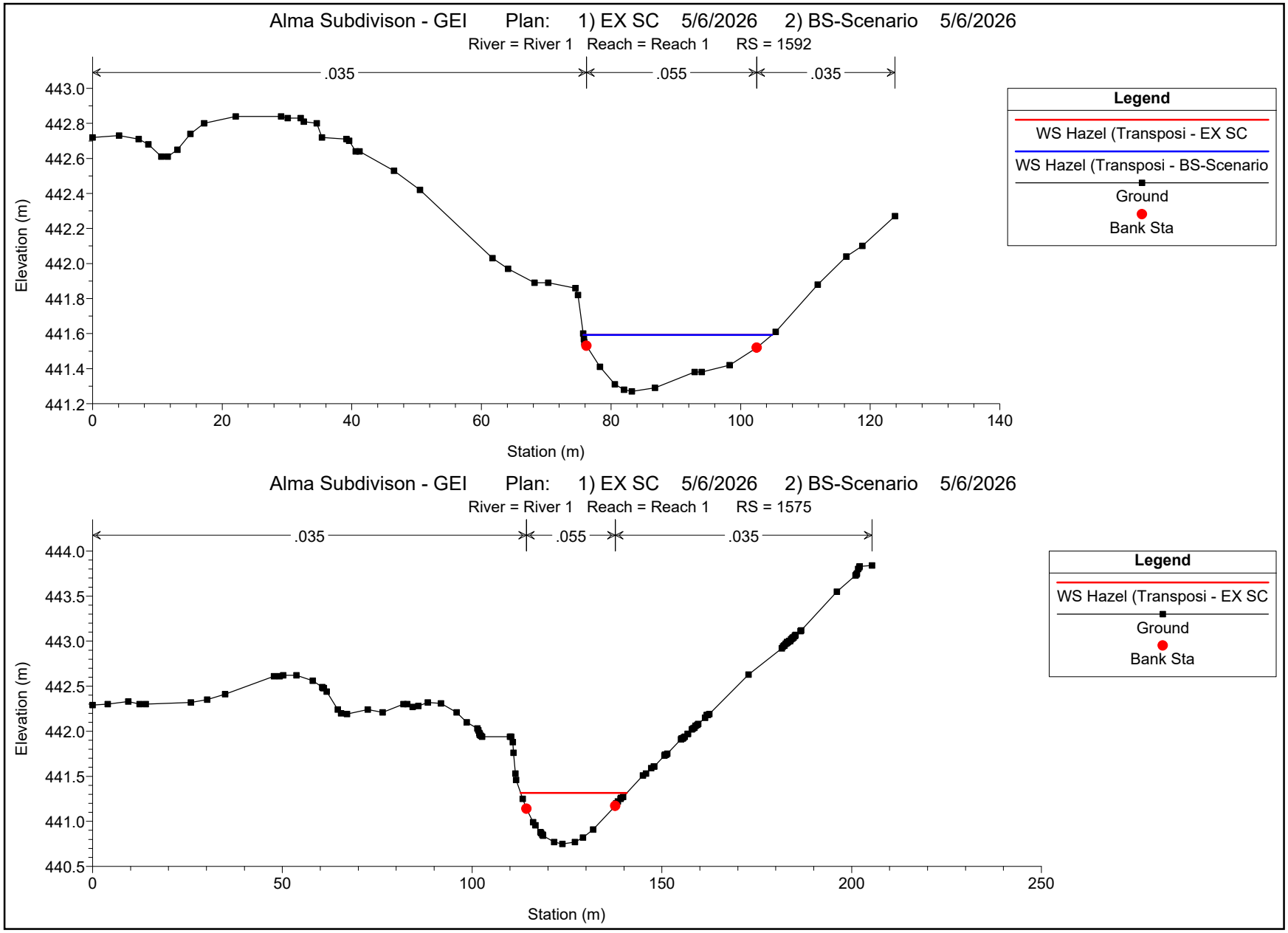
Baseline Schematic

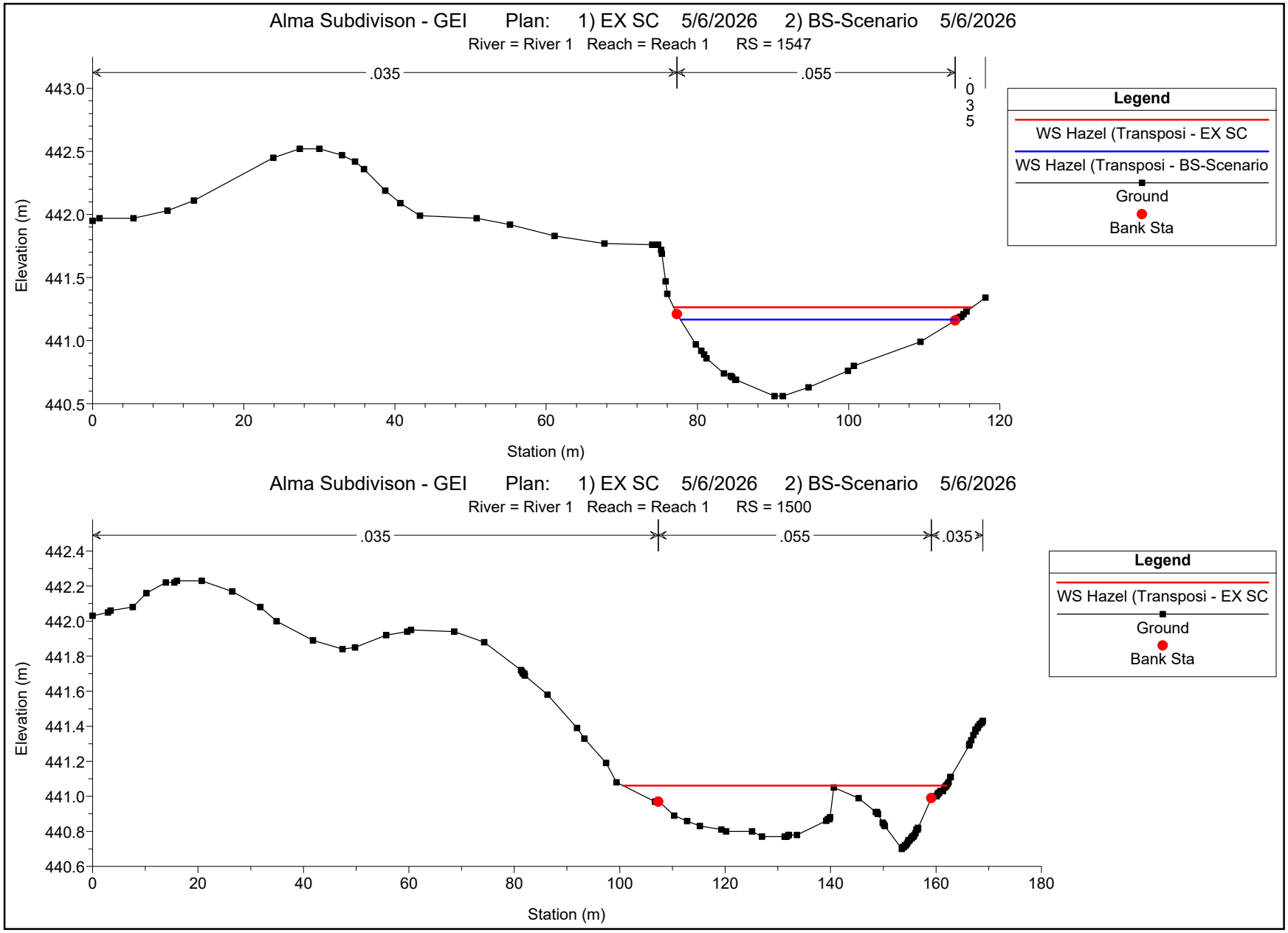


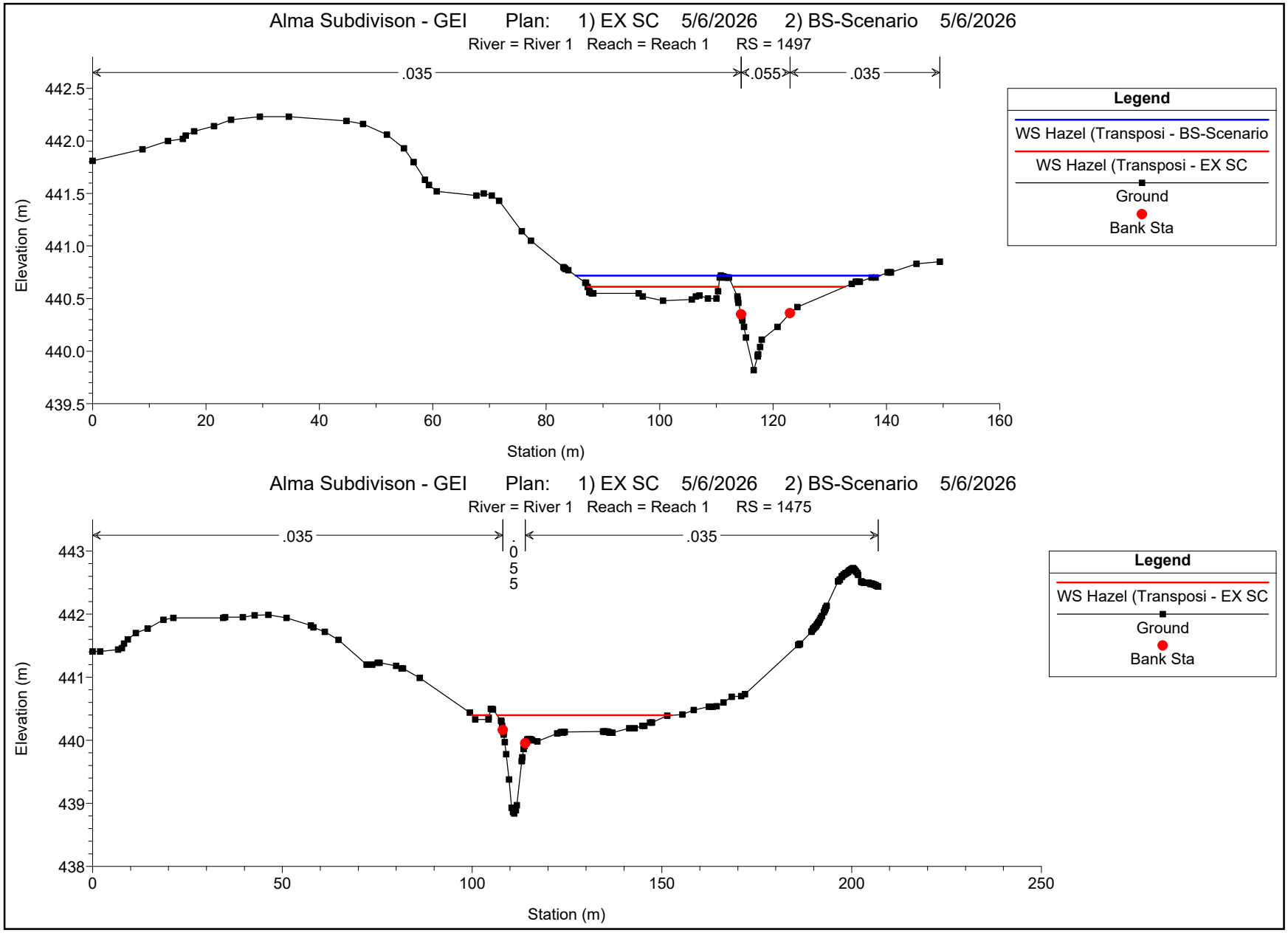
Existing Schematic

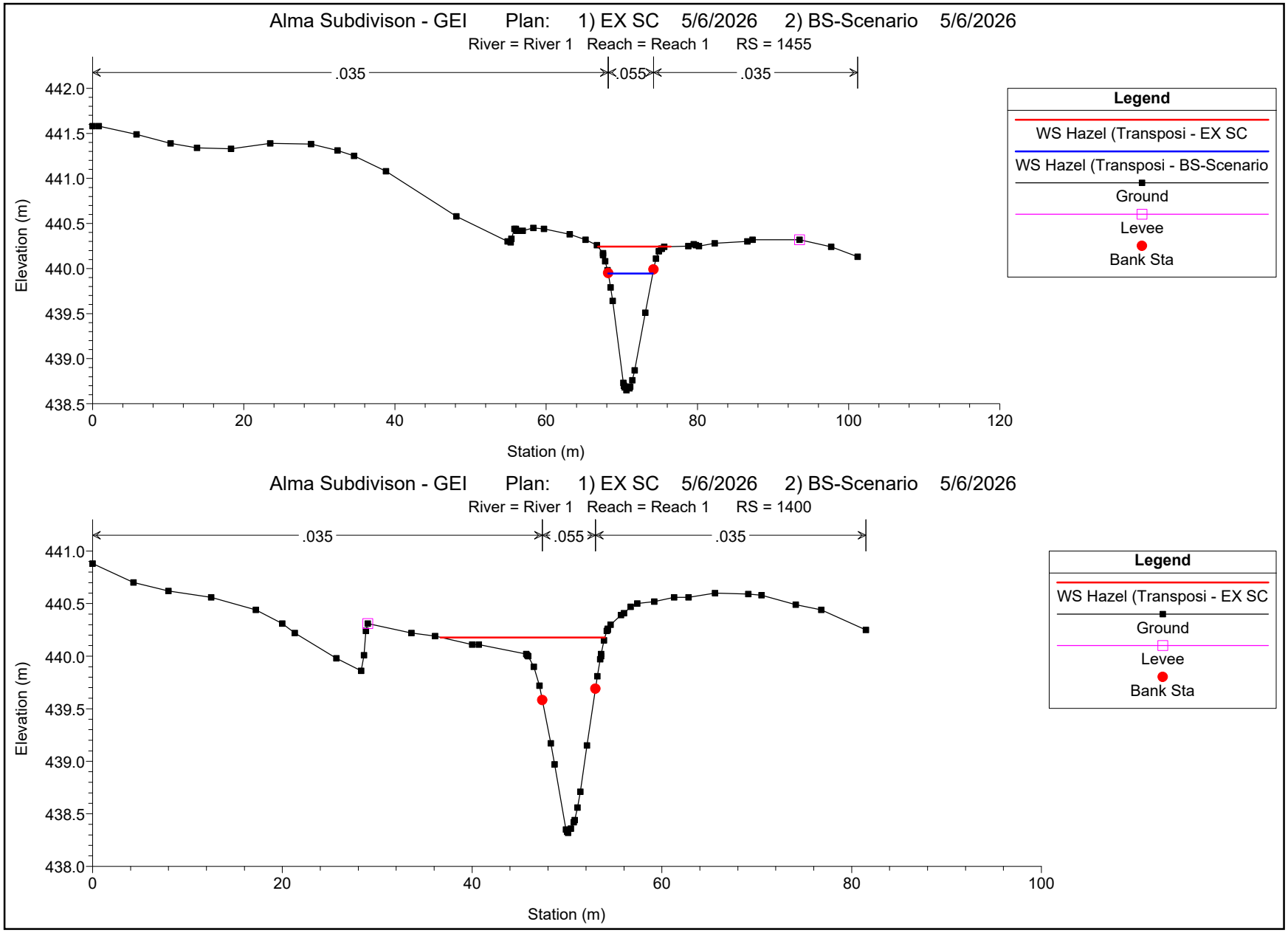


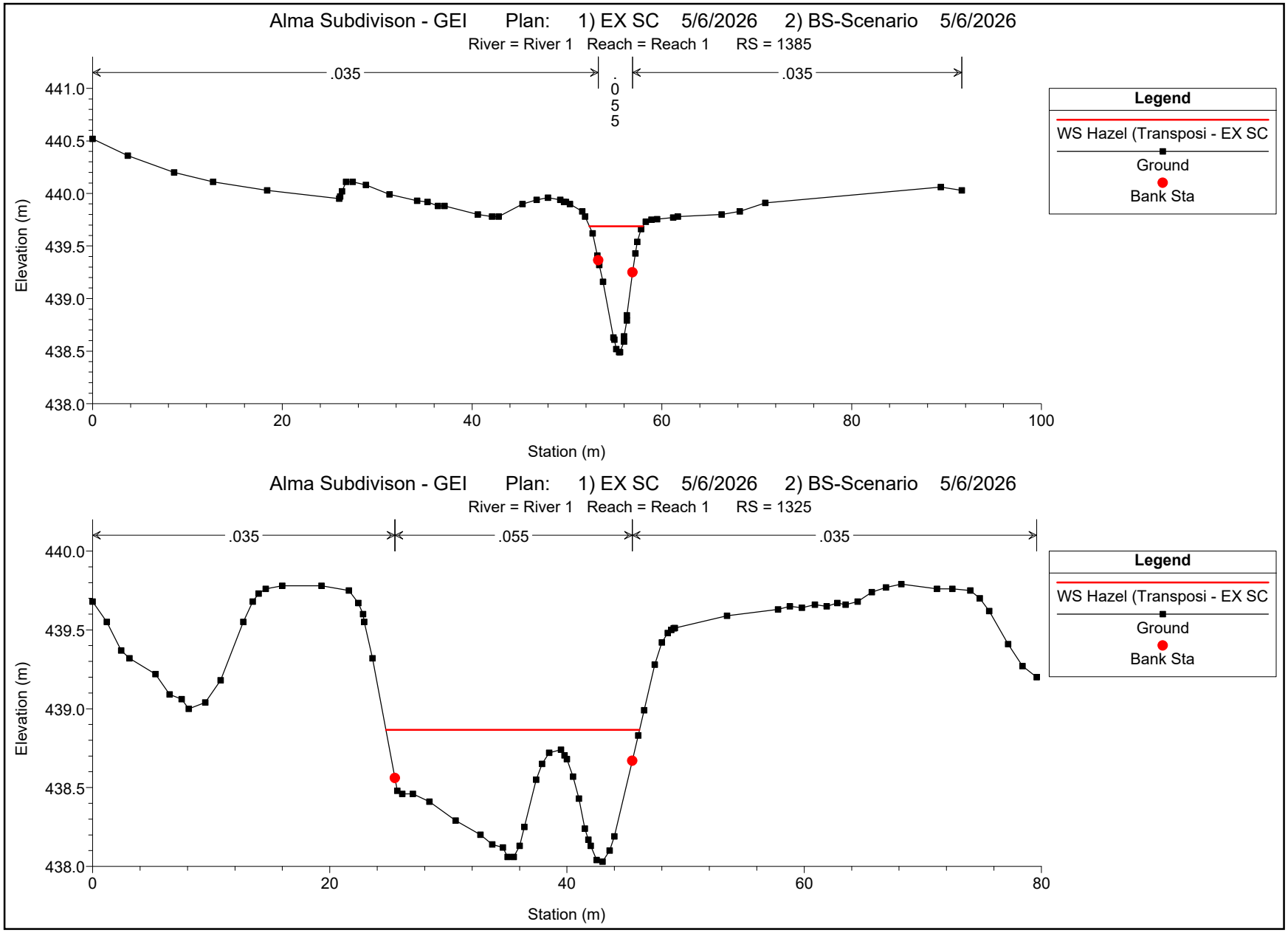

Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1631
.035
.055
.035
Elevation (m)
443.5
443.0
442.5
442.0
441.5
0
20
40
60
80
100
120
140
160
Station (m)
Legend
WS Hazel (Transposi - BS-Scenario
WS Hazel (Transposi - EX SC
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1605
.035
.055
.035
Elevation (m)
443.5
443.0
442.5
442.0
441.5
0
50
100
150
200
250
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta

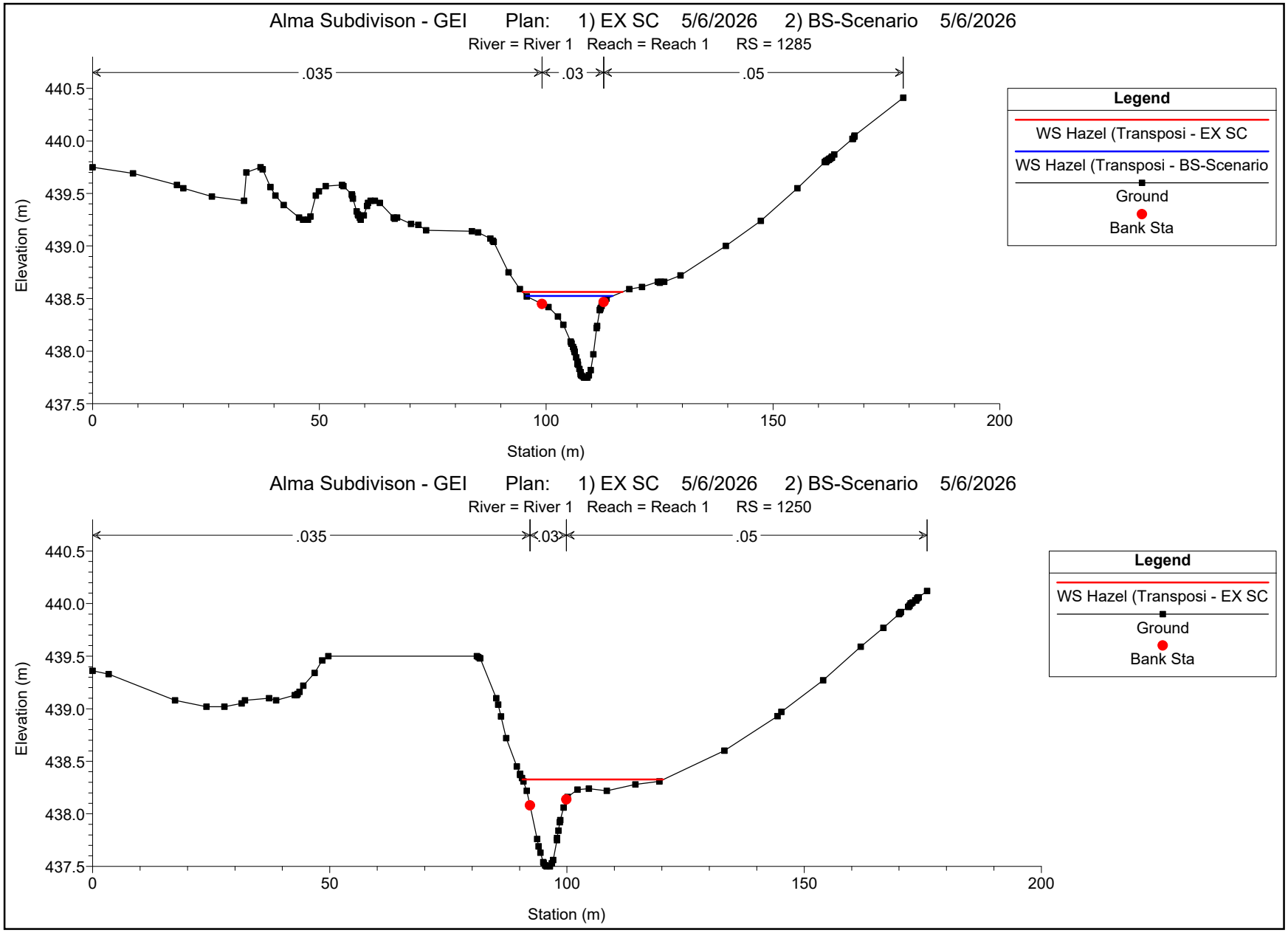

Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1592
.035
.055
.035
Elevation (m)
443.0
442.8
442.6
442.4
442.2
442.0
441.8
441.6
441.4
441.2
0
20
40
60
80
100
120
140
Station (m)
Legend
WS Hazel (Transposi - EX SC
WS Hazel (Transposi - BS-Scenario
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1575
.035
.055
.035
Elevation (m)
444.0
443.5
443.0
442.5
442.0
441.5
441.0
440.5
0
50
100
150
200
250
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta

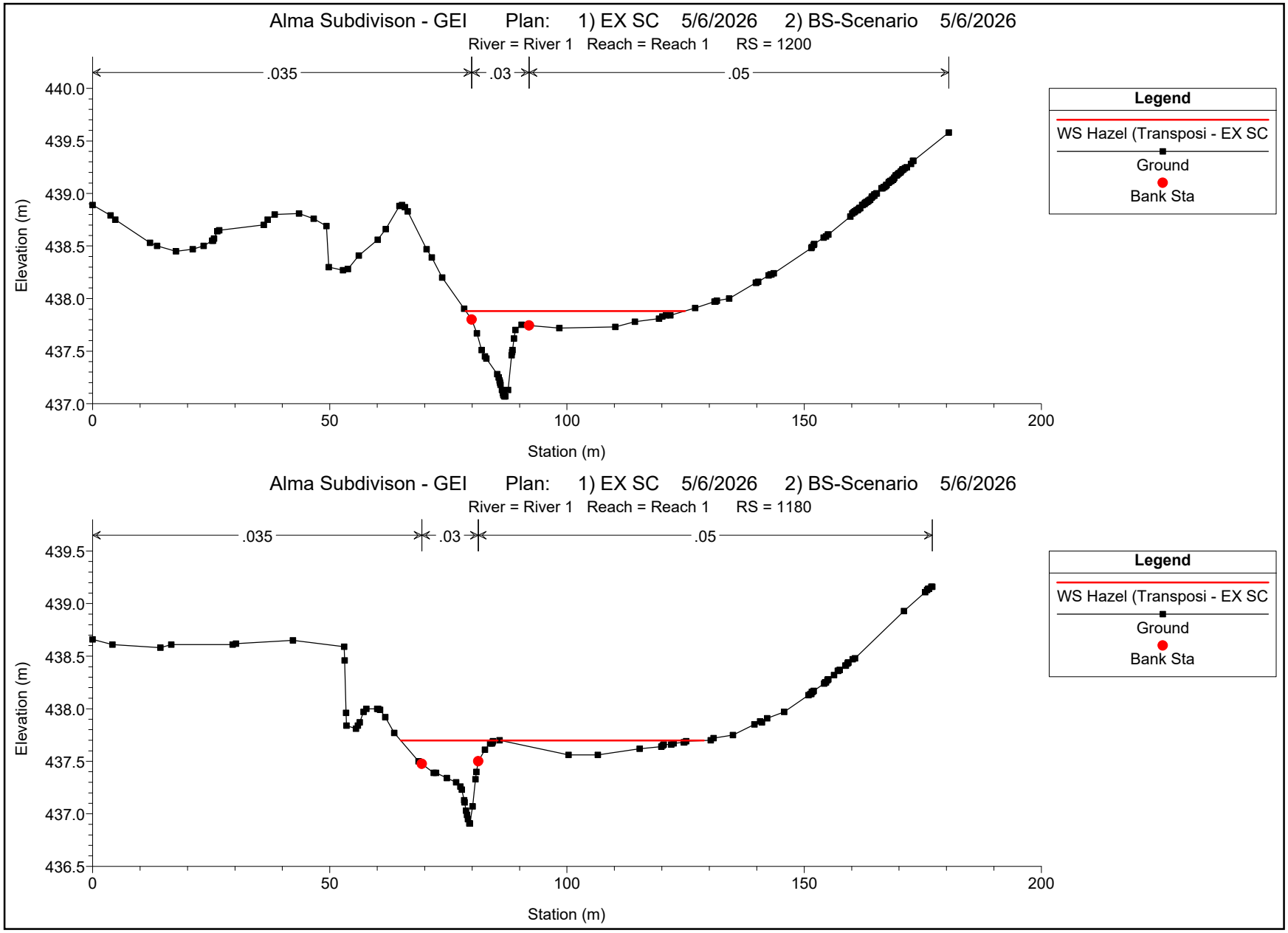

Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1547
.035
.055
.035
Elevation (m)
443.0
442.5
442.0
441.5
441.0
440.5
0
20
40
60
80
100
120
Station (m)
Legend
WS Hazel (Transposi - EX SC
WS Hazel (Transposi - BS-Scenario
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1500
.035
.055
.035
Elevation (m)
442.4
442.2
442.0
441.8
441.6
441.4
441.2
441.0
440.8
440.6
0
20
40
60
80
100
120
140
160
180
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta

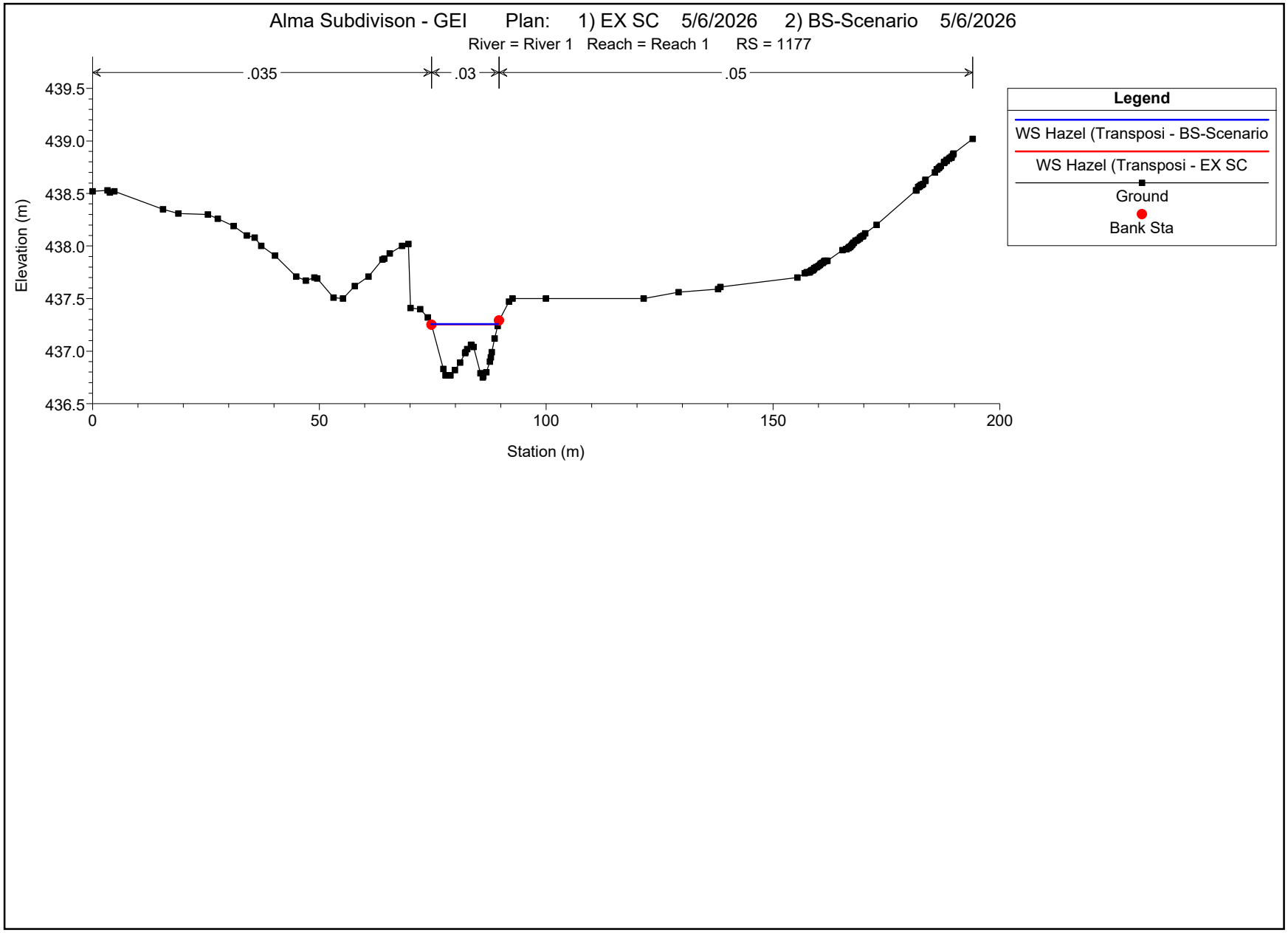

Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1497
.035
.055
.035
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - BS-Scenario
WS Hazel (Transposi - EX SC
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1475
.035
.055
.035
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta


Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1455
.035
.055
.035
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
WS Hazel (Transposi - BS-Scenario
Ground
Levee
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1400
.035
.055
.035
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Levee
Bank Sta


Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1385
.035
.055
.035
441.0
440.5
440.0
439.5
439.0
438.5
438.0
Elevation (m)
0
20
40
60
80
100
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1325
.035
.055
.035
440.0
439.5
439.0
438.5
438.0
Elevation (m)
0
20
40
60
80
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta


Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1285
.035
.03
.05
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
WS Hazel (Transposi - BS-Scenario
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1250
.035
.03
.05
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta


Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1200
.035
.03
.05
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta
Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1180
.035
.03
.05
Elevation (m)
Station (m)
Legend
WS Hazel (Transposi - EX SC
Ground
Bank Sta


Alma Subdivison - GEI Plan: 1) EX SC 5/6/2026 2) BS-Scenario 5/6/2026
River = River 1 Reach = Reach 1 RS = 1177
.035
.03
.05
439.5
439.0
438.5
438.0
437.5
437.0
436.5
Elevation (m)
0
50
100
150
200
Station (m)
Legend
WS Hazel (Transposi - BS-Scenario
WS Hazel (Transposi - EX SC
Ground
Bank Sta

HEC-RAS River: River 1 Reach: Reach 1 Profile: Hazel (Transposi

Reach	River Sta	Profile	Plan	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)	
Reach 1	1631 1631	Hazel (Transposi	EX SC	8.58	441.56	442.05		442.11	0.008964	1.01	7.93	22.19	0.48
Reach 1	1631 1631	Hazel (Transposi	BS-Scenario	8.58	441.56	442.10		442.15	0.005924	0.89	9.12	23.39	0.40
Reach 1	1605 1605	Hazel (Transposi	EX SC	8.58	441.53	441.96		441.99	0.007000	0.70	12.58	49.77	0.40
Reach 1	1592 1592	Hazel (Transposi	EX SC	8.58	441.27	441.59	441.59	441.70	0.046812	1.45	5.98	29.13	0.98
Reach 1	1592 1592	Hazel (Transposi	BS-Scenario	8.58	441.27	441.59	441.59	441.70	0.051448	1.43	5.98	29.13	1.01
Reach 1	1575 1575	Hazel (Transposi	EX SC	8.58	440.75	441.32		441.35	0.006844	0.85	10.27	28.02	0.42
Reach 1	1547 1547	Hazel (Transposi	EX SC	8.58	440.56	441.26		441.28	0.002321	0.52	16.74	39.49	0.24
Reach 1	1547 1547	Hazel (Transposi	BS-Scenario	8.58	440.56	441.17		441.19	0.005124	0.66	13.06	36.55	0.35
Reach 1	1500 1500	Hazel (Transposi	EX SC	8.58	440.70	441.06		441.09	0.013680	0.76	11.50	61.41	0.52
Reach 1	1497 1497	Hazel (Transposi	EX SC	8.58	439.82	440.61	440.61	440.70	0.017372	1.44	7.45	42.93	0.67
Reach 1	1497 1497	Hazel (Transposi	BS-Scenario	8.58	439.82	440.72	440.59	440.74	0.009569	0.69	12.41	53.58	0.45
Reach 1	1475 1475	Hazel (Transposi	EX SC	8.58	438.84	440.40		440.41	0.001783	0.72	15.49	50.49	0.23
Reach 1	1455 1455	Hazel (Transposi	EX SC	8.58	438.65	440.24	439.79	440.34	0.006631	1.40	6.33	9.60	0.44
Reach 1	1455 1455	Hazel (Transposi	BS-Scenario	8.58	438.65	439.95	439.79	440.15	0.021176	2.00	4.28	5.89	0.75
Reach 1	1400 1400	Hazel (Transposi	EX SC	8.58	438.32	440.18	439.50	440.24	0.003138	1.12	8.65	17.34	0.32
Reach 1	1385 1385	Hazel (Transposi	EX SC	8.58	438.49	439.69	439.69	440.04	0.032259	2.69	3.34	5.64	0.94
Reach 1	1325 1325	Hazel (Transposi	EX SC	8.58	438.03	438.87		438.90	0.004881	0.81	10.60	21.38	0.36
Reach 1	1285 1285	Hazel (Transposi	EX SC	8.58	437.75	438.56	438.49	438.67	0.006471	1.49	6.13	22.09	0.73
Reach 1	1285 1285	Hazel (Transposi	BS-Scenario	8.58	437.75	438.52	438.49	438.66	0.009232	1.66	5.31	19.04	0.86
Reach 1	1250 1250	Hazel (Transposi	EX SC	8.58	437.50	438.33	438.33	438.48	0.006345	1.82	6.12	29.63	0.76
Reach 1	1200 1200	Hazel (Transposi	EX SC	8.58	437.07	437.88	437.87	437.97	0.006528	1.45	8.84	46.24	0.73
Reach 1	1180 1180	Hazel (Transposi	EX SC	8.58	436.91	437.70	437.70	437.80	0.007012	1.51	8.83	63.13	0.76
Reach 1	1177 1177	Hazel (Transposi	EX SC	8.58	436.75	437.26	437.26	437.42	0.013265	1.80	4.76	14.76	1.01
Reach 1	1177 1177	Hazel (Transposi	BS-Scenario	8.58	436.75	437.26	437.26	437.42	0.013106	1.79	4.79	14.80	1.00

Appendix C

Stormwater Data Analysis

WELLINGTON COUNTY ROAD No. 17
KNOWN AS PEEL STREET
ROAD ALLOWANCE BETWEEN TOWNSHIPS OF PEEL & PILKINGTON
PIN 71425-0057 (LT)

CHURCH STREET
ALEXANDER STREET
PIN 71425-0102 (LT)
SOUTH
STREET
NAPIER STREET
PIN 71425-0105 (LT)
QUEEN

100
7.88 | 0

102
0.08 | 0

101
0.13 | 0

ALMA SUBDIVISION
TOWNSHIP OF MAPLETON

N

LEGEND

- EX. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 101 / 0.13 | 0 — CATCHMENT NUMBER; % IMPERVIOUS; CATCHMENT AREA IN HECTARES
- MAJOR OVERLAND FLOW

30 0 20 40 80
1:2000 (m)

EXISTING CONDITIONS DRAINAGE AREA PLAN

Figure No. 3

GEI Consultants Canada

2401042 (120139)
MAY 2026
Scale: 1:2000 | NAD 1983 UTM Zone 17N

FILE:B:\Working\EXACT CONSTRUCTION\2401042 - 120139 Alma Subdivision\5 Work In Progress\Drafting\Sheets\Figures\120139 - SWM Figures.dwg LAYOUT:Ex SWM
LAST SAVED BY:Paumcc4070, 5/22/2026 11:56:16 AM PLOTTED BY:McCartney, Paul 5/22/2026 12:18:11 PM

GEI Consultants

Pre-Development Drainage Parameters

Alma Subdivision

Project #2401042

May 2026

Site Info

Land Cover	Pasture
Soil Type [1]	Huron Loam
Hydrologic Soil Group [1]	C
CN [2]	79
Slope	2.5

[1] Soil Survey Complex Database by Ontario Ministry of Agriculture, Food, and Rural Affairs

[2] based on MTO Manual (1993) chart H2-6A for the land use of "Pasture/Lawn" for Hydrologic Soil Group C

Time of Concentration (Airport Method) and Time to Peak

$$t_c = 3.26 * (1.1 - C) * L^{0.5} * S_w^{-0.33}$$

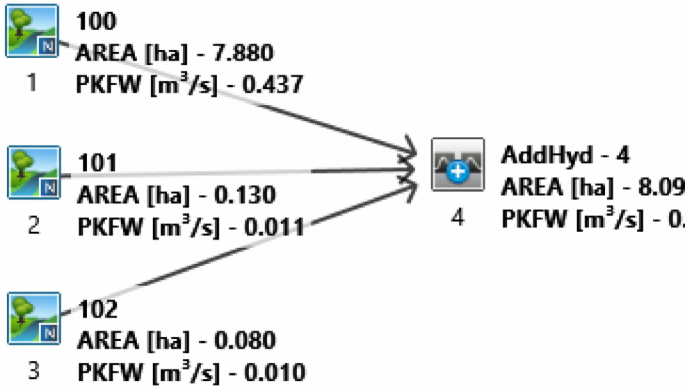
Where: t_c = time of concentration, minutes
C = runoff coefficient
L = watershed length, m
S_w = watershed slope, %

Catchments	Area (ha)	Flow Length	High Point (m)	Low Point (m)	Slope (%)	Tc (min)	N	Tp (hr)
100	7.88	547	447.00	437.50	1.74	57.19	3	0.64
101	0.13	110	438.00	436.65	1.23	28.76	3	0.32
102	0.08	45	442.40	441.00	3.11	13.53	3	0.15
Total	8.09							

Default VO Model Parameters (NASHYD)

Parameter	Description	Value
DT	Time Step Increment (min)	5
DWF	Dry Weather Flow (m^3/s)	0
CN	Curve Number	79
IA	Pervious Area Depression Storage (mm)	5.0
N	Number of Linear Reservoirs	3

Pre-Development VO Schematic



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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\07
dda0e1-5e5d-401e-8bb6-5e166d54007e\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\07
dda0e1-5e5d-401e-8bb6-5e166d54007e\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ********************************************
  ** SIMULATION : Run 1                      **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 758.485
| Ptotal= 35.69 mm |                          B=   7.538
--------------------                          C=   0.806
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.25	1.00	19.86	2.00	5.63	3.00	2.70
0.17	2.60	1.17	75.39	2.17	4.73	3.17	2.50
0.33	3.09	1.33	26.10	2.33	4.09	3.33	2.33
0.50	3.85	1.50	13.65	2.50	3.62	3.50	2.18
0.67	5.17	1.67	9.21	2.67	3.24	3.67	2.05
0.83	8.08	1.83	6.97	2.83	2.95	3.83	1.93

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.25	1.083	19.86	2.083	5.63	3.08	2.70
0.167	2.25	1.167	19.86	2.167	5.63	3.17	2.70
0.250	2.60	1.250	75.39	2.250	4.73	3.25	2.50
0.333	2.60	1.333	75.39	2.333	4.73	3.33	2.50
0.417	3.09	1.417	26.10	2.417	4.09	3.42	2.33
0.500	3.09	1.500	26.10	2.500	4.09	3.50	2.33
0.583	3.85	1.583	13.65	2.583	3.62	3.58	2.18
0.667	3.85	1.667	13.65	2.667	3.62	3.67	2.18
0.750	5.17	1.750	9.21	2.750	3.24	3.75	2.05
0.833	5.17	1.833	9.21	2.833	3.24	3.83	2.05
0.917	8.08	1.917	6.97	2.917	2.95	3.92	1.93
1.000	8.08	2.000	6.97	3.000	2.95	4.00	1.93

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.106 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 9.592
TOTAL RAINFALL (mm)= 35.693
RUNOFF COEFFICIENT = 0.269

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.25	1.083	19.86	2.083	5.63	3.08	2.70
0.167	2.25	1.167	19.86	2.167	5.63	3.17	2.70
0.250	2.60	1.250	75.39	2.250	4.73	3.25	2.50
0.333	2.60	1.333	75.39	2.333	4.73	3.33	2.50
0.417	3.09	1.417	26.10	2.417	4.09	3.42	2.33
0.500	3.09	1.500	26.10	2.500	4.09	3.50	2.33
0.583	3.85	1.583	13.65	2.583	3.62	3.58	2.18
0.667	3.85	1.667	13.65	2.667	3.62	3.67	2.18
0.750	5.17	1.750	9.21	2.750	3.24	3.75	2.05
0.833	5.17	1.833	9.21	2.833	3.24	3.83	2.05
0.917	8.08	1.917	6.97	2.917	2.95	3.92	1.93
1.000	8.08	2.000	6.97	3.000	2.95	4.00	1.93

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.003 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 9.583
TOTAL RAINFALL (mm)= 35.693
RUNOFF COEFFICIENT = 0.268

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.25	1.083	19.86	2.083	5.63	3.08	2.70
0.167	2.25	1.167	19.86	2.167	5.63	3.17	2.70
0.250	2.60	1.250	75.39	2.250	4.73	3.25	2.50
0.333	2.60	1.333	75.39	2.333	4.73	3.33	2.50
0.417	3.09	1.417	26.10	2.417	4.09	3.42	2.33
0.500	3.09	1.500	26.10	2.500	4.09	3.50	2.33
0.583	3.85	1.583	13.65	2.583	3.62	3.58	2.18
0.667	3.85	1.667	13.65	2.667	3.62	3.67	2.18
0.750	5.17	1.750	9.21	2.750	3.24	3.75	2.05
0.833	5.17	1.833	9.21	2.833	3.24	3.83	2.05
0.917	8.08	1.917	6.97	2.917	2.95	3.92	1.93
1.000	8.08	2.000	6.97	3.000	2.95	4.00	1.93

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.002 (i)
TIME TO PEAK (hrs)= 1.500
RUNOFF VOLUME (mm)= 9.532
TOTAL RAINFALL (mm)= 35.693
RUNOFF COEFFICIENT = 0.267

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

ADD HYD (0004)					
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0001):	7.88	0.106	2.17	9.59
+	ID2= 2 (0002):	0.13	0.003	1.75	9.58
	ID = 3 (0004):	8.01	0.108	2.17	9.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 3 (0004):	8.01	0.108	2.17	9.59
+	ID2= 2 (0003):	0.08	0.002	1.50	9.53
	ID = 1 (0004):	8.09	0.109	2.17	9.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\9f
3b600b-6c2a-4378-899c-05d62d4829b6\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\9f
3b600b-6c2a-4378-899c-05d62d4829b6\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ***********************************************
  ** SIMULATION : Run 2                         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 876.909
| Ptotal= 47.59 mm |                          B=   7.781
--------------------                          C=   0.780
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.33	1.00	26.31	2.00	7.99	3.00	3.97
0.17	3.83	1.17	92.89	2.17	6.78	3.17	3.69
0.33	4.52	1.33	34.15	2.33	5.90	3.33	3.44
0.50	5.57	1.50	18.51	2.50	5.25	3.50	3.23
0.67	7.37	1.67	12.75	2.67	4.73	3.67	3.05
0.83	11.26	1.83	9.79	2.83	4.32	3.83	2.89

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.180 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 16.471
TOTAL RAINFALL (mm)= 47.586
RUNOFF COEFFICIENT = 0.346

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.005 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 16.460
TOTAL RAINFALL (mm)= 47.586
RUNOFF COEFFICIENT = 0.346

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.004 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 16.370
TOTAL RAINFALL (mm)= 47.586
RUNOFF COEFFICIENT = 0.344

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

ADD HYD (0004)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	7.88	0.180	2.17	16.47
+ ID2= 2 (0002):	0.13	0.005	1.67	16.46
ID = 3 (0004):	8.01	0.183	2.17	16.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0004):	8.01	0.183	2.17	16.47
+ ID2= 2 (0003):	0.08	0.004	1.42	16.37
ID = 1 (0004):	8.09	0.184	2.17	16.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\bc
5f53cf-ca55-4c03-824f-792333f263eb\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\bc
5f53cf-ca55-4c03-824f-792333f263eb\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : Run 3                         **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 997.497
| Ptotal= 55.53 mm |                          B=   8.438
--------------------                          C=   0.775
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.00	1.00	30.98	2.00	9.55	3.00	4.76
0.17	4.58	1.17	104.23	2.17	8.11	3.17	4.42
0.33	5.41	1.33	40.04	2.33	7.07	3.33	4.13
0.50	6.67	1.50	21.97	2.50	6.28	3.50	3.88
0.67	8.82	1.67	15.20	2.67	5.67	3.67	3.66
0.83	13.43	1.83	11.69	2.83	5.17	3.83	3.46

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.237 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 21.627
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.389

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 21.615
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.389

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.005 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 21.499
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.387

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

ADD HYD (0004)					
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	7.88	0.237	2.17	21.63
+	ID2= 2 (0002):	0.13	0.006	1.67	21.62
	ID = 3 (0004):	8.01	0.241	2.17	21.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0004):	8.01	0.241	2.17	21.63
+	ID2= 2 (0003):	0.08	0.005	1.42	21.50
	ID = 1 (0004):	8.09	0.242	2.17	21.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH
==========
==========

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\54
b608e3-b859-4c5d-9d0f-5c102599091d\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\54
b608e3-b859-4c5d-9d0f-5c102599091d\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ***********************************************
  ** SIMULATION : Run 4                         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1145.741
| Ptotal= 65.80 mm |                          B=   9.035
--------------------                          C=   0.769
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.87	1.00	36.92	2.00	11.59	3.00	5.80
0.17	5.59	1.17	118.88	2.17	9.85	3.17	5.39
0.33	6.59	1.33	47.49	2.33	8.59	3.33	5.03
0.50	8.11	1.50	26.41	2.50	7.64	3.50	4.73
0.67	10.70	1.67	18.36	2.67	6.90	3.67	4.46
0.83	16.24	1.83	14.16	2.83	6.30	3.83	4.23

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.316 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 28.811
TOTAL RAINFALL (mm)= 65.805
RUNOFF COEFFICIENT = 0.438

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.008 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 28.795
TOTAL RAINFALL (mm)= 65.805
RUNOFF COEFFICIENT = 0.438

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.007 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 28.640
TOTAL RAINFALL (mm)= 65.805
RUNOFF COEFFICIENT = 0.435

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

ADD HYD (0004)					
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):		7.88	0.316	2.17	28.81
+ ID2= 2 (0002):		0.13	0.008	1.67	28.80
ID = 3 (0004):		8.01	0.321	2.17	28.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0004):		8.01	0.321	2.17	28.81
+ ID2= 2 (0003):		0.08	0.007	1.42	28.64
ID = 1 (0004):		8.09	0.323	2.08	28.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\60
4383dd-069e-4ea3-8bc9-976903c6acfd\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\60
4383dd-069e-4ea3-8bc9-976903c6acfd\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ********************************************
  ** SIMULATION : Run 5                      **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1273.113
| Ptotal= 72.61 mm |                          B=   9.492
--------------------                          C=   0.770
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.39	1.00	41.02	2.00	12.88	3.00	6.42
0.17	6.19	1.17	129.32	2.17	10.94	3.17	5.96
0.33	7.30	1.33	52.68	2.33	9.53	3.33	5.57
0.50	8.99	1.50	29.40	2.50	8.47	3.50	5.23
0.67	11.89	1.67	20.44	2.67	7.64	3.67	4.93
0.83	18.08	1.83	15.75	2.83	6.98	3.83	4.67

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.373 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 33.831
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.466

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 33.815
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.466

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.008 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 33.630
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.463

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

ADD HYD (0004)					
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):		7.88	0.373	2.17	33.83
+ ID2= 2 (0002):		0.13	0.009	1.67	33.82
ID = 3 (0004):		8.01	0.379	2.08	33.83

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0004):		8.01	0.379	2.08	33.83
+ ID2= 2 (0003):		0.08	0.008	1.42	33.63
ID = 1 (0004):		8.09	0.382	2.08	33.83

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\8e
8bc9ee-fc62-43a5-a500-3647d3bf10d2\s
  Summary filename:
C:\Users\helpen3241\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\8e
8bc9ee-fc62-43a5-a500-3647d3bf10d2\s


DATE: 05/13/2026                          TIME: 03:41:00

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ***********************************************
  ** SIMULATION : Run 6                         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1357.120
| Ptotal= 80.43 mm |                          B=   9.595
--------------------                          C=   0.763
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.12	1.00	45.28	2.00	14.47	3.00	7.28
0.17	7.01	1.17	140.19	2.17	12.31	3.17	6.76
0.33	8.26	1.33	57.98	2.33	10.75	3.33	6.32
0.50	10.15	1.50	32.65	2.50	9.57	3.50	5.94
0.67	13.37	1.67	22.82	2.67	8.65	3.67	5.61
0.83	20.21	1.83	17.65	2.83	7.90	3.83	5.31

CALIB NASHYD (0001)	Area (ha)= 7.88	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.64	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.470

PEAK FLOW (cms)= 0.437 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 39.801
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.495

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

CALIB			
NASHYD (0002)	Area (ha)= 0.13	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.32		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.016

PEAK FLOW (cms)= 0.011 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 39.783
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.495

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

CALIB			
NASHYD (0003)	Area (ha)= 0.08	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.15		

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.010 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 39.565
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.492

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

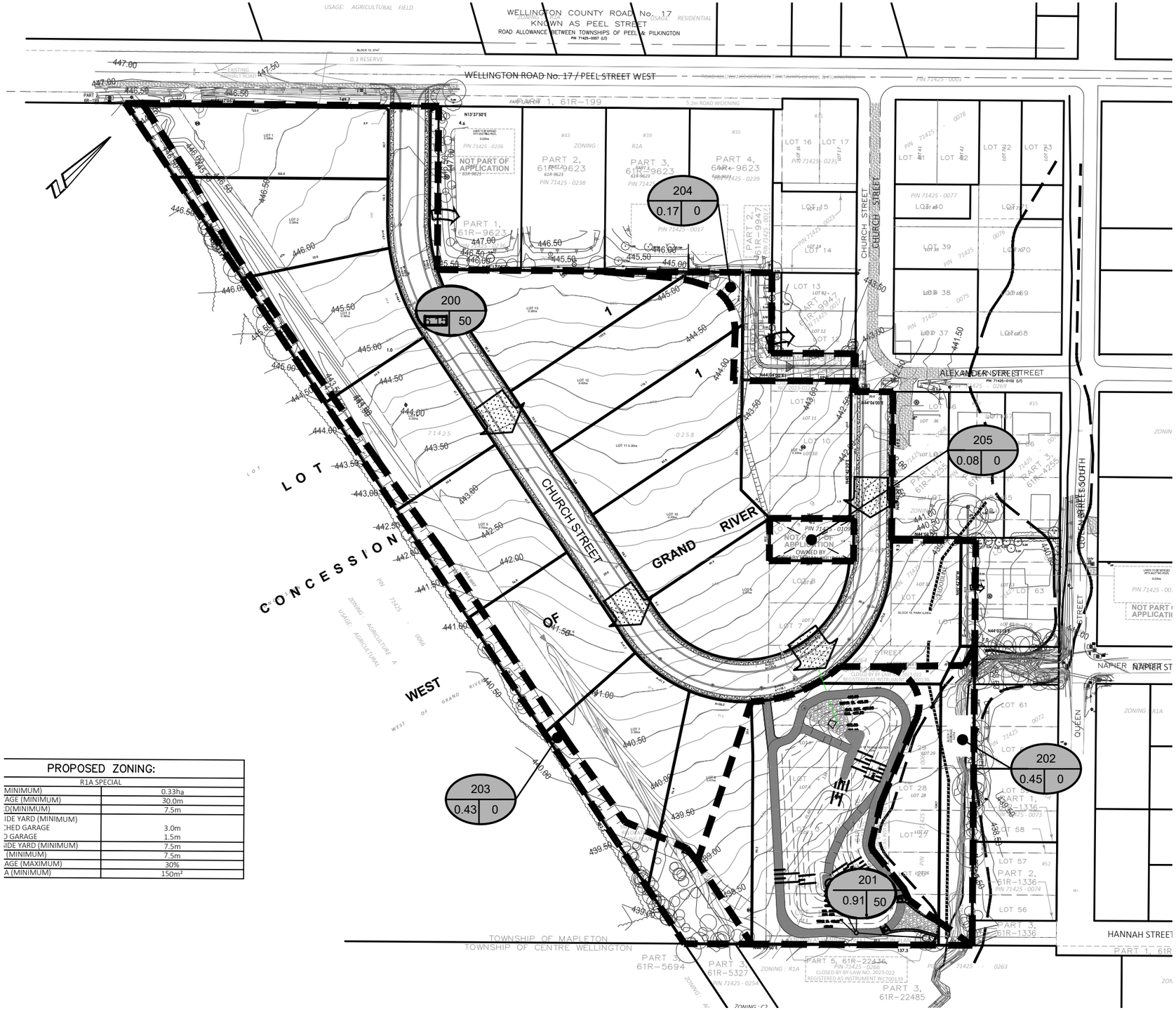
ADD HYD (0004)					
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	7.88	0.437	2.17	39.80
+	ID2= 2 (0002):	0.13	0.011	1.67	39.78
	ID = 3 (0004):	8.01	0.445	2.08	39.80

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0004):	8.01	0.445	2.08	39.80
+	ID2= 2 (0003):	0.08	0.010	1.42	39.57
	ID = 1 (0004):	8.09	0.448	2.08	39.80

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ALMA SUBDIVISION
TOWNSHIP OF MAPLETON



LEGEND

- PROP. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 201 / 0.91 / 50 — CATCHMENT NUMBER; % IMPERVIOUS; CATCHMENT AREA IN HECTARES
- MAJOR OVERLAND FLOW

30 0 20 40 80

1:2000 (m)

PROPOSED ZONING:	
R1A SPECIAL	
MINIMUM)	0.33ha
AGE (MINIMUM)	30.0m
D(MINIMUM)	7.5m
IDE YARD (MINIMUM)	
CHED GARAGE	3.0m
D GARAGE	1.5m
IDE YARD (MINIMUM)	7.5m
(MINIMUM)	7.5m
AGE (MAXIMUM)	30%
A (MINIMUM)	150m²

POST DEVELOPMENT DRAINAGE AREA PLAN

Figure No. 4

GEI Consultants Canada

2401042 (120139)
MAY 2026
Scale: 1:2000 | NAD 1983 UTM Zone 17N

FILE:B:\Working\EXACT CONSTRUCTION\2401042 - 120139 Alma Subdivision\5 Work In Progress\Drafting\Sheets\Figures\120139 - SWM Figures.dwg LAYOUT:Post SWM
LAST SAVED BY:Paumcc4070, 5/22/2026 11:56:16 AM PLOTTED BY:McCartney, Paul 5/22/2026 12:18:17 PM

GEI Consultants

Post-Development Drainage Parameters

Alma Subdivision

Project #2401042

May 2026

NASHYD

Catchments	Area (ha)	Flow Length	High Point (m)	Low Point (m)	Slope (%)	Tc (min)	N	Tp (hr)
202	0.45	300	446.00	439.00	2.33	38.42	3	0.43
203	0.43	110	438.00	436.65	1.23	28.76	3	0.32
204	0.17	89	444.40	442.12	2.56	20.29	3	0.23
205	0.08	45	442.4	441	3.11	13.53	3	0.15

Airport Method

$$t_c = 3.26 * (1.1 - C) * L^{0.5} * S_w^{-0.33}$$

Where: t_c = time of concentration, minutes
C = runoff coefficient
L = watershed length, m
S_w = watershed slope, %

Default VO Model Parameters (NASHYD)

Parameter	Description	Value
DT	Time Step Increment (min)	5
DWF	Dry Weather Flow (m^3/s)	0
IA	Pervious Area Depression Storage (mm)	5.0
N	Number of Linear Reservoirs	3

VO Model Parameters (STANHYD)

STANDHYD		Value
LGI	Overland Flow Length (Impervious)	40.0
DT	Time Step Increment	5 min
SLPI	Average Slope (Impervious)	1%
DWF	Dry Weather Flow (Base Flow)	0.00
LOSS	Rainfall Loss Method. Curve Number for lawn (fair condition).	CN* = 79, Ia = 5
SLPP	Average Slope (Pervious)	2%
MNP	Mannings Roughness Coefficient (Pervious)	0.25
DPSI	Depression Storage (Impervious)	1.5 mm
MNI	Manning's Roughness Coefficient (Impervious)	0.013

Catchments	Area (ha)	Imperviousness (TIMP)	XIMP	LGI
200	6.15	0.50	0.43	202.48
201	0.91	0.50	0.43	77.89

GEI Consultants

Quality Pond Sizing

Alma Subdivision
Project #2401042
May 2026

Quality Pond Sizing

Total Post Development Tributary Drainage Area	7.07	ha
Percent impervous	49%	
MOE Storage Volume:	176	m^3 / ha
MOE Extended Detention:	40	m^3 / imp ha
MOE Permanent Pool:	136	m^3 / ha
Required Permanent Pool Volume:	**962.2**	**m^3**
Provided Permanent Pool Volume:	**1,679.7**	**m^3**

MOE 2003 SWMP Manual: Table 3.2
Water Quality Storage Requirements based on Receiving Waters

PROTECTION LEVEL	STORAGE VOLUME (m^3/ha) FOR IMPERVIOUS LEVEL				
	35%	55%	**49%**	70%	85%
Enhanced	140	190	**176**	225	250
Normal	90	110	**104**	130	150
Basic	60	75	**71**	85	95

* Table 3.2 from the MOE SWMP Planning & Design Manual, 2004, pg 3-10

Required MOE Extended Detention Volume (40m^3/ha):	**282.8**	**m^3**
25mm Storm Event Runoff Volume:	13.19	mm
Required 25mm Event Extended Detention Volume:	**932.5**	**m^3**
Provided Extended Detention Volume:	**939.2**	**m^3**

Forebay Sizing

Settling Calculations

Water Quality Design Flow Rate from Pond (Q_p) =	0.034	m^3/s
Length to Width Ratio of Forebay (r) =	1.9	:1
Settling Velocity (V_s) =	0.0003	m/s
Minimum Forebay Length for Settling =	**14.5**	**m**

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

Eq. 4.5
MOE SWM Planning and Design Manual, 2003

Inlet Flowrate (Q) (5yr)	0.811	m^3/s
Permanent Pool Depth in Forebay (d)	1	m
Desired velocity in forebay (V_f)	0.5	m/s
Minimum Dispersion Length =	**13.0**	**m**
Minimum length of forebay =	**14.5**	**m**
Minimum Bottom Width =	**1.8**	**m**

$$Dist = \frac{8Q}{dV_F}$$

Eq. 4.6
MOE SWM Planning and Design Manual, 2003

Proposed Forebay Dimentions:

Length:	37.0 m
Width:	20.0 m
Bottom Width:	4.5 m

The proposed forebay meets all minimum size requirements.

GEI Consultants

Extended Detention Calculation
SWM Pond 24 - Ultimate Condition

Seaton Whitevale North Subdivision
File No. 2201271
May 2026

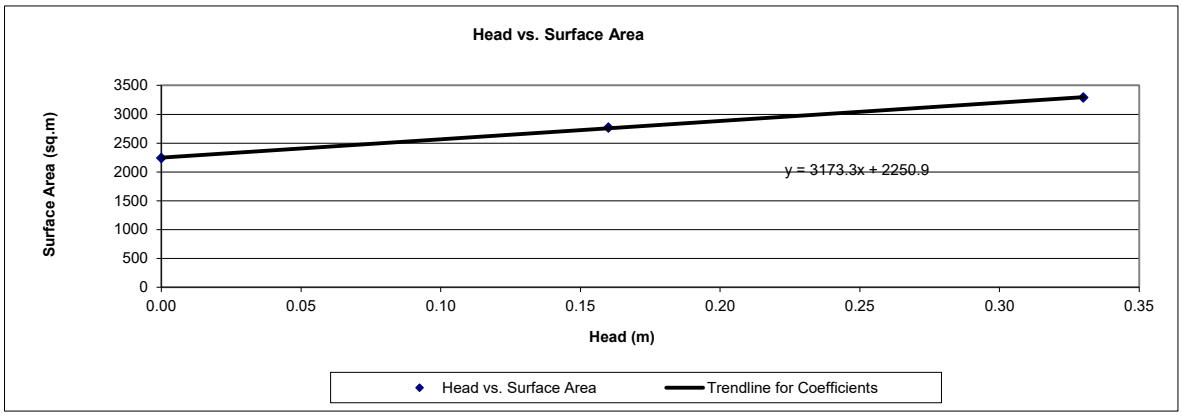
Erosion Control Volume

Required MOE Extended Detention Volume (40m3/ha):	282.8	m^3
Required 25mm Event Extended Detention Volume:	938.2	m^3
Provided Extended Detention Volume:	939.2	m^3
Minimum Required Extended Detention Drawdown Time:	24	hours

MOE Detention Time Calculation:

Active Storage:

	Elevation (m)	Head (m)	Surface Area (m^2)	Active Storage Volume (m^3)
Permanent Pool	437.30	0.00	2246	0
	437.46	0.16	2769	470
Ext. Det.	437.63	0.33	3293	939



Slope Eq'n: y=mx+b

m=	3173		
b=	2251		
Circular Orifice Diameter=	0.110	m	
Circular Orifice Area =	0.010	m^2	
Total Orifice Area (A_o)=	0.0095	m^2	
h=	0.33	m	
t=	$((0.66*C_1*h^{1.5})+(2*C_2*h^{0.5}))/2.75A_o$		*Equation 4.11, MOE SWM Planning and Design Manual*
t=	((0.66*3173*0.33^1.5)+(2*2251*0.33^0.5))/2.75*0.0095		
t=	114189.4	s	
Ext. Det. =	**31.7**	**hr**	
Extended Detention Drawdown Rate =	**8.2**	**L/s**	

GEI Consultants

SWM Pond - Orifice and Storage Sizing

Alma Subdivision
Project #2401042
May 2026

Orifice Equation: $Q = C \times A \times \sqrt{2 \times g \times h}$

Weir Equation: $Q = C \times W \times H^{3/2}$

Orifice Coefficient 0.600

Bottom Draw/Orifice 1

Description	Value	Unit
NWL	437.30	m
Orifice Diameter	0.110	m
Orifice Area	0.010	m^2
Control Elevation	437.36	m

Orifice 2

Elevation	437.63	m
Orifice Diameter	0.320	m
Orifice Area	0.080	m^2
Control Elevation	437.79	m

Orifice 3

Elevation	437.75	m
Orifice Diameter	0.420	mm
Orifice Area	0.139	m^2
Control Elevation	437.96	m

Headwater Elevation (m)	Head @ Centroid 1 (m)	Head @ Centroid 2 (m)	Head @ Centroid 3 (m)	Total Release Rate (m^3/s)	Permanent Pool	Total Active Storage Available (m^3)	Extended Detention (m^3)	2 - 100yr Storage (m^3)	
435.10					0				Bottom of Pond
436.30					314.40				Bottom of Forebay
437.30	0.000	0.000	0.000	0.0000	1679.65	0.0000	0.0000	0.000	NWL
437.40	0.005	0.000	0.000	0.0054		270.31	270.31	0.000	
437.50	0.010	0.000	0.000	0.0096		540.63	540.63	0.000	
437.60	0.013	0.000	0.000	0.0125		810.95	810.95	0.000	
437.63	0.013	0.000	0.000	0.0132		939.18	939.18	0.000	Extended Detention
437.70	0.015	0.000	0.000	0.0148		1222.50		283.325	
437.80	0.017	0.021	0.000	0.0382		1627.25		688.075	
437.90	0.019	0.071	0.000	0.0895		2032.00		1092.825	
438.00	0.020	0.098	0.074	0.1919		2436.75		1497.575	
438.10	0.022	0.119	0.138	0.2786		2841.50		1902.325	
438.25	0.024	0.145	0.198	0.3671		3448.63		2509.450	
438.30	0.025	0.153	0.215	0.3919		3651.00		2711.825	HWL
438.50	0.027	0.180	0.271	0.4777		4603.70		3954.946	Max Emergency Weir Flow
438.80	0.030	0.215	0.337	0.5826		6032.75		5383.996	Top of Pond

GEI Consultants

Sediment Accumulation

Alma Subdivision
Project #2401042
May 2026

Forebay Sediment Accumulation

Tributary Site Drainage Area:	7.07	ha
Percent impervous:	49%	
Annual Loading per Hectare:	1.54	m^3/ha/year
Annual Sediment Loading:	**10.9**	**m^3/year**
10 Year Sediment Loading:	**109**	**m^3**
10 Year Sediment Elevation in Forebay:	**436.8**	**m**
Provided Forebay Volume:	**380.29**	**m^3**
Required Cleanout Frequency:	**35.0**	**years**

MOE 2003 SWMP Manual: Table 6.3
Forebay Storage Requirements based on Sediment Loading

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m^3)	Annual Loading (m^3/ha)
35%	770	1230	0.6
49%	**1874**	**1230**	**1.5**
55%	2300	1230	1.9
70%	3495	1230	2.8
85%	4680	1230	3.8

* Table 6.3 from the MOE SWMP Planning & Design Manual, 2003, pg 6-13

GEI Consultants

Sediment Cleanout Frequency Calculations (Forebay Volume Reduced by 50%)

Alma Subdivision
Project #2401042
May 2026

Forebay Volume Reduced by 50%

Total SWM Pond Forebay Volume =	380	m^3
50% of SWM Pond Forebay Volume =	190	m^3
Annual Sediment Loading =	10.9	m^3/year
Number of Years of Sediment Accumulation reducing the Pond Forebay Volume by 50% =	**17**	**years**

GEI Consultants

Sediment Cleanout Frequency Calculations (5% Reduction in TSS Removal)

Alma Subdivision
Project #2401042
May 2026

Drainage Parameters

Area to SWM Pond =	7.07	ha
Percent Imperviousness =	49%	

Quality Pond Volume (75% TSS Removal)

Storage Volume =	140	m^3 / ha
Extended Detention =	40	m^3 / ha
Permanent Pool =	100	m^3 / ha
Required Permanent Pool Volume (75% TSS Removal) =	**704**	**m^3**

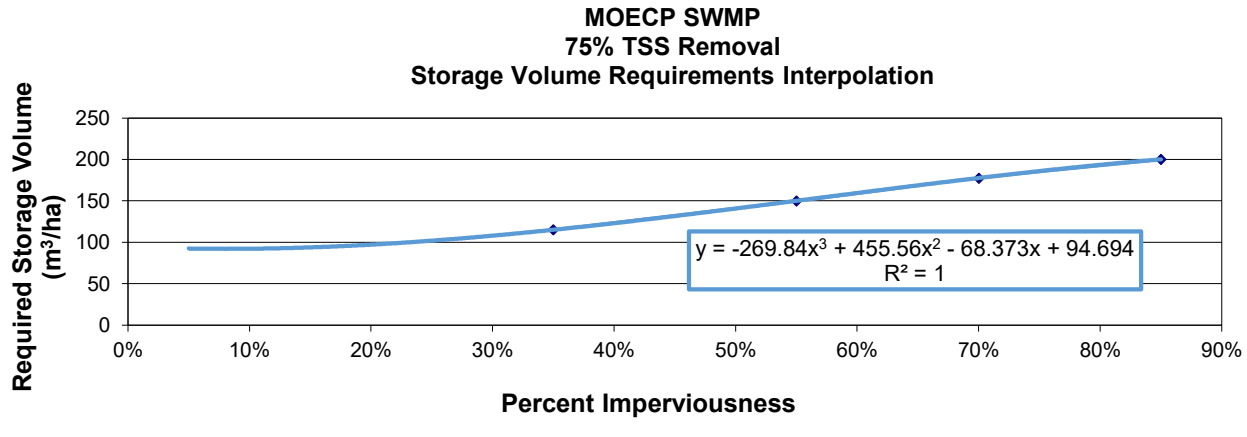
Clean-Out Frequency

Provided Permanent Pool Volume =	1,680	m^3
Permanent Pool Volume (75% TSS Removal) =	704	m^3
Reduction in Permanent Pool Volume to reduce TSS Removal to 75% =	975	m^3
Annual Sediment Loading =	10.9	m^3/year
Number of Years of Sediment Accumulation to Reduce TSS Removal Efficiency by 5% =	**90**	**years**

MOE 2003 SWMP Manual: Water Quality Storage Requirements based on Receiving Waters *

PROTECTION LEVEL	SWMP Type	STORAGE VOLUME (m^3 / ha) FOR IMPERVIOUS LEVEL				
		35%	55%	70%	49.4%	85%
Enhanced (80% TSS Removal)	Wet Pond	140	190	225		250
5% Reduction in TSS Removal (75% TSS Removal)	Wet Pond	*115*	*150*	*178*	***140***	*200*
Normal (70% TSS Removal)	Wet Pond	90	110	130		150
Basic (60% TSS Removal)	Wet Pond	60	75	85		95

* Table 3.2 from the MOE SWMP Planning & Design Manual, 2004, pg 3-10



Worksheet for Emergency Spillway

Project Description	
Solve For	Headwater Elevation

Input Data		
Discharge	1.4330	m³/s
Crest Elevation	438.30	m
Tailwater Elevation	0.00	m
Crest Surface Type	Paved	
Crest Breadth	1.219	m
Crest Length	15.00	m

Results		
Headwater Elevation	438.45	m
Headwater Height Above Crest	0.15	m
Tailwater Height Above Crest	-438.30	m
Weir Coefficient	1.66	m^(1/2)/s
Submergence Factor	1.000	
Adjusted Weir Coefficient	1.66	m^(1/2)/s
Flow Area	2.24	m²
Velocity	0.641	m/s
Wetted Perimeter	15.30	m
Top Width	15.000	m

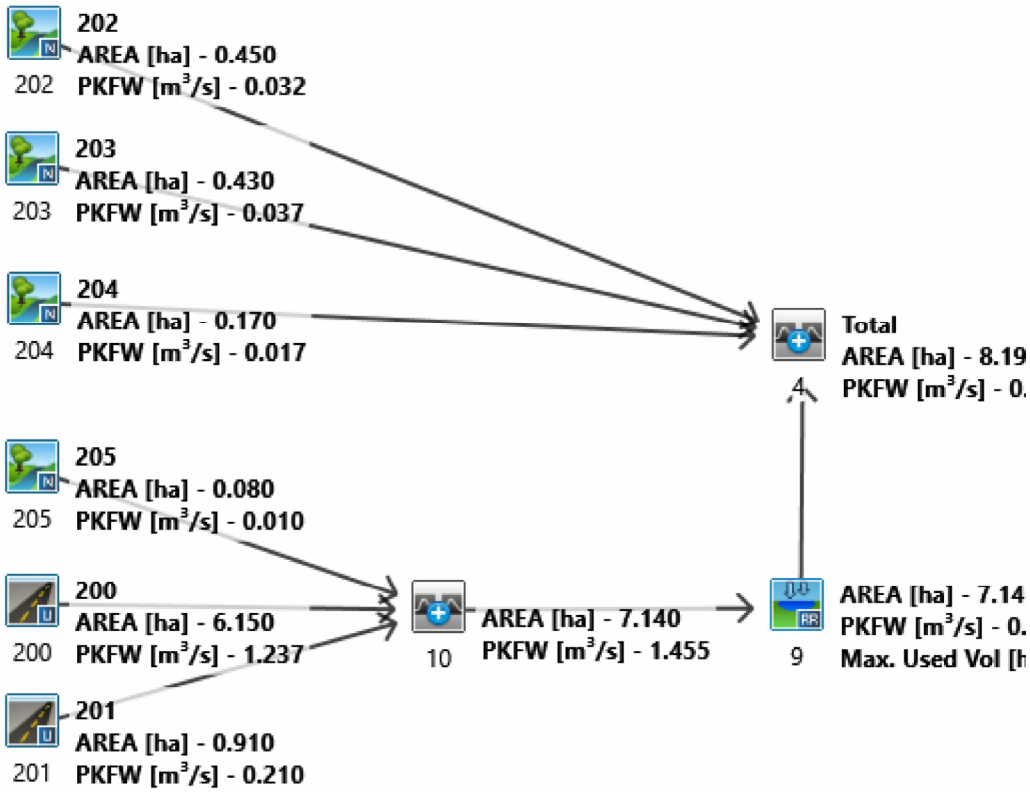
Worksheet for Emergency Spillway

Notes:

QRegoinal = 0.983 m3/s
Q100yr = 1.433 m3/s

100-year inflow to pond was selected for emergency spillway design.

Post-Development VO Schematic



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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\92
d5c380-af38-4f3a-9c53-764631140d0b\s
  Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\92
d5c380-af38-4f3a-9c53-764631140d0b\s


DATE: 05/22/2026                          TIME: 11:34:58

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ********************************************
  ** SIMULATION : 25mmChicago                **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\andree4107\AppD
|                  |              ata\Local\Temp\
```

| | dae57656-cc81-452b-a645-952a8ebf6973\7baed8a1
| Ptotal= 25.02 mm | Comments: 25mmChicago

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	1.17	6.20	2.33	4.80	3.50	2.62
0.17	2.17	1.33	12.18	2.50	4.21	3.67	2.47
0.33	2.38	1.50	41.67	2.67	3.78	3.83	2.35
0.50	2.66	1.67	15.28	2.83	3.45	4.00	2.23
0.67	3.03	1.83	9.22	3.00	3.18		
0.83	3.58	2.00	6.88	3.17	2.95		
1.00	4.47	2.17	5.62	3.33	2.76		

CALIB	
NASHYD (0202)	Area (ha)= 0.45 Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.43

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	4.47	2.250	5.62	3.33	2.95
0.167	0.00	1.250	6.20	2.333	5.62	3.42	2.76
0.250	2.17	1.333	6.20	2.417	4.80	3.50	2.76
0.333	2.17	1.417	12.18	2.500	4.80	3.58	2.62
0.417	2.38	1.500	12.18	2.583	4.21	3.67	2.62
0.500	2.38	1.583	41.67	2.667	4.21	3.75	2.47
0.583	2.66	1.667	41.67	2.750	3.78	3.83	2.47
0.667	2.66	1.750	15.28	2.833	3.78	3.92	2.35
0.750	3.03	1.833	15.28	2.917	3.45	4.00	2.35
0.833	3.03	1.917	9.22	3.000	3.45	4.08	2.23
0.917	3.58	2.000	9.22	3.083	3.18	4.17	2.23
1.000	3.58	2.083	6.88	3.167	3.18		
1.083	4.47	2.167	6.88	3.250	2.95		

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.003 (i)
TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 4.577
TOTAL RAINFALL (mm)= 25.023
RUNOFF COEFFICIENT = 0.183

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   0.43   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.00 | 1.167    4.47 | 2.250    5.62 |  3.33    2.95
              0.167    0.00 | 1.250    6.20 | 2.333    5.62 |  3.42    2.76
              0.250    2.17 | 1.333    6.20 | 2.417    4.80 |  3.50    2.76
              0.333    2.17 | 1.417   12.18 | 2.500    4.80 |  3.58    2.62
              0.417    2.38 | 1.500   12.18 | 2.583    4.21 |  3.67    2.62
              0.500    2.38 | 1.583   41.67 | 2.667    4.21 |  3.75    2.47
              0.583    2.66 | 1.667   41.67 | 2.750    3.78 |  3.83    2.47
              0.667    2.66 | 1.750   15.28 | 2.833    3.78 |  3.92    2.35
              0.750    3.03 | 1.833   15.28 | 2.917    3.45 |  4.00    2.35
              0.833    3.03 | 1.917    9.22 | 3.000    3.45 |  4.08    2.23
              0.917    3.58 | 2.000    9.22 | 3.083    3.18 |  4.17    2.23
              1.000    3.58 | 2.083    6.88 | 3.167    3.18 |
              1.083    4.47 | 2.167    6.88 | 3.250    2.95 |

     Unit Hyd Qpeak  (cms)=   0.051

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   4.577
     TOTAL RAINFALL   (mm)=  25.023
     RUNOFF COEFFICIENT   =   0.183

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   0.08   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	4.47	2.250	5.62	3.33	2.95
0.167	0.00	1.250	6.20	2.333	5.62	3.42	2.76
0.250	2.17	1.333	6.20	2.417	4.80	3.50	2.76
0.333	2.17	1.417	12.18	2.500	4.80	3.58	2.62
0.417	2.38	1.500	12.18	2.583	4.21	3.67	2.62
0.500	2.38	1.583	41.67	2.667	4.21	3.75	2.47
0.583	2.66	1.667	41.67	2.750	3.78	3.83	2.47
0.667	2.66	1.750	15.28	2.833	3.78	3.92	2.35
0.750	3.03	1.833	15.28	2.917	3.45	4.00	2.35
0.833	3.03	1.917	9.22	3.000	3.45	4.08	2.23
0.917	3.58	2.000	9.22	3.083	3.18	4.17	2.23
1.000	3.58	2.083	6.88	3.167	3.18		
1.083	4.47	2.167	6.88	3.250	2.95		

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 4.549
TOTAL RAINFALL (mm)= 25.023
RUNOFF COEFFICIENT = 0.182

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

CALIB STANDHYD (0200) ID= 1 DT= 5.0 min	Area (ha)= 6.15 Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.08	3.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	202.48	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	4.47	2.250	5.62	3.33	2.95
0.167	0.00	1.250	6.20	2.333	5.62	3.42	2.76
0.250	2.17	1.333	6.20	2.417	4.80	3.50	2.76
0.333	2.17	1.417	12.18	2.500	4.80	3.58	2.62
0.417	2.38	1.500	12.18	2.583	4.21	3.67	2.62
0.500	2.38	1.583	41.67	2.667	4.21	3.75	2.47

0.583	2.66	1.667	41.67	2.750	3.78	3.83	2.47
0.667	2.66	1.750	15.28	2.833	3.78	3.92	2.35
0.750	3.03	1.833	15.28	2.917	3.45	4.00	2.35
0.833	3.03	1.917	9.22	3.000	3.45	4.08	2.23
0.917	3.58	2.000	9.22	3.083	3.18	4.17	2.23
1.000	3.58	2.083	6.88	3.167	3.18		
1.083	4.47	2.167	6.88	3.250	2.95		

			TOTALS
Max.Eff.Inten.(mm/hr)=	41.67	5.66	
over (min)	5.00	30.00	
Storage Coeff. (min)=	5.54 (ii)	27.79 (ii)	
Unit Hyd. Tpeak (min)=	5.00	30.00	
Unit Hyd. peak (cms)=	0.20	0.04	
PEAK FLOW (cms)=	0.27	0.03	0.273 (iii)
TIME TO PEAK (hrs)=	1.67	2.25	1.67
RUNOFF VOLUME (mm)=	23.52	5.58	13.29
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.94	0.22	0.53

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201)	Area (ha)= 0.91
ID= 1 DT= 5.0 min	Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.46	0.46
Dep. Storage (mm)=	1.50	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	77.89	40.00
Mannings n =	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	4.47	2.250	5.62	3.33	2.95
0.167	0.00	1.250	6.20	2.333	5.62	3.42	2.76
0.250	2.17	1.333	6.20	2.417	4.80	3.50	2.76
0.333	2.17	1.417	12.18	2.500	4.80	3.58	2.62

0.417	2.38	1.500	12.18	2.583	4.21	3.67	2.62
0.500	2.38	1.583	41.67	2.667	4.21	3.75	2.47
0.583	2.66	1.667	41.67	2.750	3.78	3.83	2.47
0.667	2.66	1.750	15.28	2.833	3.78	3.92	2.35
0.750	3.03	1.833	15.28	2.917	3.45	4.00	2.35
0.833	3.03	1.917	9.22	3.000	3.45	4.08	2.23
0.917	3.58	2.000	9.22	3.083	3.18	4.17	2.23
1.000	3.58	2.083	6.88	3.167	3.18		
1.083	4.47	2.167	6.88	3.250	2.95		

Max.Eff.Inten.(mm/hr)=	41.67	5.66	
over (min)	5.00	30.00	
Storage Coeff. (min)=	3.12 (ii)	25.37 (ii)	
Unit Hyd. Tpeak (min)=	5.00	30.00	
Unit Hyd. peak (cms)=	0.27	0.04	
			TOTALS
PEAK FLOW (cms)=	0.04	0.00	0.045 (iii)
TIME TO PEAK (hrs)=	1.67	2.25	1.67
RUNOFF VOLUME (mm)=	23.52	5.58	13.28
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.94	0.22	0.53

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0010)					
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.	
	(ha)	(cms)	(hrs)	(mm)	
ID1= 1 (0200):	6.15	0.273	1.67	13.29	
+ ID2= 2 (0201):	0.91	0.045	1.67	13.28	
ID = 3 (0010):	7.06	0.318	1.67	13.29	

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):	7.06	0.318	1.67	13.29	
+ ID2= 2 (0205):	0.08	0.001	1.83	4.55	

```
        ==================================================
        ID = 1 (  0010):     7.14   0.318     1.67    13.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.1919      0.1498
                          0.0148     0.0283    |   0.2786      0.1902
                          0.0382     0.0688    |   0.3671      0.2509
                          0.0895     0.1093    |   0.3919      0.2712

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0010)      7.140      0.318      1.67      13.19
   OUTFLOW: ID= 1 (  0009)      7.140      0.034      4.00      13.13

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.82
                  TIME SHIFT OF PEAK FLOW         (min)=140.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0623

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

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


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.00 | 1.167    4.47 | 2.250    5.62 |  3.33    2.95
              0.167    0.00 | 1.250    6.20 | 2.333    5.62 |  3.42    2.76
              0.250    2.17 | 1.333    6.20 | 2.417    4.80 |  3.50    2.76
              0.333    2.17 | 1.417   12.18 | 2.500    4.80 |  3.58    2.62
              0.417    2.38 | 1.500   12.18 | 2.583    4.21 |  3.67    2.62
              0.500    2.38 | 1.583   41.67 | 2.667    4.21 |  3.75    2.47
              0.583    2.66 | 1.667   41.67 | 2.750    3.78 |  3.83    2.47
              0.667    2.66 | 1.750   15.28 | 2.833    3.78 |  3.92    2.35
              0.750    3.03 | 1.833   15.28 | 2.917    3.45 |  4.00    2.35
              0.833    3.03 | 1.917    9.22 | 3.000    3.45 |  4.08    2.23
              0.917    3.58 | 2.000    9.22 | 3.083    3.18 |  4.17    2.23
              1.000    3.58 | 2.083    6.88 | 3.167    3.18 |
              1.083    4.47 | 2.167    6.88 | 3.250    2.95 |
```

```
     Unit Hyd Qpeak  (cms)=   0.028

     PEAK FLOW       (cms)=   0.001 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   4.571
     TOTAL RAINFALL   (mm)=  25.023
     RUNOFF COEFFICIENT   =   0.183

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.45   0.003     2.33     4.58
      + ID2= 2 (  0203):     0.43   0.003     2.08     4.58
        ================================================
        ID = 3 (  0004):     0.88   0.006     2.17     4.58

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.006     2.17     4.58
      + ID2= 2 (  0204):     0.17   0.001     2.00     4.57
        ================================================
        ID = 1 (  0004):     1.05   0.007     2.17     4.58

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.05   0.007     2.17     4.58
      + ID2= 2 (  0009):     7.14   0.034     4.00    13.13
        ================================================
        ID = 3 (  0004):     8.19   0.038     3.58    12.03

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

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

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

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\a2292783-915d-435b-a5a3-4e236875725d\s
Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\a2292783-915d-435b-a5a3-4e236875725d\s

DATE: 05/22/2026 TIME: 11:34:58

USER:

COMMENTS: _____

****
** SIMULATION : Hazel **
****

READ STORM	Filename: C:\Users\andree4107\AppData\Local\Temp\dae57656-cc81-452b-a645-952a8ebf6973\c7da8ba2
Ptotal=212.00 mm	Comments: Hazel

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.00	3.00	13.00	6.00	23.00	9.00	53.00
1.00	4.00	4.00	17.00	7.00	13.00	10.00	38.00
2.00	6.00	5.00	13.00	8.00	13.00	11.00	13.00

CALIB			
NASHYD (0202)	Area (ha)=	0.45	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.43	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00

2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.054 (i)
TIME TO PEAK (hrs)= 10.167
RUNOFF VOLUME (mm)= 156.071
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.736

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

CALIB NASHYD (0203) ID= 1 DT= 5.0 min	Area (ha)= 0.43	Curve Number (CN)= 79.0	# of Linear Res.(N)= 3.00	U.H. Tp(hrs)= 0.32

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00

1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.054 (i)
TIME TO PEAK (hrs)= 10.083
RUNOFF VOLUME (mm)= 156.039
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.736

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

CALIB					
NASHYD (0205)	Area (ha)=	0.08	Curve Number (CN)=	79.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.15			

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00

0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.011 (i)
TIME TO PEAK (hrs)= 10.000
RUNOFF VOLUME (mm)= 155.183
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.732

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

CALIB
STANDHYD (0200)
ID= 1 DT= 5.0 min

Area (ha)= 6.15
Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.08	3.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	202.48	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	56.08	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.03 (ii)	13.92 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.21	0.08	
			TOTALS

PEAK FLOW (cms)=	0.39	0.47	0.856 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	210.50	163.70	183.82
TOTAL RAINFALL (mm)=	212.00	212.00	212.00
RUNOFF COEFFICIENT =	0.99	0.77	0.87

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201) | Area (ha)= 0.91
ID= 1 DT= 5.0 min | Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.46	0.46
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	77.89	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00

1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	56.08	
over (min)	5.00	15.00	
Storage Coeff. (min)=	2.83 (ii)	11.73 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.28	0.09	
			TOTALS
PEAK FLOW (cms)=	0.06	0.07	0.127 (iii)
TIME TO PEAK (hrs)=	9.67	10.00	10.00
RUNOFF VOLUME (mm)=	210.50	163.70	183.81
TOTAL RAINFALL (mm)=	212.00	212.00	212.00
RUNOFF COEFFICIENT =	0.99	0.77	0.87

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0010)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0200):	6.15	0.856	10.00	183.82
+ ID2= 2 (0201):	0.91	0.127	10.00	183.81
ID = 3 (0010):	7.06	0.983	10.00	183.82

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0010)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0010):	7.06	0.983	10.00	183.82
	+ ID2= 2 (0205):	0.08	0.011	10.00	155.18
	ID = 1 (0010):	7.14	0.993	10.00	183.50

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0009)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1919	0.1498
	0.0148	0.0283	0.2786	0.1902
	0.0382	0.0688	0.3671	0.2509
	0.0895	0.1093	0.3919	0.2712

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0010)	7.140	0.993	10.00	183.50
OUTFLOW: ID= 1 (0009)	7.140	0.591	11.08	183.43

PEAK FLOW REDUCTION [Qout/Qin](%)= 59.52
TIME SHIFT OF PEAK FLOW (min)= 65.00
MAXIMUM STORAGE USED (ha.m.)= 0.4341

CALIB			
NASHYD (0204)	Area (ha)= 0.17	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.23		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00

0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.028

PEAK FLOW (cms)= 0.022 (i)
TIME TO PEAK (hrs)= 10.000
RUNOFF VOLUME (mm)= 155.913
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.735

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

ADD HYD (0004)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	0.45	0.054	10.17	156.07

```
      + ID2= 2 (  0203):     0.43   0.054    10.08   156.04
        ================================================
        ID = 3 (  0004):     0.88   0.108    10.08   156.06

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.108    10.08   156.06
      + ID2= 2 (  0204):     0.17   0.022    10.00   155.91
        ================================================
        ID = 1 (  0004):     1.05   0.130    10.08   156.03

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.05   0.130    10.08   156.03
      + ID2= 2 (  0009):     7.14   0.591    11.08   183.43
        ================================================
        ID = 3 (  0004):     8.19   0.694    11.00   179.92

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

 FINISH
================================================================================
======================

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
```

All rights reserved.

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\81666ced-ebec-4d12-9fb7-3c2a62ab0e3e\s
Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\81666ced-ebec-4d12-9fb7-3c2a62ab0e3e\s

DATE: 05/22/2026 TIME: 11:34:58

USER:

COMMENTS: _____

****
** SIMULATION : Run 1 **
****

| CHICAGO STORM |
| Ptotal= 35.69 mm |

IDF curve parameters: A= 758.485
B= 7.538
C= 0.806
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.25	1.00	19.86	2.00	5.63	3.00	2.70
0.17	2.60	1.17	75.39	2.17	4.73	3.17	2.50
0.33	3.09	1.33	26.10	2.33	4.09	3.33	2.33
0.50	3.85	1.50	13.65	2.50	3.62	3.50	2.18
0.67	5.17	1.67	9.21	2.67	3.24	3.67	2.05
0.83	8.08	1.83	6.97	2.83	2.95	3.83	1.93

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   0.45   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.25 | 1.083   19.86 | 2.083    5.63 |  3.08    2.70
              0.167    2.25 | 1.167   19.86 | 2.167    5.63 |  3.17    2.70
              0.250    2.60 | 1.250   75.39 | 2.250    4.73 |  3.25    2.50
              0.333    2.60 | 1.333   75.39 | 2.333    4.73 |  3.33    2.50
              0.417    3.09 | 1.417   26.10 | 2.417    4.09 |  3.42    2.33
              0.500    3.09 | 1.500   26.10 | 2.500    4.09 |  3.50    2.33
              0.583    3.85 | 1.583   13.65 | 2.583    3.62 |  3.58    2.18
              0.667    3.85 | 1.667   13.65 | 2.667    3.62 |  3.67    2.18
              0.750    5.17 | 1.750    9.21 | 2.750    3.24 |  3.75    2.05
              0.833    5.17 | 1.833    9.21 | 2.833    3.24 |  3.83    2.05
              0.917    8.08 | 1.917    6.97 | 2.917    2.95 |  3.92    1.93
              1.000    8.08 | 2.000    6.97 | 3.000    2.95 |  4.00    1.93

     Unit Hyd Qpeak  (cms)=   0.040

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=   9.589
     TOTAL RAINFALL   (mm)=  35.693
     RUNOFF COEFFICIENT   =   0.269

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   0.43   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

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


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

0.083	2.25	1.083	19.86	2.083	5.63	3.08	2.70
0.167	2.25	1.167	19.86	2.167	5.63	3.17	2.70
0.250	2.60	1.250	75.39	2.250	4.73	3.25	2.50
0.333	2.60	1.333	75.39	2.333	4.73	3.33	2.50
0.417	3.09	1.417	26.10	2.417	4.09	3.42	2.33
0.500	3.09	1.500	26.10	2.500	4.09	3.50	2.33
0.583	3.85	1.583	13.65	2.583	3.62	3.58	2.18
0.667	3.85	1.667	13.65	2.667	3.62	3.67	2.18
0.750	5.17	1.750	9.21	2.750	3.24	3.75	2.05
0.833	5.17	1.833	9.21	2.833	3.24	3.83	2.05
0.917	8.08	1.917	6.97	2.917	2.95	3.92	1.93
1.000	8.08	2.000	6.97	3.000	2.95	4.00	1.93

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 9.588
TOTAL RAINFALL (mm)= 35.693
RUNOFF COEFFICIENT = 0.269

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

CALIB NASHYD (0205) ID= 1 DT= 5.0 min	Area (ha)= 0.08	Curve Number (CN)= 79.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.15	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.25	1.083	19.86	2.083	5.63	3.08	2.70
0.167	2.25	1.167	19.86	2.167	5.63	3.17	2.70
0.250	2.60	1.250	75.39	2.250	4.73	3.25	2.50
0.333	2.60	1.333	75.39	2.333	4.73	3.33	2.50
0.417	3.09	1.417	26.10	2.417	4.09	3.42	2.33
0.500	3.09	1.500	26.10	2.500	4.09	3.50	2.33
0.583	3.85	1.583	13.65	2.583	3.62	3.58	2.18
0.667	3.85	1.667	13.65	2.667	3.62	3.67	2.18
0.750	5.17	1.750	9.21	2.750	3.24	3.75	2.05
0.833	5.17	1.833	9.21	2.833	3.24	3.83	2.05
0.917	8.08	1.917	6.97	2.917	2.95	3.92	1.93
1.000	8.08	2.000	6.97	3.000	2.95	4.00	1.93

Unit Hyd Qpeak (cms)= 0.020

```
     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   9.532
     TOTAL RAINFALL   (mm)=  35.693
     RUNOFF COEFFICIENT   =   0.267

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0200)|   Area    (ha)=   6.15
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.08         3.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     202.48        40.00
     Mannings n           =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
              0.083     2.25 | 1.083    19.86 | 2.083     5.63 |  3.08     2.70
              0.167     2.25 | 1.167    19.86 | 2.167     5.63 |  3.17     2.70
              0.250     2.60 | 1.250    75.39 | 2.250     4.73 |  3.25     2.50
              0.333     2.60 | 1.333    75.39 | 2.333     4.73 |  3.33     2.50
              0.417     3.09 | 1.417    26.10 | 2.417     4.09 |  3.42     2.33
              0.500     3.09 | 1.500    26.10 | 2.500     4.09 |  3.50     2.33
              0.583     3.85 | 1.583    13.65 | 2.583     3.62 |  3.58     2.18
              0.667     3.85 | 1.667    13.65 | 2.667     3.62 |  3.67     2.18
              0.750     5.17 | 1.750     9.21 | 2.750     3.24 |  3.75     2.05
              0.833     5.17 | 1.833     9.21 | 2.833     3.24 |  3.83     2.05
              0.917     8.08 | 1.917     6.97 | 2.917     2.95 |  3.92     1.93
              1.000     8.08 | 2.000     6.97 | 3.000     2.95 |  4.00     1.93

     Max.Eff.Inten.(mm/hr)=      75.39        18.98
               over (min)        5.00        20.00
     Storage Coeff.  (min)=      4.37 (ii)   18.09 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=      0.23         0.06
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.51         0.09         0.537 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.58          1.33
     RUNOFF VOLUME    (mm)=     34.19        11.26         21.12
```

```
     TOTAL RAINFALL   (mm)=      35.69        35.69          35.69
     RUNOFF COEFFICIENT   =       0.96         0.32           0.59

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    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 (  0201)|   Area    (ha)=   0.91
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.46         0.46
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      77.89        40.00
     Mannings n           =      0.013        0.250

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


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.25 | 1.083   19.86 | 2.083    5.63 |  3.08    2.70
              0.167    2.25 | 1.167   19.86 | 2.167    5.63 |  3.17    2.70
              0.250    2.60 | 1.250   75.39 | 2.250    4.73 |  3.25    2.50
              0.333    2.60 | 1.333   75.39 | 2.333    4.73 |  3.33    2.50
              0.417    3.09 | 1.417   26.10 | 2.417    4.09 |  3.42    2.33
              0.500    3.09 | 1.500   26.10 | 2.500    4.09 |  3.50    2.33
              0.583    3.85 | 1.583   13.65 | 2.583    3.62 |  3.58    2.18
              0.667    3.85 | 1.667   13.65 | 2.667    3.62 |  3.67    2.18
              0.750    5.17 | 1.750    9.21 | 2.750    3.24 |  3.75    2.05
              0.833    5.17 | 1.833    9.21 | 2.833    3.24 |  3.83    2.05
              0.917    8.08 | 1.917    6.97 | 2.917    2.95 |  3.92    1.93
              1.000    8.08 | 2.000    6.97 | 3.000    2.95 |  4.00    1.93

     Max.Eff.Inten.(mm/hr)=      75.39        18.98
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       2.46 (ii)   16.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.30         0.06
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.01          0.085 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.33         1.58          1.33
     RUNOFF VOLUME    (mm)=      34.19        11.26         21.11
     TOTAL RAINFALL   (mm)=      35.69        35.69         35.69
     RUNOFF COEFFICIENT   =       0.96         0.32          0.59

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    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  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0200):     6.15   0.537     1.33    21.12
      + ID2= 2 (  0201):     0.91   0.085     1.33    21.11
        ================================================
        ID = 3 (  0010):     7.06   0.622     1.33    21.12

     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):     7.06   0.622     1.33    21.12
      + ID2= 2 (  0205):     0.08   0.002     1.50     9.53
        ================================================
        ID = 1 (  0010):     7.14   0.624     1.33    20.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1919      0.1498
                          0.0148     0.0283   |   0.2786      0.1902
                          0.0382     0.0688   |   0.3671      0.2509
                          0.0895     0.1093   |   0.3919      0.2712

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

```
   INFLOW : ID= 2 (  0010)      7.140      0.624      1.33      20.99
   OUTFLOW: ID= 1 (  0009)      7.140      0.074      2.50      20.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.78
                  TIME SHIFT OF PEAK FLOW         (min)= 70.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0967

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.25 | 1.083   19.86 | 2.083    5.63 |  3.08    2.70
              0.167    2.25 | 1.167   19.86 | 2.167    5.63 |  3.17    2.70
              0.250    2.60 | 1.250   75.39 | 2.250    4.73 |  3.25    2.50
              0.333    2.60 | 1.333   75.39 | 2.333    4.73 |  3.33    2.50
              0.417    3.09 | 1.417   26.10 | 2.417    4.09 |  3.42    2.33
              0.500    3.09 | 1.500   26.10 | 2.500    4.09 |  3.50    2.33
              0.583    3.85 | 1.583   13.65 | 2.583    3.62 |  3.58    2.18
              0.667    3.85 | 1.667   13.65 | 2.667    3.62 |  3.67    2.18
              0.750    5.17 | 1.750    9.21 | 2.750    3.24 |  3.75    2.05
              0.833    5.17 | 1.833    9.21 | 2.833    3.24 |  3.83    2.05
              0.917    8.08 | 1.917    6.97 | 2.917    2.95 |  3.92    1.93
              1.000    8.08 | 2.000    6.97 | 3.000    2.95 |  4.00    1.93

     Unit Hyd Qpeak  (cms)=   0.028

     PEAK FLOW       (cms)=   0.004 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=   9.578
     TOTAL RAINFALL   (mm)=  35.693
     RUNOFF COEFFICIENT   =   0.268

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.45   0.008     1.83     9.59
```

```
      + ID2= 2 (  0203):     0.43   0.009     1.75     9.59
        ================================================
        ID = 3 (  0004):     0.88   0.016     1.75     9.59

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


--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.016     1.75     9.59
      + ID2= 2 (  0204):     0.17   0.004     1.58     9.58
        ================================================
        ID = 1 (  0004):     1.05   0.020     1.75     9.59

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


--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.05   0.020     1.75     9.59
      + ID2= 2 (  0009):     7.14   0.074     2.50    20.92
        ================================================
        ID = 3 (  0004):     8.19   0.085     2.17    19.47

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


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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\82
40da6f-e72c-4563-b355-0764f2e7dc9a\s
  Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\82
40da6f-e72c-4563-b355-0764f2e7dc9a\s


DATE: 05/22/2026                          TIME: 11:34:58

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
----------------------
  ***********************************************
  ** SIMULATION : Run 2                         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 876.909
| Ptotal= 47.59 mm |                          B=   7.781
--------------------                          C=   0.780
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    3.33 |  1.00   26.31 |  2.00    7.99 |  3.00    3.97
                0.17    3.83 |  1.17   92.89 |  2.17    6.78 |  3.17    3.69
                0.33    4.52 |  1.33   34.15 |  2.33    5.90 |  3.33    3.44
                0.50    5.57 |  1.50   18.51 |  2.50    5.25 |  3.50    3.23
                0.67    7.37 |  1.67   12.75 |  2.67    4.73 |  3.67    3.05
                0.83   11.26 |  1.83    9.79 |  2.83    4.32 |  3.83    2.89


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   0.45   Curve Number   (CN)= 79.0
```

```
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

```
     Unit Hyd Qpeak  (cms)=   0.040

     PEAK FLOW       (cms)=   0.013 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  16.467
     TOTAL RAINFALL   (mm)=  47.586
     RUNOFF COEFFICIENT   =   0.346

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   0.43   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44

0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 16.465
TOTAL RAINFALL (mm)= 47.586
RUNOFF COEFFICIENT = 0.346

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

CALIB			
NASHYD (0205)	Area (ha)=	0.08	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.15	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.004 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 16.370
TOTAL RAINFALL (mm)= 47.586

RUNOFF COEFFICIENT = 0.344

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

CALIB		
STANDHYD (0200)	Area (ha)=	6.15
ID= 1 DT= 5.0 min	Total Imp(%)=	50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.08	3.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	202.48	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Max.Eff.Inten.(mm/hr)=		92.89	31.03	
over (min)		5.00	20.00	
Storage Coeff. (min)=		4.02 (ii)	15.29 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		0.24	0.07	
				TOTALS
PEAK FLOW	(cms)=	0.64	0.16	0.695 (iii)
TIME TO PEAK	(hrs)=	1.33	1.58	1.33
RUNOFF VOLUME	(mm)=	46.09	18.87	30.57
TOTAL RAINFALL	(mm)=	47.59	47.59	47.59
RUNOFF COEFFICIENT	=	0.97	0.40	0.64

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201)
ID= 1 DT= 5.0 min

Area (ha)= 0.91
Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.46	0.46
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	77.89	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Max.Eff.Inten.(mm/hr)=		92.89	31.03	
over (min)		5.00	15.00	
Storage Coeff. (min)=		2.26 (ii)	13.54 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.30	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.10	0.03	0.112 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	46.09	18.87	30.56
TOTAL RAINFALL	(mm)=	47.59	47.59	47.59
RUNOFF COEFFICIENT	=	0.97	0.40	0.64

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0010)|		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3			(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0200):		6.15	0.695	1.33	30.57
	+ ID2= 2 (0201):		0.91	0.112	1.33	30.56
	ID = 3 (0010):		7.06	0.808	1.33	30.57

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0010)|		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1			(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0010):		7.06	0.808	1.33	30.57
	+ ID2= 2 (0205):		0.08	0.004	1.42	16.37
	ID = 1 (0010):		7.14	0.811	1.33	30.41

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0009)	IN= 2---> OUT= 1	DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)		OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000		0.1919	0.1498
	0.0148	0.0283		0.2786	0.1902
	0.0382	0.0688		0.3671	0.2509
	0.0895	0.1093		0.3919	0.2712

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0010)	7.140	0.811	1.33	30.41
OUTFLOW: ID= 1 (0009)	7.140	0.138	2.25	30.34

PEAK FLOW REDUCTION [Qout/Qin](%)= 17.08
TIME SHIFT OF PEAK FLOW (min)= 55.00

MAXIMUM STORAGE USED (ha.m.)= 0.1287

CALIB			
NASHYD (0204)	Area (ha)= 0.17	Curve Number (CN)= 79.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.23		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.33	1.083	26.31	2.083	7.99	3.08	3.97
0.167	3.33	1.167	26.31	2.167	7.99	3.17	3.97
0.250	3.83	1.250	92.89	2.250	6.78	3.25	3.69
0.333	3.83	1.333	92.89	2.333	6.78	3.33	3.69
0.417	4.52	1.417	34.15	2.417	5.90	3.42	3.44
0.500	4.52	1.500	34.15	2.500	5.90	3.50	3.44
0.583	5.57	1.583	18.51	2.583	5.25	3.58	3.23
0.667	5.57	1.667	18.51	2.667	5.25	3.67	3.23
0.750	7.37	1.750	12.75	2.750	4.73	3.75	3.05
0.833	7.37	1.833	12.75	2.833	4.73	3.83	3.05
0.917	11.26	1.917	9.79	2.917	4.32	3.92	2.89
1.000	11.26	2.000	9.79	3.000	4.32	4.00	2.89

Unit Hyd Qpeak (cms)= 0.028

PEAK FLOW (cms)= 0.007 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 16.449
TOTAL RAINFALL (mm)= 47.586
RUNOFF COEFFICIENT = 0.346

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

ADD HYD (0004)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0202):	0.45	0.013	1.83	16.47
	+ ID2= 2 (0203):	0.43	0.015	1.67	16.46
	ID = 3 (0004):	0.88	0.028	1.75	16.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.028     1.75    16.47
      + ID2= 2 (  0204):     0.17   0.007     1.58    16.45
        ================================================
        ID = 1 (  0004):     1.05   0.034     1.75    16.46

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.05   0.034     1.75    16.46
      + ID2= 2 (  0009):     7.14   0.138     2.25    30.34
        ================================================
        ID = 3 (  0004):     8.19   0.161     2.17    28.56

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\8b
```

2429ff-98f3-4e37-b20a-2823b16dfd0a\s
  Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\8b
2429ff-98f3-4e37-b20a-2823b16dfd0a\s

DATE: 05/22/2026 TIME: 11:34:58

USER:

COMMENTS: _____

  ****
  ** SIMULATION : Run 3 **
  ****

| CHICAGO STORM |
| Ptotal= 55.53 mm |

IDF curve parameters: A= 997.497
B= 8.438
C= 0.775
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.00	1.00	30.98	2.00	9.55	3.00	4.76
0.17	4.58	1.17	104.23	2.17	8.11	3.17	4.42
0.33	5.41	1.33	40.04	2.33	7.07	3.33	4.13
0.50	6.67	1.50	21.97	2.50	6.28	3.50	3.88
0.67	8.82	1.67	15.20	2.67	5.67	3.67	3.66
0.83	13.43	1.83	11.69	2.83	5.17	3.83	3.46

| CALIB |
| NASHYD (0202)|
|ID= 1 DT= 5.0 min |

Area (ha)= 0.45 Curve Number (CN)= 79.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.43

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.017 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 21.624
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.389

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

CALIB NASHYD (0203) ID= 1 DT= 5.0 min	Area (ha)= 0.43	Curve Number (CN)= 79.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.32	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66

0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.020 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 21.620
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.389

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

CALIB			
NASHYD (0205)	Area (ha)=	0.08	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.15	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.005 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 21.499
TOTAL RAINFALL (mm)= 55.528
RUNOFF COEFFICIENT = 0.387

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

```
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   6.15
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.08         3.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     202.48        40.00
     Mannings n             =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    4.00 | 1.083   30.98 | 2.083    9.55 |  3.08    4.76
              0.167    4.00 | 1.167   30.98 | 2.167    9.55 |  3.17    4.76
              0.250    4.58 | 1.250  104.23 | 2.250    8.11 |  3.25    4.42
              0.333    4.58 | 1.333  104.23 | 2.333    8.11 |  3.33    4.42
              0.417    5.41 | 1.417   40.04 | 2.417    7.07 |  3.42    4.13
              0.500    5.41 | 1.500   40.04 | 2.500    7.07 |  3.50    4.13
              0.583    6.67 | 1.583   21.97 | 2.583    6.28 |  3.58    3.88
              0.667    6.67 | 1.667   21.97 | 2.667    6.28 |  3.67    3.88
              0.750    8.82 | 1.750   15.20 | 2.750    5.67 |  3.75    3.66
              0.833    8.82 | 1.833   15.20 | 2.833    5.67 |  3.83    3.66
              0.917   13.43 | 1.917   11.69 | 2.917    5.17 |  3.92    3.46
              1.000   13.43 | 2.000   11.69 | 3.000    5.17 |  4.00    3.46

     Max.Eff.Inten.(mm/hr)=     104.23        47.30
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.84 (ii)   13.36 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.25         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.73         0.23          0.838 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      54.03        24.48          37.18
     TOTAL RAINFALL   (mm)=      55.53        55.53          55.53
     RUNOFF COEFFICIENT   =       0.97         0.44           0.67

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    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 (  0201)|   Area    (ha)=   0.91
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.46         0.46
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      77.89        40.00
     Mannings n             =     0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    4.00 | 1.083   30.98 | 2.083    9.55 |  3.08    4.76
              0.167    4.00 | 1.167   30.98 | 2.167    9.55 |  3.17    4.76
              0.250    4.58 | 1.250  104.23 | 2.250    8.11 |  3.25    4.42
              0.333    4.58 | 1.333  104.23 | 2.333    8.11 |  3.33    4.42
              0.417    5.41 | 1.417   40.04 | 2.417    7.07 |  3.42    4.13
              0.500    5.41 | 1.500   40.04 | 2.500    7.07 |  3.50    4.13
              0.583    6.67 | 1.583   21.97 | 2.583    6.28 |  3.58    3.88
              0.667    6.67 | 1.667   21.97 | 2.667    6.28 |  3.67    3.88
              0.750    8.82 | 1.750   15.20 | 2.750    5.67 |  3.75    3.66
              0.833    8.82 | 1.833   15.20 | 2.833    5.67 |  3.83    3.66
              0.917   13.43 | 1.917   11.69 | 2.917    5.17 |  3.92    3.46
              1.000   13.43 | 2.000   11.69 | 3.000    5.17 |  4.00    3.46

     Max.Eff.Inten.(mm/hr)=     104.23        47.30
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.16 (ii)   11.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.31         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.04          0.131 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      54.03        24.48          37.18
     TOTAL RAINFALL   (mm)=      55.53        55.53          55.53
     RUNOFF COEFFICIENT   =       0.97         0.44           0.67

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    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  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0200):     6.15   0.838     1.33    37.18
      + ID2= 2 (  0201):     0.91   0.131     1.33    37.18
        ================================================
        ID = 3 (  0010):     7.06   0.968     1.33    37.18

     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):     7.06   0.968     1.33    37.18
      + ID2= 2 (  0205):     0.08   0.005     1.42    21.50
        ================================================
        ID = 1 (  0010):     7.14   0.973     1.33    37.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1919      0.1498
                          0.0148     0.0283   |   0.2786      0.1902
                          0.0382     0.0688   |   0.3671      0.2509
                          0.0895     0.1093   |   0.3919      0.2712

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0010)      7.140      0.973      1.33      37.01
   OUTFLOW: ID= 1 (  0009)      7.140      0.192      2.17      36.94

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.72
                  TIME SHIFT OF PEAK FLOW         (min)= 50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1498

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.23

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.00	1.083	30.98	2.083	9.55	3.08	4.76
0.167	4.00	1.167	30.98	2.167	9.55	3.17	4.76
0.250	4.58	1.250	104.23	2.250	8.11	3.25	4.42
0.333	4.58	1.333	104.23	2.333	8.11	3.33	4.42
0.417	5.41	1.417	40.04	2.417	7.07	3.42	4.13
0.500	5.41	1.500	40.04	2.500	7.07	3.50	4.13
0.583	6.67	1.583	21.97	2.583	6.28	3.58	3.88
0.667	6.67	1.667	21.97	2.667	6.28	3.67	3.88
0.750	8.82	1.750	15.20	2.750	5.67	3.75	3.66
0.833	8.82	1.833	15.20	2.833	5.67	3.83	3.66
0.917	13.43	1.917	11.69	2.917	5.17	3.92	3.46
1.000	13.43	2.000	11.69	3.000	5.17	4.00	3.46

```
     Unit Hyd Qpeak  (cms)=   0.028

     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  21.601
     TOTAL RAINFALL   (mm)=  55.528
     RUNOFF COEFFICIENT   =   0.389

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.45   0.017     1.83    21.62
      + ID2= 2 (  0203):     0.43   0.020     1.67    21.62
        ================================================
        ID = 3 (  0004):     0.88   0.037     1.75    21.62

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.037     1.75    21.62
      + ID2= 2 (  0204):     0.17   0.009     1.58    21.60
        ================================================
        ID = 1 (  0004):     1.05   0.045     1.75    21.62

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.05   0.045     1.75    21.62
      + ID2= 2 (  0009):     7.14   0.192     2.17    36.94
        ================================================
        ID = 3 (  0004):     8.19   0.226     2.00    34.98

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\16
88c495-6fdd-45b2-b875-c2fe7df82d42\s
  Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\16
88c495-6fdd-45b2-b875-c2fe7df82d42\s
```

DATE: 05/22/2026 TIME: 11:34:58

USER:

COMMENTS: _____

****
** SIMULATION : Run 4 **
****

CHICAGO STORM	Ptotal= 65.80 mm

IDF curve parameters: A=1145.741
B= 9.035
C= 0.769
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.87	1.00	36.92	2.00	11.59	3.00	5.80
0.17	5.59	1.17	118.88	2.17	9.85	3.17	5.39
0.33	6.59	1.33	47.49	2.33	8.59	3.33	5.03
0.50	8.11	1.50	26.41	2.50	7.64	3.50	4.73
0.67	10.70	1.67	18.36	2.67	6.90	3.67	4.46
0.83	16.24	1.83	14.16	2.83	6.30	3.83	4.23

CALIB NASHYD (0202) ID= 1 DT= 5.0 min	Area (ha)= 0.45 Ia (mm)= 5.00 U.H. Tp(hrs)= 0.43	Curve Number (CN)= 79.0 # of Linear Res.(N)= 3.00

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80

0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.023 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 28.807
TOTAL RAINFALL (mm)= 65.805
RUNOFF COEFFICIENT = 0.438

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

CALIB			
NASHYD (0203)	Area (ha)=	0.43	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.32	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.051

```
     PEAK FLOW       (cms)=   0.026 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  28.801
     TOTAL RAINFALL   (mm)=  65.805
     RUNOFF COEFFICIENT   =   0.438

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   0.08   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

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


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.87 | 1.083   36.92 | 2.083   11.59 |  3.08    5.80
               0.167    4.87 | 1.167   36.92 | 2.167   11.59 |  3.17    5.80
               0.250    5.59 | 1.250  118.88 | 2.250    9.85 |  3.25    5.39
               0.333    5.59 | 1.333  118.88 | 2.333    9.85 |  3.33    5.39
               0.417    6.59 | 1.417   47.49 | 2.417    8.59 |  3.42    5.03
               0.500    6.59 | 1.500   47.48 | 2.500    8.59 |  3.50    5.03
               0.583    8.11 | 1.583   26.41 | 2.583    7.64 |  3.58    4.73
               0.667    8.11 | 1.667   26.41 | 2.667    7.64 |  3.67    4.73
               0.750   10.70 | 1.750   18.36 | 2.750    6.90 |  3.75    4.46
               0.833   10.70 | 1.833   18.36 | 2.833    6.90 |  3.83    4.46
               0.917   16.24 | 1.917   14.16 | 2.917    6.30 |  3.92    4.23
               1.000   16.24 | 2.000   14.16 | 3.000    6.30 |  4.00    4.23

     Unit Hyd Qpeak  (cms)=   0.020

     PEAK FLOW       (cms)=   0.007 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  28.640
     TOTAL RAINFALL   (mm)=  65.805
     RUNOFF COEFFICIENT   =   0.435

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   6.15
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.08	3.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	202.48	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Max.Eff.Inten.(mm/hr)=		118.88	61.59	
	over (min)	5.00	15.00	
Storage Coeff. (min)=		3.64 (ii)	12.21 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.25	0.09	
				TOTALS
PEAK FLOW	(cms)=	0.83	0.31	0.997 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	64.30	32.21	46.01
TOTAL RAINFALL	(mm)=	65.80	65.80	65.80
RUNOFF COEFFICIENT	=	0.98	0.49	0.70

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201)	Area (ha)= 0.91

|ID= 1 DT= 5.0 min | Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.46	0.46
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	77.89	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Max.Eff.Inten.(mm/hr)=		118.88	61.59	
over (min)		5.00	15.00	
Storage Coeff. (min)=		2.05 (ii)	10.62 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.31	0.09	
				TOTALS
PEAK FLOW	(cms)=	0.13	0.05	0.154 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	64.30	32.21	46.00
TOTAL RAINFALL	(mm)=	65.80	65.80	65.80
RUNOFF COEFFICIENT	=	0.98	0.49	0.70

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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  (  0010)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0200):     6.15   0.997     1.33    46.01
      + ID2= 2 (  0201):     0.91   0.154     1.33    46.00
        ================================================
        ID = 3 (  0010):     7.06   1.151     1.33    46.01

     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):     7.06   1.151     1.33    46.01
      + ID2= 2 (  0205):     0.08   0.007     1.42    28.64
        ================================================
        ID = 1 (  0010):     7.14   1.157     1.33    45.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1919      0.1498
                          0.0148     0.0283   |   0.2786      0.1902
                          0.0382     0.0688   |   0.3671      0.2509
                          0.0895     0.1093   |   0.3919      0.2712

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0010)      7.140      1.157      1.33      45.81
   OUTFLOW: ID= 1 (  0009)      7.140      0.253      2.08      45.75

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.85
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1783

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.87	1.083	36.92	2.083	11.59	3.08	5.80
0.167	4.87	1.167	36.92	2.167	11.59	3.17	5.80
0.250	5.59	1.250	118.88	2.250	9.85	3.25	5.39
0.333	5.59	1.333	118.88	2.333	9.85	3.33	5.39
0.417	6.59	1.417	47.49	2.417	8.59	3.42	5.03
0.500	6.59	1.500	47.48	2.500	8.59	3.50	5.03
0.583	8.11	1.583	26.41	2.583	7.64	3.58	4.73
0.667	8.11	1.667	26.41	2.667	7.64	3.67	4.73
0.750	10.70	1.750	18.36	2.750	6.90	3.75	4.46
0.833	10.70	1.833	18.36	2.833	6.90	3.83	4.46
0.917	16.24	1.917	14.16	2.917	6.30	3.92	4.23
1.000	16.24	2.000	14.16	3.000	6.30	4.00	4.23

Unit Hyd Qpeak (cms)= 0.028

PEAK FLOW (cms)= 0.012 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 28.776
TOTAL RAINFALL (mm)= 65.805
RUNOFF COEFFICIENT = 0.437

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

ADD HYD (0004)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0202):	0.45	0.023	1.83	28.81
	+ ID2= 2 (0203):	0.43	0.026	1.67	28.80
	ID = 3 (0004):	0.88	0.049	1.75	28.80

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0004):	0.88	0.049	1.75	28.80
	+ ID2= 2 (0204):	0.17	0.012	1.58	28.78
	ID = 1 (0004):	1.05	0.059	1.75	28.80

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     1.05   0.059     1.75    28.80
     + ID2= 2 (  0009):     7.14   0.253     2.08    45.75
       ================================================
       ID = 3 (  0004):     8.19   0.301     2.00    43.57
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

==========

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

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

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

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

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\7def09b8-3fa2-4641-ba61-e6e45d277c64\s

Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\7def09b8-3fa2-4641-ba61-e6e45d277c64\s

DATE: 05/22/2026   TIME: 11:34:58

USER:

COMMENTS: _____

```
  **********************************************
  ** SIMULATION : Run 5                        **
  **********************************************
```

CHICAGO STORM	Ptotal= 72.61 mm

IDF curve parameters: A=1273.113
B= 9.492
C= 0.770
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.39	1.00	41.02	2.00	12.88	3.00	6.42
0.17	6.19	1.17	129.32	2.17	10.94	3.17	5.96
0.33	7.30	1.33	52.68	2.33	9.53	3.33	5.57
0.50	8.99	1.50	29.40	2.50	8.47	3.50	5.23
0.67	11.89	1.67	20.44	2.67	7.64	3.67	4.93
0.83	18.08	1.83	15.75	2.83	6.98	3.83	4.67

CALIB NASHYD (0202) ID= 1 DT= 5.0 min

Area (ha)= 0.45 Curve Number (CN)= 79.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.43

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57

0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.027 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 33.826
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.466

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

CALIB					
NASHYD (0203)	Area (ha)=	0.43	Curve Number (CN)=	79.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.32			

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.031 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 33.820
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.466

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

CALIB			
NASHYD (0205)	Area (ha)=	0.08	Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.15	

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Unit Hyd Qpeak (cms)= 0.020

PEAK FLOW (cms)= 0.008 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 33.630
TOTAL RAINFALL (mm)= 72.615
RUNOFF COEFFICIENT = 0.463

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

CALIB			
STANDHYD (0200)	Area (ha)=	6.15	
ID= 1 DT= 5.0 min	Total Imp(%)=	50.00	Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.08	3.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	202.48	40.00

Mannings n = 0.013 0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

			TOTALS
Max.Eff.Inten.(mm/hr)=	129.32	71.91	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.52 (ii)	11.57 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.26	0.09	
PEAK FLOW (cms)=	0.91	0.38	1.112 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	71.11	37.56	51.99
TOTAL RAINFALL (mm)=	72.61	72.61	72.61
RUNOFF COEFFICIENT =	0.98	0.52	0.72

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201)
ID= 1 DT= 5.0 min

Area (ha)= 0.91
Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.46	0.46
Dep. Storage	(mm)=	1.50	5.00

Average Slope	(%)=	1.00	2.00
Length	(m)=	77.89	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.39	1.083	41.02	2.083	12.88	3.08	6.42
0.167	5.39	1.167	41.02	2.167	12.88	3.17	6.42
0.250	6.19	1.250	129.32	2.250	10.94	3.25	5.96
0.333	6.19	1.333	129.32	2.333	10.94	3.33	5.96
0.417	7.30	1.417	52.68	2.417	9.53	3.42	5.57
0.500	7.30	1.500	52.68	2.500	9.53	3.50	5.57
0.583	8.99	1.583	29.40	2.583	8.47	3.58	5.23
0.667	8.99	1.667	29.40	2.667	8.47	3.67	5.23
0.750	11.89	1.750	20.44	2.750	7.64	3.75	4.93
0.833	11.89	1.833	20.44	2.833	7.64	3.83	4.93
0.917	18.08	1.917	15.75	2.917	6.98	3.92	4.67
1.000	18.08	2.000	15.75	3.000	6.98	4.00	4.67

Max.Eff.Inten.(mm/hr)=		129.32	71.91	
over (min)		5.00	15.00	
Storage Coeff. (min)=		1.98 (ii)	10.04 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.31	0.10	
				TOTALS
PEAK FLOW	(cms)=	0.14	0.06	0.172 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	71.11	37.56	51.98
TOTAL RAINFALL	(mm)=	72.61	72.61	72.61
RUNOFF COEFFICIENT	=	0.98	0.52	0.72

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0010) 1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0200):		6.15	1.112	1.33	51.99

```
      + ID2= 2 (  0201):     0.91   0.172     1.33    51.98
        ================================================
        ID = 3 (  0010):     7.06   1.284     1.33    51.99

     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):     7.06   1.284     1.33    51.99
      + ID2= 2 (  0205):     0.08   0.008     1.42    33.63
        ================================================
        ID = 1 (  0010):     7.14   1.291     1.33    51.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1919      0.1498
                          0.0148     0.0283   |   0.2786      0.1902
                          0.0382     0.0688   |   0.3671      0.2509
                          0.0895     0.1093   |   0.3919      0.2712

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0010)      7.140      1.291      1.33      51.78
   OUTFLOW: ID= 1 (  0009)      7.140      0.291      2.08      51.72

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.54
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1987

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

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


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

```
                0.083    5.39 | 1.083   41.02 | 2.083   12.88 |  3.08    6.42
                0.167    5.39 | 1.167   41.02 | 2.167   12.88 |  3.17    6.42
                0.250    6.19 | 1.250  129.32 | 2.250   10.94 |  3.25    5.96
                0.333    6.19 | 1.333  129.32 | 2.333   10.94 |  3.33    5.96
                0.417    7.30 | 1.417   52.68 | 2.417    9.53 |  3.42    5.57
                0.500    7.30 | 1.500   52.68 | 2.500    9.53 |  3.50    5.57
                0.583    8.99 | 1.583   29.40 | 2.583    8.47 |  3.58    5.23
                0.667    8.99 | 1.667   29.40 | 2.667    8.47 |  3.67    5.23
                0.750   11.89 | 1.750   20.44 | 2.750    7.64 |  3.75    4.93
                0.833   11.89 | 1.833   20.44 | 2.833    7.64 |  3.83    4.93
                0.917   18.08 | 1.917   15.75 | 2.917    6.98 |  3.92    4.67
                1.000   18.08 | 2.000   15.75 | 3.000    6.98 |  4.00    4.67

     Unit Hyd Qpeak  (cms)=   0.028

     PEAK FLOW       (cms)=   0.015 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  33.790
     TOTAL RAINFALL   (mm)=  72.615
     RUNOFF COEFFICIENT   =   0.465

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.45   0.027     1.83    33.83
      + ID2= 2 (  0203):     0.43   0.031     1.67    33.82
        ================================================
        ID = 3 (  0004):     0.88   0.058     1.75    33.82

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.88   0.058     1.75    33.82
      + ID2= 2 (  0204):     0.17   0.015     1.58    33.79
        ================================================
        ID = 1 (  0004):     1.05   0.070     1.67    33.82

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

--------------------
```

```
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     1.05   0.070     1.67    33.82
     + ID2= 2 (  0009):     7.14   0.291     2.08    51.72
       ================================================
       ID = 3 (  0004):     8.19   0.350     1.92    49.42

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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\a9
cdfaa0-801b-4453-87e6-774c35c0baeb\s
  Summary filename:
C:\Users\andree4107\AppData\Local\Civica\VH5\a42ba706-5a5b-4669-8eb5-498cd59c7c94\a9
cdfaa0-801b-4453-87e6-774c35c0baeb\s


DATE: 05/22/2026                          TIME: 11:34:58

USER:



COMMENTS: _____________________________________________________________
```

```
--------------------------------------------------------------------------------
-----------------------
  ***********************************************
  ** SIMULATION : Run 6                         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1357.120
| Ptotal= 80.43 mm |                          B=   9.595
--------------------                          C=   0.763
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    6.12 |  1.00   45.28 |  2.00   14.47 |  3.00    7.28
                0.17    7.01 |  1.17  140.19 |  2.17   12.31 |  3.17    6.76
                0.33    8.26 |  1.33   57.98 |  2.33   10.75 |  3.33    6.32
                0.50   10.15 |  1.50   32.65 |  2.50    9.57 |  3.50    5.94
                0.67   13.37 |  1.67   22.82 |  2.67    8.65 |  3.67    5.61
                0.83   20.21 |  1.83   17.65 |  2.83    7.90 |  3.83    5.31


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   0.45   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

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


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.12 | 1.083   45.28 | 2.083   14.47 |  3.08    7.28
               0.167    6.12 | 1.167   45.28 | 2.167   14.47 |  3.17    7.28
               0.250    7.01 | 1.250  140.19 | 2.250   12.31 |  3.25    6.76
               0.333    7.01 | 1.333  140.19 | 2.333   12.31 |  3.33    6.76
               0.417    8.26 | 1.417   57.98 | 2.417   10.75 |  3.42    6.32
               0.500    8.26 | 1.500   57.98 | 2.500   10.75 |  3.50    6.32
               0.583   10.15 | 1.583   32.65 | 2.583    9.57 |  3.58    5.94
               0.667   10.15 | 1.667   32.65 | 2.667    9.57 |  3.67    5.94
               0.750   13.37 | 1.750   22.82 | 2.750    8.65 |  3.75    5.61
               0.833   13.37 | 1.833   22.82 | 2.833    8.65 |  3.83    5.61
               0.917   20.21 | 1.917   17.65 | 2.917    7.90 |  3.92    5.31
```

1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.040

PEAK FLOW (cms)= 0.032 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 39.796
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.495

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

CALIB	
NASHYD (0203)	Area (ha)= 0.43 Curve Number (CN)= 79.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.32

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.051

PEAK FLOW (cms)= 0.037 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 39.789
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.495

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

```
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   0.08   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.15

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

```
     Unit Hyd Qpeak  (cms)=   0.020

     PEAK FLOW       (cms)=   0.010 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  39.565
     TOTAL RAINFALL   (mm)=  80.430
     RUNOFF COEFFICIENT   =   0.492

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

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   6.15
|ID= 1 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  43.00
-------------------

                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.08         3.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     202.48        40.00
     Mannings n           =      0.013        0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Max.Eff.Inten.(mm/hr)=	140.19	83.41	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.41 (ii)	11.00 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.26	0.09	
			TOTALS
PEAK FLOW (cms)=	0.99	0.45	1.237 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	78.93	43.89	58.96
TOTAL RAINFALL (mm)=	80.43	80.43	80.43
RUNOFF COEFFICIENT =	0.98	0.55	0.73

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0201)
ID= 1 DT= 5.0 min

Area (ha)= 0.91
Total Imp(%)= 50.00 Dir. Conn.(%)= 43.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.46	0.46
Dep. Storage (mm)=	1.50	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	77.89	40.00
Mannings n =	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.12	1.083	45.28	2.083	14.47	3.08	7.28
0.167	6.12	1.167	45.28	2.167	14.47	3.17	7.28
0.250	7.01	1.250	140.19	2.250	12.31	3.25	6.76
0.333	7.01	1.333	140.19	2.333	12.31	3.33	6.76
0.417	8.26	1.417	57.98	2.417	10.75	3.42	6.32
0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Max.Eff.Inten.(mm/hr)=	140.19	83.41		
over (min)	5.00	10.00		
Storage Coeff. (min)=	1.92 (ii)	9.51 (ii)		
Unit Hyd. Tpeak (min)=	5.00	10.00		
Unit Hyd. peak (cms)=	0.31	0.12		
			TOTALS	
PEAK FLOW (cms)=	0.15	0.07	0.210 (iii)	
TIME TO PEAK (hrs)=	1.33	1.42	1.33	
RUNOFF VOLUME (mm)=	78.93	43.89	58.95	
TOTAL RAINFALL (mm)=	80.43	80.43	80.43	
RUNOFF COEFFICIENT =	0.98	0.55	0.73	

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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 (0010)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0200):	6.15	1.237	1.33	58.96
	+ ID2= 2 (0201):	0.91	0.210	1.33	58.95
	ID = 3 (0010):	7.06	1.447	1.33	58.96

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):     7.06   1.447     1.33    58.96
     + ID2= 2 (  0205):     0.08   0.010     1.42    39.57
       ================================================
       ID = 1 (  0010):     7.14   1.455     1.33    58.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0009)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.1919      0.1498
                          0.0148     0.0283    |   0.2786      0.1902
                          0.0382     0.0688    |   0.3671      0.2509
                          0.0895     0.1093    |   0.3919      0.2712

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0010)      7.140      1.455      1.33      58.74
   OUTFLOW: ID= 1 (  0009)      7.140      0.327      2.08      58.67

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.45
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.2232

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.17   Curve Number   (CN)= 79.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

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


                            ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    6.12 | 1.083   45.28 | 2.083   14.47 |  3.08    7.28
              0.167    6.12 | 1.167   45.28 | 2.167   14.47 |  3.17    7.28
              0.250    7.01 | 1.250  140.19 | 2.250   12.31 |  3.25    6.76
              0.333    7.01 | 1.333  140.19 | 2.333   12.31 |  3.33    6.76
              0.417    8.26 | 1.417   57.98 | 2.417   10.75 |  3.42    6.32
```

0.500	8.26	1.500	57.98	2.500	10.75	3.50	6.32
0.583	10.15	1.583	32.65	2.583	9.57	3.58	5.94
0.667	10.15	1.667	32.65	2.667	9.57	3.67	5.94
0.750	13.37	1.750	22.82	2.750	8.65	3.75	5.61
0.833	13.37	1.833	22.82	2.833	8.65	3.83	5.61
0.917	20.21	1.917	17.65	2.917	7.90	3.92	5.31
1.000	20.21	2.000	17.65	3.000	7.90	4.00	5.31

Unit Hyd Qpeak (cms)= 0.028

PEAK FLOW (cms)= 0.017 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 39.755
TOTAL RAINFALL (mm)= 80.430
RUNOFF COEFFICIENT = 0.494

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

ADD HYD (0004)

1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	0.45	0.032	1.83	39.80
+ ID2= 2 (0203):	0.43	0.037	1.67	39.79
ID = 3 (0004):	0.88	0.068	1.75	39.79

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)

3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0004):	0.88	0.068	1.75	39.79
+ ID2= 2 (0204):	0.17	0.017	1.58	39.76
ID = 1 (0004):	1.05	0.082	1.67	39.79

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)

1 + 2 = 3

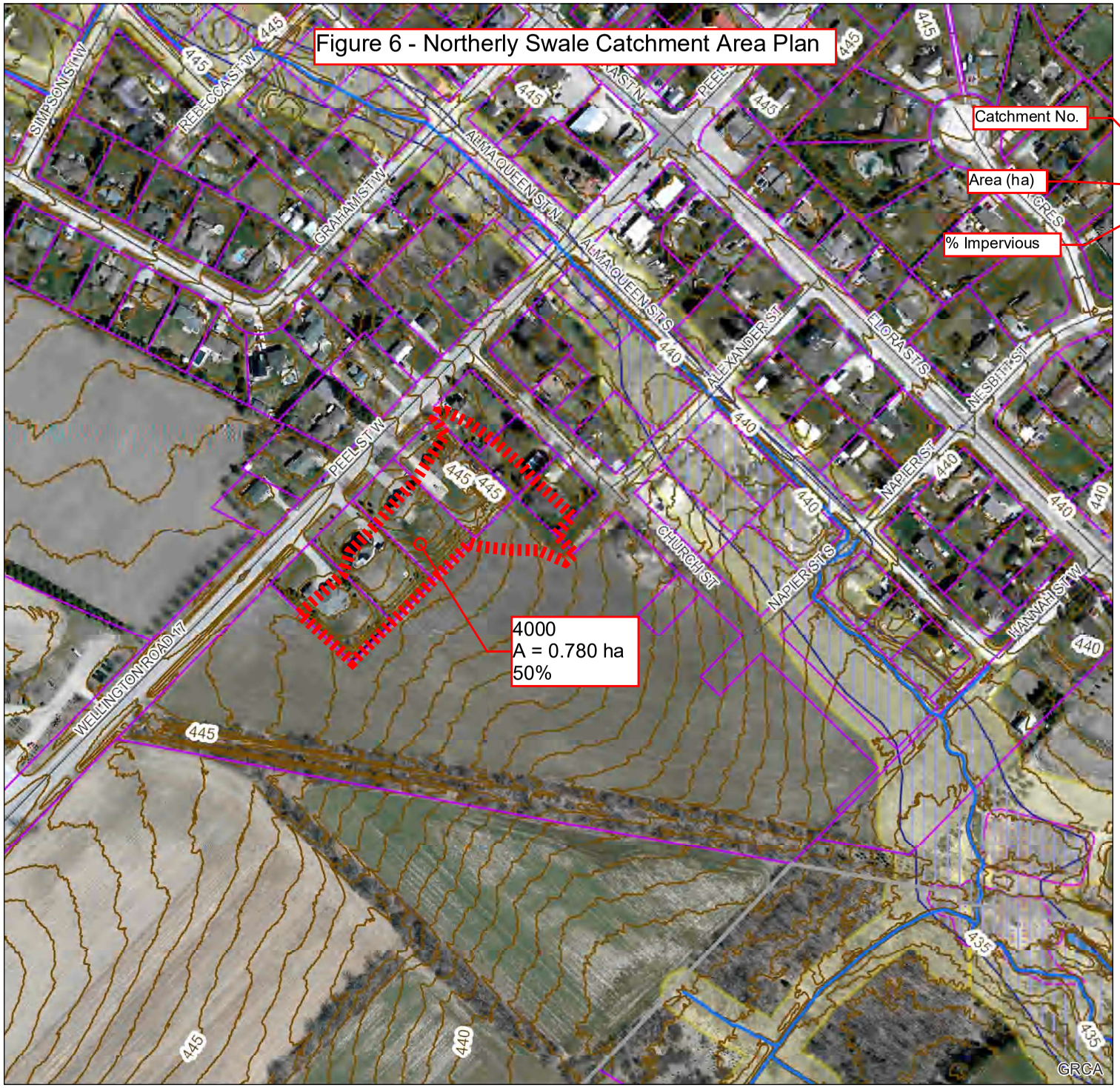
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):	1.05	0.082	1.67	39.79
+ ID2= 2 (0009):	7.14	0.327	2.08	58.67

```
        ==================================================
        ID = 3 (  0004):     8.19   0.396     1.92    56.25

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

NORTHERLY SWALE

Figure 6 - Northerly Swale Catchment Area Plan



Grand River Conservation Authority

Date: Nov 14, 2022

Catchment No.

Area (ha)

% Impervious

1000
A = 64.54 ha
5%

Catchment Boundary

Legend

- Regulation Limit (GRCA)
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
  - Special Policy Area
- Slope Valley (GRCA)
  - Steep
  - Oversteep
  - Steep
- Slope Erosion (GRCA)
  - Oversteep
  - Toe
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)
- Parcel - Assessment (MPAC/MNRF)

This legend is static and may not fully reflect the layers shown on the map. The text of Ontario Regulation 150/06 supercedes the mapping as represented by these layers.

Copyright Grand River Conservation Authority, 2022.
Disclaimer: This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.
The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

0 20 40 80 120 Metres

N

Map Centre (UTM NAD83 z17): 540,010.12 4,841,739.88

This map is not to be used for navigation | 2020 Ortho (ON)

NAD 1983 UTM Zone 17N

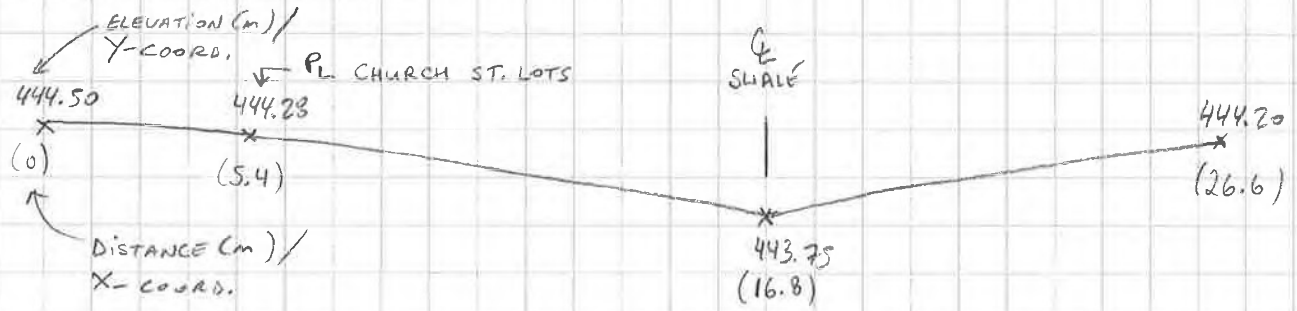
Scale: 3,804

Project No: 120139 Date: Nov. 14/22

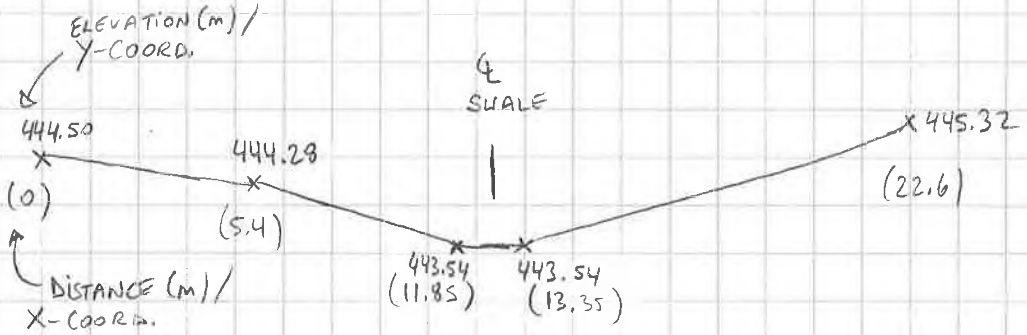
Project: ALMA SUBDIVISION

Name: NORTHERLY SWALE - MIDUSS SECTION Sheet:

EXISTING CROSS-SECTION



PROPOSED CROSS-SECTION



SECTION A-A, SEE GM BLUEPLAN DWG. NO. 8.

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\N-Swale Model"
"                Output filename:         120139 - Existing 2 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:28:14 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      758.485   Coefficient A"
"        7.538   Constant B"
"        0.806   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           83.116    mm/hr"
"             Total depth                 51.605    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.075     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  41.678     5.349      8.191      minutes"
"             Time to Centroid       584.526    629.349    625.844    minutes"
"             Rainfall depth         51.605     51.605     51.605     mm"
"             Rainfall volume        201.26     201.26     402.52     c.m"
"             Rainfall losses        47.386     1.889      24.637     mm"
"             Runoff depth           4.219      49.716     26.968     mm"
"             Runoff volume          16.45      193.89     210.35     c.m"
"             Runoff coefficient     0.082      0.963      0.523      "
"             Maximum flow           0.006      0.074      0.075      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.075     0.075     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.075   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.096    metre"
"             Velocity                      0.372    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.075    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:         120139 - Existing 5 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:31:22 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      876.909   Coefficient A"
"        7.781   Constant B"
"        0.780   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          101.955    mm/hr"
"             Total depth                 72.080    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.097     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  28.782     4.930      8.455      minutes"
"             Time to Centroid       578.679    631.173    623.414    minutes"
"             Rainfall depth         72.080     72.080     72.080     mm"
"             Rainfall volume        281.11     281.11     562.23     c.m"
"             Rainfall losses        59.943     2.104      31.024     mm"
"             Runoff depth           12.137     69.976     41.057     mm"
"             Runoff volume          47.33      272.91     320.24     c.m"
"             Runoff coefficient     0.168      0.971      0.570      "
"             Maximum flow           0.019      0.095      0.097      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.097     0.097     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.097   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.106    metre"
"             Velocity                      0.397    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.084    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:        120139 - Existing 10 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:36:15 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      997.497   Coefficient A"
"        8.438   Constant B"
"        0.775   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          113.928    mm/hr"
"             Total depth                 85.001    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.112     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  27.015     4.716      8.667      minutes"
"             Time to Centroid       577.306    630.519    621.090    minutes"
"             Rainfall depth         85.001     85.001     85.001     mm"
"             Rainfall volume        331.50     331.50     663.01     c.m"
"             Rainfall losses        67.166     2.184      34.675     mm"
"             Runoff depth           17.835     82.817     50.326     mm"
"             Runoff volume          69.56      322.99     392.55     c.m"
"             Runoff coefficient     0.210      0.974      0.592      "
"             Maximum flow           0.029      0.108      0.112      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.112     0.112     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.112   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.112    metre"
"             Velocity                      0.412    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.089    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:        120139 - Existing 25 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:38:43 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1145.741   Coefficient A"
"        9.035   Constant B"
"        0.769   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          129.475    mm/hr"
"             Total depth                101.960    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.133     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  25.334     4.480      8.717      minutes"
"             Time to Centroid       575.537    630.191    619.088    minutes"
"             Rainfall depth         101.960    101.960    101.960    mm"
"             Rainfall volume        397.64     397.64     795.28     c.m"
"             Rainfall losses        76.587     2.434      39.510     mm"
"             Runoff depth           25.373     99.526     62.449     mm"
"             Runoff volume          98.95      388.15     487.10     c.m"
"             Runoff coefficient     0.249      0.976      0.612      "
"             Maximum flow           0.044      0.125      0.133      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.133     0.133     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.133   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.120    metre"
"             Velocity                      0.430    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.095    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:        120139 - Existing 50 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:40:25 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1273.113   Coefficient A"
"        9.492   Constant B"
"        0.770   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          140.566    mm/hr"
"             Total depth                112.445    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.149     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  24.388     4.335      8.705      minutes"
"             Time to Centroid       574.731    629.205    617.334    minutes"
"             Rainfall depth         112.445    112.445    112.445    mm"
"             Rainfall volume        438.54     438.54     877.07     c.m"
"             Rainfall losses        81.858     2.678      42.268     mm"
"             Runoff depth           30.587     109.767    70.177     mm"
"             Runoff volume          119.29     428.09     547.38     c.m"
"             Runoff coefficient     0.272      0.976      0.624      "
"             Maximum flow           0.055      0.137      0.149      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.149     0.149     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.149   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.125    metre"
"             Velocity                      0.442    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.099    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\N-Swale Model"
"                Output filename:       120139 - Existing 100 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:42:05 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1357.120   Coefficient A"
"        9.595   Constant B"
"        0.763   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          152.190    mm/hr"
"             Total depth                126.124    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.165     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  23.526     4.200      8.605      minutes"
"             Time to Centroid       574.951    629.808    617.304    minutes"
"             Rainfall depth         126.124    126.124    126.124    mm"
"             Rainfall volume        491.88     491.88     983.77     c.m"
"             Rainfall losses        89.735     2.873      46.304     mm"
"             Runoff depth           36.389     123.251    79.820     mm"
"             Runoff volume          141.92     480.68     622.60     c.m"
"             Runoff coefficient     0.289      0.977      0.633      "
"             Maximum flow           0.064      0.149      0.165      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.165     0.165     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.165   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            4.   Define an arbitrary cross-section"
"                   0.000     5.400    16.800    26.600"
"                 445.500   444.280   443.750   444.200"
"         0.450   Channel depth    metre"
"         0.970   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.130    metre"
"             Velocity                      0.454    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.103    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                       0.780    hectare"
"             Total Impervious area                      0.390    hectare"
"             Total % impervious                        50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:        \\gue-projects\users stuff\szaga\Documents\"
"                                                Alma Subdivision\MIDUSS\N Swale"
"                Output filename:                    120139_EX_Reg-N-Swale.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:               11/14/2022 at 3:23:06 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"     5000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"            7   9999hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
```

```
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.070     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  38.575     6.404      13.705     minutes"
"             Time to Centroid       2792.332   2237.227   2363.201   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        1111.50    1111.50    2223.00    c.m"
"             Rainfall losses        209.180    26.719     117.949    mm"
"             Runoff depth           75.820     258.281    167.051    mm"
"             Runoff volume          295.70     1007.29    1302.99    c.m"
"             Runoff coefficient     0.266      0.906      0.586      "
"             Maximum flow           0.033      0.049      0.070      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.070     0.070     0.000     0.000"
" 52          CHANNEL DESIGN"
"        0.070   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           4.   Define an arbitrary cross-section"
"                  0.000     5.400    16.800    26.600"
"                445.500   444.280   443.750   444.200"
"        0.450   Channel depth    metre"
"        0.970   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.094    metre"
"             Velocity                      0.366    m/sec"
"             Channel capacity              2.266    c.m/sec"
"             Critical depth                0.073    metre"
" 38          START/RE-START TOTALS 4000"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.780    hectare"
"             Total Impervious area                     0.390    hectare"
"             Total % impervious                       50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:            120139 - Prop. 2 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 1:12:01 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      758.485   Coefficient A"
"        7.538   Constant B"
"        0.806   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           83.116    mm/hr"
"             Total depth                 51.605    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.075     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  41.678     5.349      8.191      minutes"
"             Time to Centroid       584.526    629.349    625.844    minutes"
"             Rainfall depth         51.605     51.605     51.605     mm"
"             Rainfall volume        201.26     201.26     402.52     c.m"
"             Rainfall losses        47.386     1.889      24.637     mm"
"             Runoff depth           4.219      49.716     26.968     mm"
"             Runoff volume          16.45      193.89     210.35     c.m"
"             Runoff coefficient     0.082      0.963      0.523      "
"             Maximum flow           0.006      0.074      0.075      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.075     0.075     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.075   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            5.   Define an arbitrary cross-section"
"                   0.000     5.400    11.850    13.350    22.600"
"                 444.500   444.280   443.540   443.540   445.320"
"         0.960   Channel depth    metre"
"         2.070   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.066    metre"
"             Velocity                      0.581    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.058    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                        0.780    hectare"
"             Total Impervious area                       0.390    hectare"
"             Total % impervious                         50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\N-Swale Model"
"                Output filename:            120139 - Prop. 5 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                  2/2/2024 at 1:09:58 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      876.909   Coefficient A"
"        7.781   Constant B"
"        0.780   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          101.955    mm/hr"
"             Total depth                 72.080    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.097     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  28.782     4.930      8.455      minutes"
"             Time to Centroid       578.679    631.173    623.414    minutes"
"             Rainfall depth         72.080     72.080     72.080     mm"
"             Rainfall volume        281.11     281.11     562.23     c.m"
"             Rainfall losses        59.943     2.104      31.024     mm"
"             Runoff depth           12.137     69.976     41.057     mm"
"             Runoff volume          47.33      272.91     320.24     c.m"
"             Runoff coefficient     0.168      0.971      0.570      "
"             Maximum flow           0.019      0.095      0.097      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.097     0.097     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.097   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            5.   Define an arbitrary cross-section"
"                   0.000     5.400    11.850    13.350    22.600"
"                 444.500   444.280   443.540   443.540   445.320"
"         0.960   Channel depth    metre"
"         2.070   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.076    metre"
"             Velocity                      0.630    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.067    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                        0.780    hectare"
"             Total Impervious area                       0.390    hectare"
"             Total % impervious                         50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\N-Swale Model"
"                Output filename:           120139 - Prop. 10 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                  2/2/2024 at 1:07:12 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      997.497   Coefficient A"
"        8.438   Constant B"
"        0.775   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          113.928    mm/hr"
"             Total depth                 85.001    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.112     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  27.015     4.716      8.667      minutes"
"             Time to Centroid       577.306    630.519    621.090    minutes"
"             Rainfall depth         85.001     85.001     85.001     mm"
"             Rainfall volume        331.50     331.50     663.01     c.m"
"             Rainfall losses        67.166     2.184      34.675     mm"
"             Runoff depth           17.835     82.817     50.326     mm"
"             Runoff volume          69.56      322.99     392.55     c.m"
"             Runoff coefficient     0.210      0.974      0.592      "
"             Maximum flow           0.029      0.108      0.112      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.112     0.112     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.112   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            5.   Define an arbitrary cross-section"
"                   0.000     5.400    11.850    13.350    22.600"
"                 444.500   444.280   443.540   443.540   445.320"
"         0.960   Channel depth    metre"
"         2.070   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.082    metre"
"             Velocity                      0.658    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.073    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                        0.780    hectare"
"             Total Impervious area                       0.390    hectare"
"             Total % impervious                         50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\N-Swale Model"
"                Output filename:           120139 - Prop. 25 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:56:41 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1145.741   Coefficient A"
"        9.035   Constant B"
"        0.769   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          129.475    mm/hr"
"             Total depth                101.960    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.133     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  25.334     4.480      8.717      minutes"
"             Time to Centroid       575.537    630.191    619.088    minutes"
"             Rainfall depth         101.960    101.960    101.960    mm"
"             Rainfall volume        397.64     397.64     795.28     c.m"
"             Rainfall losses        76.587     2.434      39.510     mm"
"             Runoff depth           25.373     99.526     62.449     mm"
"             Runoff volume          98.95      388.15     487.10     c.m"
"             Runoff coefficient     0.249      0.976      0.612      "
"             Maximum flow           0.044      0.125      0.133      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.133     0.133     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.133   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            5.   Define an arbitrary cross-section"
"                   0.000     5.400    11.850    13.350    22.600"
"                 444.500   444.280   443.540   443.540   445.320"
"         0.960   Channel depth    metre"
"         2.070   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.090    metre"
"             Velocity                      0.694    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.081    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                        0.780    hectare"
"             Total Impervious area                       0.390    hectare"
"             Total % impervious                         50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\N-Swale Model"
"                Output filename:           120139 - Prop. 50 yr - N Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 12:52:48 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1273.113   Coefficient A"
"        9.492   Constant B"
"        0.770   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          140.566    mm/hr"
"             Total depth                112.445    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"       50.000   % Impervious"
"        0.780   Total Area"
"      115.000   Flow length"
"        2.000   Overland Slope"
"        0.390   Pervious Area"
"      115.000   Pervious length"
"        2.000   Pervious slope"
"        0.390   Impervious Area"
"      115.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

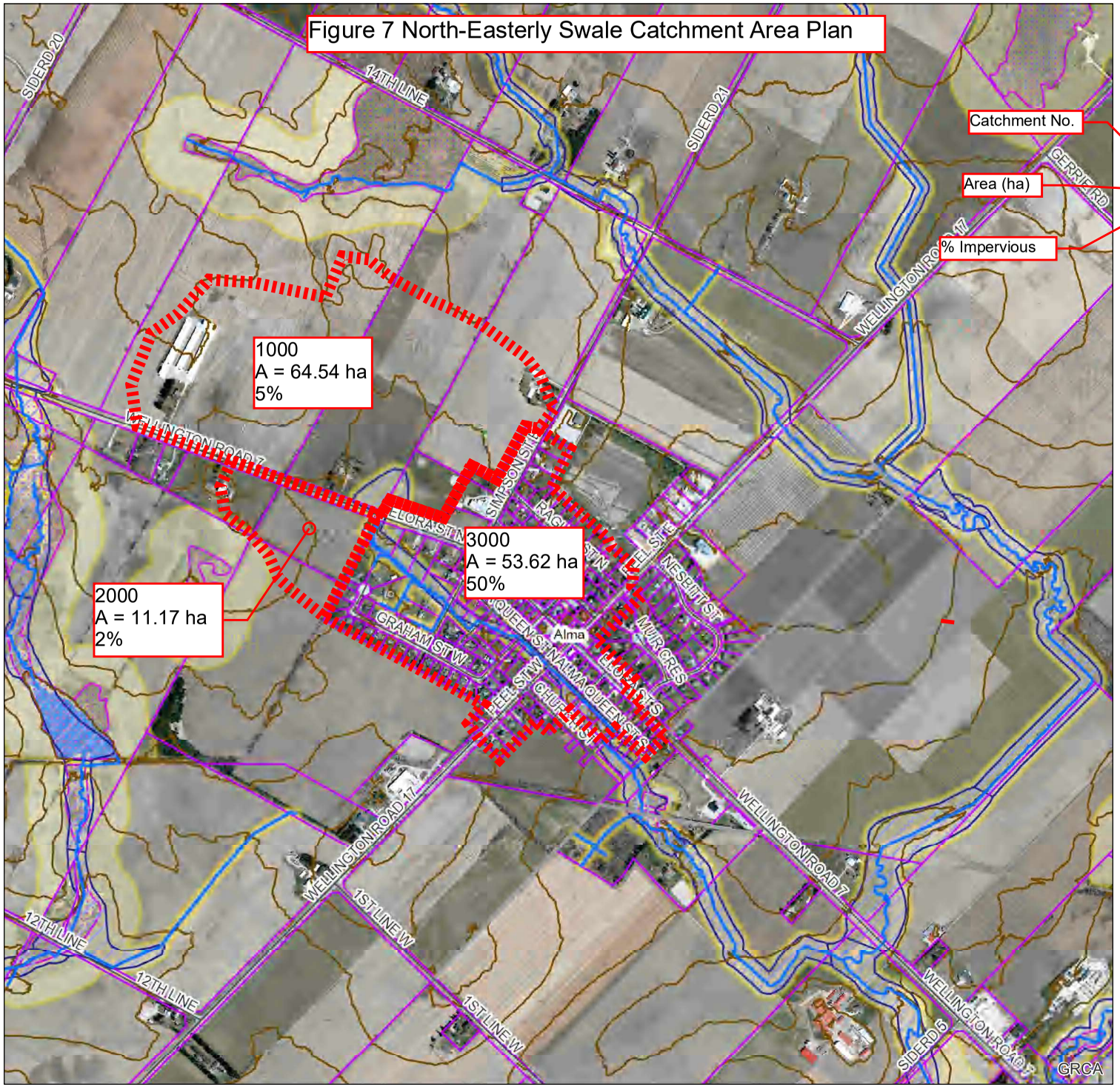
```
"                    0.149     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  24.388     4.335      8.705      minutes"
"             Time to Centroid       574.731    629.205    617.334    minutes"
"             Rainfall depth         112.445    112.445    112.445    mm"
"             Rainfall volume        438.54     438.54     877.07     c.m"
"             Rainfall losses        81.858     2.678      42.268     mm"
"             Runoff depth           30.587     109.767    70.177     mm"
"             Runoff volume          119.29     428.09     547.38     c.m"
"             Runoff coefficient     0.272      0.976      0.624      "
"             Maximum flow           0.055      0.137      0.149      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.149     0.149     0.000     0.000"
" 52          CHANNEL DESIGN"
"         0.149   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            1.   Cross-section type: 0=trapezoidal; 1=general"
"            5.   Define an arbitrary cross-section"
"                   0.000     5.400    11.850    13.350    22.600"
"                 444.500   444.280   443.540   443.540   445.320"
"         0.960   Channel depth    metre"
"         2.070   Gradient   %"
"            0.   Variable roughness: 0=False; 1=True"
"                  0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.096    metre"
"             Velocity                      0.717    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.087    metre"
" 38          START/RE-START TOTALS 4000"
"              3   Runoff Totals on EXIT"
"             Total Catchment area                        0.780    hectare"
"             Total Impervious area                       0.390    hectare"
"             Total % impervious                         50.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:        \\gue-projects\users stuff\szaga\Documents\"
"                                                Alma Subdivision\MIDUSS\N Swale"
"                Output filename:                    120139_PR_Reg-N-Swale.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:               11/14/2022 at 4:11:36 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"     5000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"            7   9999hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         4000   Existing Peel and Church St. Lots "
"        50.000   % Impervious"
"         0.780   Total Area"
"       115.000   Flow length"
"         2.000   Overland Slope"
"         0.390   Pervious Area"
"       115.000   Pervious length"
"         2.000   Pervious slope"
"         0.390   Impervious Area"
"       115.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
```

```
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.070     0.000     0.000     0.000 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           0.390      0.390      0.780      hectare"
"             Time of concentration  38.575     6.404      13.705     minutes"
"             Time to Centroid       2792.332   2237.227   2363.201   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        1111.50    1111.50    2223.00    c.m"
"             Rainfall losses        209.180    26.719     117.949    mm"
"             Runoff depth           75.820     258.281    167.051    mm"
"             Runoff volume          295.70     1007.29    1302.99    c.m"
"             Runoff coefficient     0.266      0.906      0.586      "
"             Maximum flow           0.033      0.049      0.070      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.070     0.070     0.000     0.000"
" 52          CHANNEL DESIGN"
"        0.070   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           5.   Define an arbitrary cross-section"
"                  0.000     5.400    11.850    13.350    22.600"
"                444.500   444.280   443.540   443.540   445.320"
"        0.960   Channel depth    metre"
"        2.070   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"             Depth of flow                 0.063    metre"
"             Velocity                      0.569    m/sec"
"             Channel capacity             19.748    c.m/sec"
"             Critical depth                0.055    metre"
" 38          START/RE-START TOTALS 4000"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.780    hectare"
"             Total Impervious area                     0.390    hectare"
"             Total % impervious                       50.000"
" 19          EXIT"
```

NORTH-EASTERLY SWALE

Figure 7 North-Easterly Swale Catchment Area Plan



Grand River Conservation Authority
Date: Oct 21, 2022

Catchment No.
Area (ha)
% Impervious

1000
A = 64.54 ha
5%

Catchment Boundary

Legend

- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Flood (GRCA)
- Regulated Watercourse (GRCA)
- Parcel - Assessment Public (MPAC/MNRF)
- Contour CGVD2013 - Regional (GRCA)
- Floodplain - Special Policy Area (GRCA)

Floodplain (GRCA)

- Engineered
- Estimated
- Approximate
- Lake Erie Erosion (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Wetland (GRCA)

Slope Valley (GRCA)

- Steep
- Oversteep

Copyright Grand River Conservation Authority, 2022.
Disclaimer: This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.
The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

0 100 200 400 600 Metres

N

Map Centre (UTM NAD83 z17): 540,045.65 4,842,308.45

This map is not to be used for navigation | 2020 Ortho (ON)

NAD 1983 UTM Zone 17N

Scale: 16,839

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\NE Swale Model"
"                Output filename:        120139 - Existing 2 yr - NE Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 11:28:31 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      758.485   Coefficient A"
"        7.538   Constant B"
"        0.806   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            83.116    mm/hr"
"             Total depth                  51.605    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    0.548     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  123.183    15.811     82.282     minutes"
"             Time to Centroid       656.867    646.248    652.821    minutes"
"             Rainfall depth         51.605     51.605     51.605     mm"
"             Rainfall volume        3.1640     0.1665     3.3306     ha-m"
"             Rainfall losses        47.384     2.255      45.127     mm"
"             Runoff depth           4.221      49.350     6.478      mm"
"             Runoff volume          2588.10    1592.52    4180.62    c.m"
"             Runoff coefficient     0.082      0.956      0.126      "
"             Maximum flow           0.338      0.496      0.548      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.548     0.548     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.094     0.548     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  81.270     10.431     67.574     minutes"
"             Time to Centroid       619.668    637.569    623.128    minutes"
"             Rainfall depth         51.605     51.605     51.605     mm"
"             Rainfall volume        5648.98    115.29     5764.26    c.m"
"             Rainfall losses        47.384     2.033      46.477     mm"
"             Runoff depth           4.221      49.571     5.128      mm"
"             Runoff volume          462.01     110.74     572.76     c.m"
```

```
"             Runoff coefficient     0.082      0.961      0.099      "
"             Maximum flow           0.089      0.040      0.094      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.094     0.603     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     4.181     0.603     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  117.826    15.123     23.210     minutes"
"             Time to Centroid       652.115    645.144    645.692    minutes"
"             Rainfall depth         51.605     51.605     51.605     mm"
"             Rainfall volume        1.3835     1.3835     2.7671     ha-m"
"             Rainfall losses        47.384     2.219      24.801     mm"
"             Runoff depth           4.221      49.385     26.803     mm"
"             Runoff volume          0.1132     1.3240     1.4372     ha-m"
"             Runoff coefficient     0.082      0.957      0.519      "
"             Maximum flow           0.153      4.157      4.181      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     4.181     4.784     0.000     0.000"
" 52          CHANNEL DESIGN"
"        4.784   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.082    metre"
"              Velocity                      0.591    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                0.774    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.400   X-factor <= 0.5"
"      154.444   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                  4.466    c.m/sec"
"                      4.181     4.784     4.466     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                          NEW SWM\NE Swale Model"
"                Output filename:        120139 - Existing 5 yr - NE Swale.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:                 2/2/2024 at 11:33:20 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      876.909   Coefficient A"
"        7.781   Constant B"
"        0.780   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          101.955    mm/hr"
"             Total depth                 72.080    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    1.273     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  85.067     14.570     68.739     minutes"
"             Time to Centroid       637.709    646.555    639.758    minutes"
"             Rainfall depth         72.080     72.080     72.080     mm"
"             Rainfall volume        4.4195     0.2326     4.6521     ha-m"
"             Rainfall losses        59.928     2.481      57.056     mm"
"             Runoff depth           12.152     69.600     15.024     mm"
"             Runoff volume          7450.79    2245.98    9696.77    c.m"
"             Runoff coefficient     0.169      0.966      0.208      "
"             Maximum flow           1.184      0.634      1.273      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.273     1.273     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.323     1.273     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  56.124     9.613      51.250     minutes"
"             Time to Centroid       607.501    638.784    610.778    minutes"
"             Rainfall depth         72.080     72.080     72.080     mm"
"             Rainfall volume        7890.36    161.03     8051.39    c.m"
"             Rainfall losses        59.925     2.374      58.774     mm"
"             Runoff depth           12.155     69.706     13.306     mm"
"             Runoff volume          1330.59    155.72     1486.31    c.m"
```

```
"             Runoff coefficient     0.169      0.967      0.185      "
"             Maximum flow           0.314      0.051      0.323      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.323     1.553     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     5.422     1.553     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  81.368     13.936     23.958     minutes"
"             Time to Centroid       633.860    645.547    643.810    minutes"
"             Rainfall depth         72.080     72.080     72.080     mm"
"             Rainfall volume        1.9325     1.9325     3.8650     ha-m"
"             Rainfall losses        59.927     2.461      31.194     mm"
"             Runoff depth           12.154     69.620     40.887     mm"
"             Runoff volume          0.3258     1.8665     2.1923     ha-m"
"             Runoff coefficient     0.169      0.966      0.567      "
"             Maximum flow           0.548      5.296      5.422      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     5.422     6.467     0.000     0.000"
" 52          CHANNEL DESIGN"
"        6.467   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.145    metre"
"              Velocity                      0.619    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                0.933    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.397   X-factor <= 0.5"
"      147.267   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                  6.200    c.m/sec"
"                      5.422     6.467     6.200     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\NE Swale Model"
"                Output filename:       120139 - Existing 10 yr - NE Swale.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:                 2/2/2024 at 11:35:23 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      997.497   Coefficient A"
"        8.438   Constant B"
"        0.775   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           113.928    mm/hr"
"             Total depth                  85.001    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    1.862     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  79.845     13.937     66.959     minutes"
"             Time to Centroid       633.544    645.136    635.811    minutes"
"             Rainfall depth         85.001     85.001     85.001     mm"
"             Rainfall volume        5.2117     0.2743     5.4860     ha-m"
"             Rainfall losses        67.162     2.623      63.935     mm"
"             Runoff depth           17.840     82.379     21.067     mm"
"             Runoff volume          1.0938     0.2658     1.3596     ha-m"
"             Runoff coefficient     0.210      0.969      0.248      "
"             Maximum flow           1.756      0.725      1.862      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.862     1.862     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.468     1.862     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  52.678     9.195      48.925     minutes"
"             Time to Centroid       604.626    637.708    607.481    minutes"
"             Rainfall depth         85.001     85.001     85.001     mm"
"             Rainfall volume        9304.75    189.89     9494.64    c.m"
"             Rainfall losses        67.163     2.437      65.868     mm"
"             Runoff depth           17.838     82.564     19.133     mm"
"             Runoff volume          1952.70    184.45     2137.15    c.m"
```

```
"             Runoff coefficient     0.210      0.971      0.225      "
"             Maximum flow           0.459      0.059      0.468      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.468     2.289     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     6.243     2.289     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  76.373     13.331     24.548     minutes"
"             Time to Centroid       629.849    644.186    641.635    minutes"
"             Rainfall depth         85.001     85.001     85.001     mm"
"             Rainfall volume        2.2789     2.2789     4.5578     ha-m"
"             Rainfall losses        67.162     2.583      34.872     mm"
"             Runoff depth           17.839     82.418     50.129     mm"
"             Runoff volume          0.4783     2.2096     2.6879     ha-m"
"             Runoff coefficient     0.210      0.970      0.590      "
"             Maximum flow           0.797      6.045      6.243      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     6.243     7.594     0.000     0.000"
" 52          CHANNEL DESIGN"
"        7.594   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.180    metre"
"              Velocity                      0.638    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                0.974    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.395   X-factor <= 0.5"
"      143.034   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                  7.356    c.m/sec"
"                      6.243     7.594     7.356     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\NE Swale Model"
"                Output filename:       120139 - Existing 25 yr - NE Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 11:37:59 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1145.741   Coefficient A"
"        9.035   Constant B"
"        0.769   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          129.475    mm/hr"
"             Total depth                101.960    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    2.895     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  74.876     13.242     64.374     minutes"
"             Time to Centroid       627.502    643.881    630.293    minutes"
"             Rainfall depth         101.960    101.960    101.960    mm"
"             Rainfall volume        6.2514     0.3290     6.5805     ha-m"
"             Rainfall losses        76.549     2.800      72.862     mm"
"             Runoff depth           25.410     99.159     29.098     mm"
"             Runoff volume          1.5580     0.3200     1.8780     ha-m"
"             Runoff coefficient     0.249      0.973      0.285      "
"             Maximum flow           2.769      0.841      2.895      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.895     2.895     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.735     2.895     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  49.400     8.736      46.391     minutes"
"             Time to Centroid       600.836    636.797    603.497    minutes"
"             Rainfall depth         101.960    101.960    101.960    mm"
"             Rainfall volume        1.1161     0.0228     1.1389     ha-m"
"             Rainfall losses        76.550     2.487      75.069     mm"
"             Runoff depth           25.410     99.473     26.891     mm"
"             Runoff volume          2781.50    222.22     3003.72    c.m"
```

```
"             Runoff coefficient     0.249      0.976      0.264      "
"             Maximum flow           0.721      0.069      0.735      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.735     3.520     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     7.327     3.520     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  71.620     12.666     24.690     minutes"
"             Time to Centroid       624.104    642.996    639.142    minutes"
"             Rainfall depth         101.960    101.960    101.960    mm"
"             Rainfall volume        2.7335     2.7335     5.4671     ha-m"
"             Rainfall losses        76.549     2.787      39.668     mm"
"             Runoff depth           25.410     99.173     62.292     mm"
"             Runoff volume          0.6812     2.6588     3.3401     ha-m"
"             Runoff coefficient     0.249      0.973      0.611      "
"             Maximum flow           1.255      7.052      7.327      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     7.327     9.209     0.000     0.000"
" 52          CHANNEL DESIGN"
"        9.209   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.222    metre"
"              Velocity                      0.662    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                1.017    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.390   X-factor <= 0.5"
"      137.780   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                  8.997    c.m/sec"
"                      7.327     9.209     8.997     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\NE Swale Model"
"                Output filename:       120139 - Existing 50 yr - NE Swale.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:                 2/2/2024 at 11:40:00 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1273.113   Coefficient A"
"        9.492   Constant B"
"        0.770   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          140.566    mm/hr"
"             Total depth                112.445    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    3.666     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  72.079     12.813     62.683     minutes"
"             Time to Centroid       624.418    642.361    627.263    minutes"
"             Rainfall depth         112.445    112.445    112.445    mm"
"             Rainfall volume        6.8944     0.3629     7.2572     ha-m"
"             Rainfall losses        81.856     2.930      77.910     mm"
"             Runoff depth           30.589     109.515    34.535     mm"
"             Runoff volume          1.8755     0.3534     2.2289     ha-m"
"             Runoff coefficient     0.272      0.974      0.307      "
"             Maximum flow           3.510      0.922      3.666      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    3.666     3.666     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.914     3.666     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  47.555     8.454      44.882     minutes"
"             Time to Centroid       598.874    635.478    601.376    minutes"
"             Rainfall depth         112.445    112.445    112.445    mm"
"             Rainfall volume        1.2309     0.0251     1.2560     ha-m"
"             Rainfall losses        81.872     2.543      80.285     mm"
"             Runoff depth           30.573     109.903    32.160     mm"
"             Runoff volume          3346.76    245.52     3592.28    c.m"
```

```
"             Runoff coefficient     0.272      0.977      0.286      "
"             Maximum flow           0.899      0.075      0.914      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.914     4.448     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     8.154     4.448     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  68.945     12.256     24.634     minutes"
"             Time to Centroid       621.170    641.523    637.079    minutes"
"             Rainfall depth         112.445    112.445    112.445    mm"
"             Rainfall volume        3.0147     3.0147     6.0293     ha-m"
"             Rainfall losses        81.855     2.942      42.399     mm"
"             Runoff depth           30.590     109.503    70.047     mm"
"             Runoff volume          0.8201     2.9358     3.7559     ha-m"
"             Runoff coefficient     0.272      0.974      0.623      "
"             Maximum flow           1.577      7.868      8.154      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     8.154    10.319     0.000     0.000"
" 52          CHANNEL DESIGN"
"       10.319   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.248    metre"
"              Velocity                      0.678    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                1.042    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.390   X-factor <= 0.5"
"      134.494   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                 10.168    c.m/sec"
"                      8.154    10.319    10.168     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           C:\Users\rsingh\Desktop\My Jobs\120139\"
"                                                        NEW SWM\NE Swale Model"
"                Output filename:       120139 - Existing 100yr - NE Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/2/2024 at 11:43:26 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"     1440.000   Max. Storm length"
"     1440.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1357.120   Coefficient A"
"        9.595   Constant B"
"        0.763   Exponent C"
"        0.375   Fraction R"
"     1440.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          152.190    mm/hr"
"             Total depth                126.124    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
```

```
"                    4.297     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  69.534     12.413     60.914     minutes"
"             Time to Centroid       624.563    642.438    627.260    minutes"
"             Rainfall depth         126.124    126.124    126.124    mm"
"             Rainfall volume        7.7330     0.4070     8.1401     ha-m"
"             Rainfall losses        89.696     3.121      85.367     mm"
"             Runoff depth           36.428     123.003    40.757     mm"
"             Runoff volume          2.2335     0.3969     2.6305     ha-m"
"             Runoff coefficient     0.289      0.975      0.323      "
"             Maximum flow           4.128      1.024      4.297      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    4.297     4.297     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    1.070     4.297     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  45.875     8.189      43.436     minutes"
"             Time to Centroid       599.047    635.789    601.425    minutes"
"             Rainfall depth         126.124    126.124    126.124    mm"
"             Rainfall volume        1.3806     0.0282     1.4088     ha-m"
"             Rainfall losses        89.698     2.615      87.957     mm"
"             Runoff depth           36.426     123.509    38.167     mm"
"             Runoff volume          3987.38    275.92     4263.30    c.m"
```

```
"             Runoff coefficient     0.289      0.979      0.303      "
"             Maximum flow           1.053      0.088      1.070      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.070     5.243     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     9.085     5.243     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  66.510     11.873     24.347     minutes"
"             Time to Centroid       621.301    641.564    636.937    minutes"
"             Rainfall depth         126.124    126.124    126.124    mm"
"             Rainfall volume        3.3814     3.3814     6.7628     ha-m"
"             Rainfall losses        89.698     3.007      46.353     mm"
"             Runoff depth           36.426     123.117    79.771     mm"
"             Runoff volume          0.9766     3.3008     4.2773     ha-m"
"             Runoff coefficient     0.289      0.976      0.632      "
"             Maximum flow           1.914      8.722      9.085      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     9.085    11.536     0.000     0.000"
" 52          CHANNEL DESIGN"
"       11.536   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
```

```
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"              Depth of flow                 1.274    metre"
"              Velocity                      0.696    m/sec"
"              Channel capacity             16.662    c.m/sec"
"              Critical depth                1.066    metre"
" 53           ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.386   X-factor <= 0.5"
"      131.088   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                 11.413    c.m/sec"
"                      9.085    11.536    11.413     0.000 c.m/sec"
" 38           START/RE-START TOTALS 3000"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                    129.330    hectare"
"              Total Impervious area                    30.260    hectare"
"              Total % impervious                       23.398"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\120139"
"                Output filename:                   120139_EX_Reg-NE-Swale.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 2/24/2023 at 5:22:20 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"     5000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"            7   9999hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         1000   Existing Farm Field "
"        5.000   % Impervious"
"       64.540   Total Area"
"      700.000   Flow length"
"        2.000   Overland Slope"
"       61.313   Pervious Area"
"      700.000   Pervious length"
"        2.000   Pervious slope"
"        3.227   Impervious Area"
"      700.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
```

```
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     3.886     0.000     0.000     0.000 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           61.313     3.227      64.540     hectare"
"             Time of concentration  114.011    18.928     98.872     minutes"
"             Time to Centroid       2866.677   2300.051   2776.458   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        17.4742    0.9197     18.3939    ha-m"
"             Rainfall losses        207.052    4.534      196.926    mm"
"             Runoff depth           77.948     280.466    88.074     mm"
"             Runoff volume          4.7792     0.9051     5.6843     ha-m"
"             Runoff coefficient     0.274      0.984      0.309      "
"             Maximum flow           3.703      0.372      3.886      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     3.886     3.886     0.000     0.000"
" 33          CATCHMENT 2000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         2000   Existing Farm Field"
"        2.000   % Impervious"
"       11.170   Total Area"
"      350.000   Flow length"
"        2.000   Overland Slope"
"       10.947   Pervious Area"
"      350.000   Pervious length"
"        2.000   Pervious slope"
"        0.223   Impervious Area"
"      350.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.799     3.886     0.000     0.000 c.m/sec"
"             Catchment 2000         Pervious   Impervious Total Area "
"             Surface Area           10.947     0.223      11.170     hectare"
"             Time of concentration  75.219     12.488     71.002     minutes"
"             Time to Centroid       2831.604   2293.580   2795.432   minutes"
```

```
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        3.1198     0.0637     3.1834     ha-m"
"             Rainfall losses        207.392    10.907     203.462    mm"
"             Runoff depth           77.608     274.093    81.538     mm"
"             Runoff volume          8495.44    612.32     9107.77    c.m"
"             Runoff coefficient     0.272      0.962      0.286      "
"             Maximum flow           0.776      0.027      0.799      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.799     4.607     0.000     0.000"
" 33          CATCHMENT 3000"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"         3000   Developed part of Town"
"       50.000   % Impervious"
"       53.620   Total Area"
"      650.000   Flow length"
"        2.000   Overland Slope"
"       26.810   Pervious Area"
"      650.000   Pervious length"
"        2.000   Pervious slope"
"       26.810   Impervious Area"
"      650.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     4.602     4.607     0.000     0.000 c.m/sec"
"             Catchment 3000         Pervious   Impervious Total Area "
"             Surface Area           26.810     26.810     53.620     hectare"
"             Time of concentration  109.053    18.105     37.923     minutes"
"             Time to Centroid       2862.311   2297.705   2420.736   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        7.6409     7.6409     15.2817    ha-m"
"             Rainfall losses        206.803    4.345      105.574    mm"
"             Runoff depth           78.197     280.655    179.426    mm"
"             Runoff volume          2.0965     7.5244     9.6208     ha-m"
"             Runoff coefficient     0.274      0.985      0.630      "
"             Maximum flow           1.633      3.115      4.602      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     4.602     9.209     0.000     0.000"
```

```
" 52          CHANNEL DESIGN"
"        9.209   Current peak flow    c.m/sec"
"        0.060   Manning 'n'"
"           1.   Cross-section type: 0=trapezoidal; 1=general"
"           7.   Define an arbitrary cross-section"
"                  0.000     3.300     7.000    10.000    13.200"
"                 15.900    90.600"
"                439.420   438.610   438.360   438.000   437.370"
"                438.200   439.000"
"        1.630   Channel depth    metre"
"        0.850   Gradient   %"
"           0.   Variable roughness: 0=False; 1=True"
"                 0.0400    0.0400    0.0400    0.0400    0.0400"
"                 0.0400    0.0400"
"             Depth of flow                 1.222    metre"
"             Velocity                      0.662    m/sec"
"             Channel capacity             16.662    c.m/sec"
"             Critical depth                1.017    metre"
" 53          ROUTE    Channel Route 122"
"       121.60      Channel Route 122 Reach length   ( metre)"
"        0.390   X-factor <= 0.5"
"      137.780   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      163.636   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  9.080    c.m/sec"
"                     4.602     9.209     9.080     0.000 c.m/sec"
" 38          START/RE-START TOTALS 3000"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    129.330    hectare"
"             Total Impervious area                    30.260    hectare"
"             Total % impervious                       23.398"
" 19          EXIT"
```

Alma Subdivision
Town of Mapletown
Existing Condition Monthly Water Balance
Project No: 2401042 - 123019

EXISTING CONDITION

Soil Type: Silt Loam

Total Site Area = 8.01 ha

Vegetation: Shallow-rooted crops

Percent Impervious = 0%

Root Zone Depth= 0.62 m

Soil Moisture Retention Capacity= 125 mm

Runoff Factor = 0.52

Evapotranspiration Factor for Impervious Surfaces = 0.33

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotrans-piration	Correction Factors	Adjusted Potential Evapotrans-piration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff	Runoff Volume	Recharge Through Pervious Surfaces	Enhanced Recharge
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)
Jan	-8.0	0.00	0.0	24.3	0.0	69.8	69.8		268.7	0.0	0.0	0.0	0.0	0.0	8.8	0.0	8.8	5	369	339	0
Feb	-7.2	0.00	0.0	24.6	0.0	52.5	52.5		321.2	0.0	0.0	0.0	0.0	0.0	4.4	0.0	4.4	2	185	169	0
Mar	-2.1	0.00	0.0	30.6	0.0	66.9	66.9		388.1	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.2	1	92	85	0
Apr	5.1	1.03	0.8	33.6	26.9	76.8	49.9		125.0	0.0	26.9	26.9	0.0	49.9	25.0	31.3	56.3	29	2,351	2,157	0
May	12.2	3.86	2.0	37.8	75.6	83.8	8.2		125.0	0.0	75.6	75.6	0.0	8.2	16.6	115.9	132.5	69	5,534	5,077	0
Jun	17.1	6.44	2.8	38.4	107.5	88.5	-19.0	-19.0	106.0	-19.0	107.5	107.5	0.0	0.0	8.3	57.9	66.2	35	2,767	2,539	0
Jul	19.7	7.97	3.3	38.7	127.7	83.9	-43.8	-62.8	74.0	-32.0	115.9	115.9	11.8	0.0	4.1	29.0	33.1	17	1,383	1,269	0
Aug	18.8	7.43	3.1	36.0	111.6	92.1	-19.5	-82.3	64.0	-10.0	102.1	102.1	9.5	0.0	2.1	14.5	16.6	9	692	635	0
Sep	14.4	4.96	2.4	31.2	74.9	92.3	17.4		81.4	17.4	74.9	74.9	0.0	0.0	1.0	7.2	8.3	4	346	317	0
Oct	8.1	2.08	1.3	28.5	37.1	73.5	36.5		117.9	36.5	37.1	37.1	0.0	0.0	0.5	3.6	4.1	2	173	159	0
Nov	1.7	0.20	0.3	24.3	7.3	84.6	77.3		125.0	7.1	7.3	7.3	0.0	70.2	35.3	1.8	37.2	19	1,552	1,424	0
Dec	-4.5	0.00	0.0	23.1	0.0	73.9	73.9		198.9	0.0	0.0	0.0	0.0	0.0	17.7	1.0	18.7	10	780	716	0
Total		**34.0**				**938.6**	**370.1**				**547.2**	**547.2**	**21.3**	**128.3**	**126.1**	**262.3**	**388.4**	**286**	**16,223**	**14,886**	**0**

Total Recharge **14,886**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-2000 for the Fergus Shand Dam

Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*

Alma Subdivision
Town of Mapletown
Post-Development Condition Monthly Water Balance
Project No: 2401042 - 123019

POST-DEVELOPMENT CONDITION

Soil Type: Silt Loam

Total Site Area = 8.01 ha

Vegetation: Shallow-rooted crops

Percent Impervious = 44%

Root Zone Depth= 0.62 m

Soil Moisture Retention Capacity= 125 mm

Runoff Factor = 0.73

Evapotranspiration Factor for Impervious Surfaces = 0.33

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotrans-piration	Correction Factors	Adjusted Potential Evapotrans-piration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff	Runoff Volume	Recharge Through Pervious Surfaces	Enhanced Recharge
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)
Jan	-8.0	0.00	0.0	24.3	0.0	69.8	69.8		268.7	0.0	0.0	0.0	0.0	0.0	11.4	0.0	11.4	8	664	245	0
Feb	-7.2	0.00	0.0	24.6	0.0	52.5	52.5		321.2	0.0	0.0	0.0	0.0	0.0	5.7	0.0	5.7	4	332	123	0
Mar	-2.1	0.00	0.0	30.6	0.0	66.9	66.9		388.1	0.0	0.0	0.0	0.0	0.0	2.8	0.0	2.8	2	166	61	0
Apr	5.1	1.03	0.8	33.6	26.9	76.8	49.9		125.0	0.0	26.9	19.1	7.8	57.7	28.9	31.3	60.2	44	3,520	1,300	0
May	12.2	3.86	2.0	37.8	75.6	83.8	8.2		125.0	0.0	75.6	53.6	22.0	30.2	29.5	115.9	145.4	106	8,506	3,141	0
Jun	17.1	6.44	2.8	38.4	107.5	88.5	-19.0	-19.0	106.0	-19.0	107.5	76.3	31.2	31.2	30.4	57.9	88.3	64	5,166	1,908	0
Jul	19.7	7.97	3.3	38.7	127.7	83.9	-43.8	-62.8	74.0	-32.0	115.9	82.2	45.5	33.7	32.0	29.0	61.0	45	3,567	1,318	0
Aug	18.8	7.43	3.1	36.0	111.6	92.1	-19.5	-82.3	64.0	-10.0	102.1	72.4	39.2	29.7	30.8	14.5	45.3	33	2,651	979	0
Sep	14.4	4.96	2.4	31.2	74.9	92.3	17.4		81.4	17.4	74.9	53.1	21.7	21.7	26.3	7.2	33.5	24	1,961	724	0
Oct	8.1	2.08	1.3	28.5	37.1	73.5	36.5		117.9	36.5	37.1	26.3	10.8	10.8	18.5	3.6	22.1	16	1,295	478	0
Nov	1.7	0.20	0.3	24.3	7.3	84.6	77.3		125.0	7.1	7.3	5.2	2.1	72.3	45.4	1.8	47.2	34	2,762	1,020	0
Dec	-4.5	0.00	0.0	23.1	0.0	73.9	73.9		198.9	0.0	0.0	0.0	0.0	0.0	22.7	1.0	23.7	17	1,387	512	0
Total		**34.0**				**938.6**	**370.1**				**547.2**	**388.3**	**180.2**	**287.2**	**284.4**	**262.3**	**546.7**	**286**	**31,977**	**11,810**	**0**

Total Recharge **11,810**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-2000 for the Guelph Arboretum

Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*

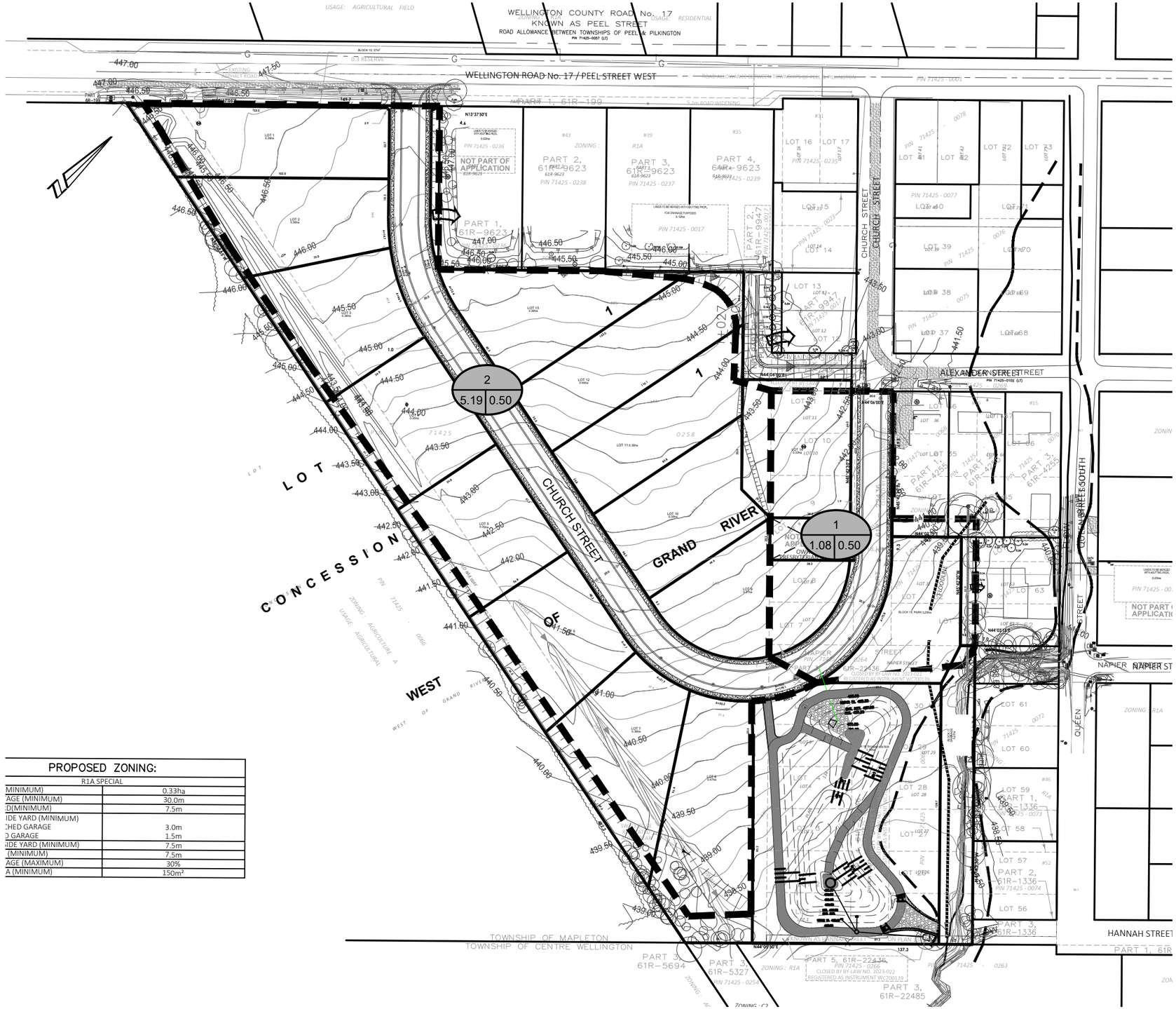
Alma Subdivision
City of Guelph
Monthly Water Balance Summary
Project No: 2401042 - 123019

	Existing Recharge Volume	**Proposed** Recharge Volume	Proposed Recharge Volume **Change**
	(m^3)	(m^3)	(%)
Jan	339	245	72%
Feb	169	123	72%
Mar	85	61	72%
Apr	2,157	1,300	60%
May	5,077	3,141	62%
Jun	2,539	1,908	75%
Jul	1,269	1,318	104%
Aug	635	979	154%
Sep	317	724	228%
Oct	159	478	302%
Nov	1,424	1,020	72%
Dec	716	512	72%
Total	**14,886**	**11,810**	**79%**

Appendix D

Preliminary Storm Sewer Design Sheet

ALMA SUBDIVISION
TOWNSHIP OF MAPLETON



LEGEND

DRAINAGE AREA BOUNDARY

1 — CATCHMENT NUMBER

1.08 | 0.50 — RUNOFF COEFFICIENT "C"

CATCHMENT AREA IN HECTARES

30 0 20 40 80

1:2000 (m)

PROPOSED ZONING:	
R1A SPECIAL	
MINIMUM)	0.33ha
AGE (MINIMUM)	30.0m
D(MINIMUM)	7.5m
IDE YARD (MINIMUM)	
CHED GARAGE	3.0m
D GARAGE	1.5m
IDE YARD (MINIMUM)	7.5m
(MINIMUM)	7.5m
AGE (MAXIMUM)	30%
A (MINIMUM)	150m²

PRELIMINARY STORM SEWER DRAINAGE AREA PLAN

Figure No. 5

GEI Consultants Canada

2401042 (120139)
MAY 2026
Scale: 1:2000 | NAD 1983 UTM Zone 17N

FILE:B:\Working\EXACT CONSTRUCTION\2401042 - 120139 Alma Subdivision\5 Work In Progress\Drafting\Sheets\Figures\120139 - SWM Figures.dwg
LAST SAVED BY:Paumcc4070, 5/22/2026 11:56:16 AM PLOTTED BY:McCartney, Paul 5/22/2026 12:18:24 PM

Mount Forest Chicago Storm Parameters

A = 876.909
B = 7.781
C = 0.78

Intensity = $A / (t + B)^C$

Q = CiA (m^3/s)

STORM SEWER DESIGN

5 Year Design

Alma Subdivision - Preliminary Pipe Sizing

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
Church Street	Catchment 1	Low Spot	1.08	0.5	0.54	0.54	10.00	92.89	**0.139**		375	0.013	2.00	0.258	2.33	-
Church Street	Catchment 2	Low Spot	5.19	0.5	2.60	2.60	10.00	92.89	**0.670**		675	0.013	1.81	1.175	3.28	-
SWM Block	Low Spot	Headwall	-	-	-	3.14	10.00	92.89	**0.809**		900	0.013	0.50	1.330	2.09	-

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

Date:	May 22, 2026	Project:	Alma Subdivision
Designed By:	SZ		
Checked By:	AEK	File:	120139