URBANTECH®

FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

EMPIRE ERIN, 5525 8TH LINE

TOWN OF ERIN, COUNTY OF WELLINGTON

PREPARED FOR
EC (ERIN) GP. INC.

Urbantech File No.: 21-684

1ST SUBMISSION – MAY 2022

Urbantech® Consulting, A Division of Leighton-Zec Ltd. | 3760 14th Avenue, Suite 301 • Markham • ON • L3R 3T7 | 905.946.9461
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1 INTRODUCTION & BACKGROUND

This report provides functional servicing design and stormwater management information in support of the Draft Plan of Subdivision for the proposed Empire Erin residential development located in the Town of Erin, County of Wellington. The purpose of this report is to outline details for the proposed grading, sanitary sewer, stormwater management (SWM) and water distribution systems required to service the subject development. This report is intended to present the functional design and calculations in sufficient detail to support the Draft Plan of Subdivision for the proposed Empire Erin residential development.

As shown on **Figure 1.0** provided in **Appendix A**, the subject site is bounded:

- To the east and north by the Natural Heritage System (NHS) and the West Credit River;
- To the south by the existing Erin Heights development; and
- To the west by 8th Line.

The subject site is comprised of part of Lot 19, and lies within the limits of the West Credit River subwatershed, under the Credit Valley Conservation (CVC) jurisdiction.

As per the Draft Plan of Subdivision prepared by Armstrong Planning & Project Management, the development consists of the following land use types:

- 197 Single Detached Residential lots;
- 66 Street Townhouses;
- 25 Rear Access Street Townhouses;
- 0.77 ha of Stormwater Management blocks;
- 0.69 ha of Park block;
- 0.59 ha Open Space; and
- 3.53 ha of Road Right-of-Way

It should be noted that the number of units listed above for each residential land use represents the maximum allowable number of units for the lotless blocks, and that actual lotting is to be determined prior to registration of the Draft Plan of Subdivision.

In the proposed development, there will be two (2) street connections to 8th Line at Street A and Street B as illustrated on **Drawing 2.2A** in **Appendix A.**

The servicing and development concept presented within this report are an extension of the information contained in the following reports and studies:

- Preliminary Geotechnical Investigation, 5525 8th Line, prepared by DS Consultants Ltd. (May 5, 2021);
- Meander Belt Width and Erosion Hazard Assessment for the Credit River – Erin Branch, prepared by GEO Morphix Ltd. (January 16, 2020); and
- Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis, Erin Fairways Subdivision, prepared by Terra-Dynamics Consulting Inc. (May 18, 2022).

The intention of this report is to demonstrate that the proposed Draft Plan of Subdivision prepared by Armstrong Planning & Project Management generally conforms to the findings and requirements of the above studies.

The technical design information in this report also considers the following guidelines:

- Town of Erin Engineering Design Standards;
- Credit Valley Conservation Stormwater Management Criteria;
- Ministry of the Environment's Stormwater Management Planning and Design Manual;
- Toronto and Region Conservation Authority's Erosion and Sediment Control Guide for Urban Construction; and
- Low Impact Development Stormwater Management Planning and Design Guide.

This report is also applicable to any future revisions to the Draft Plan, assuming the revisions are in general conformance with the concepts outlined herein.

2 SITE TOPOGRAPHY & GRADING

2.1. EXISTING CONDITIONS

The subject site is currently an existing golf course and is approximately 13.86 ha in size. The existing site topography is such that the site is moderately sloped towards the main branch of the West Credit River along the north boundary of the site, and towards tributary CR1-1 of the West Credit River along the east boundary of the site, as illustrated on **Drawing 1.2** provided in **Appendix A**.

2.2. PROPOSED CONDITIONS

The site grading design considers the following objectives and constraints:

- Conforms to Town of Erin design criteria;
- Respects existing boundary conditions;
- Optimize cut and fill operations to minimize import/export of materials;
- Provides overland flow conveyance for major storm conditions;
- Grading works within the NHS buffer have been proposed to minimize the need for retaining wall wherever possible;
- Grading works within the NHS buffer will also be coordinated with WSP to ensure minimal / no ecological impacts to the existing NHS features; and
- Provides minimum cover on proposed servicing.

The preliminary grading plan is shown on **Drawing 2.2B** provided in **Appendix A**. The proposed site has the following grading characteristics:

- Proposed grades match existing grade along the east, west and south boundaries of the site;
- Proposed grading along the north boundary of the site extends into the NHS buffer in order to accommodate the proposed grading transition while minimizing the implementation of retaining walls;
- Retaining wall is proposed along certain sections around the site boundary where required;
- Retaining wall is also proposed along the west side of the East SWM facility located in open space Block 31;
- Road centerline grades have been set at 0.5% to 5.0%; and
- A continuous overland flow path has been provided via the proposed right-of-ways (ROWs) to the north SWM facility.

Grading cross sections to describe proposed boundary conditions are shown on **Drawings 2.2C-2.2D** in **Appendix A**, and **Drawing 2.2E** illustrates preliminary cut and fill across the site based on the preliminary grading plan shown on **Drawing 2.2B**.

The proposed road ROWs throughout the subject site will sufficiently accommodate all proposed services and utilities in accordance with Town standards for 18.0 m and 20.0 m ROWs, and provide overland flow conveyance for major storm conditions.

2.2.1. Sediment and Erosion Control

Erosion and sediment control (ESC) will be implemented during all site construction works including topsoil stripping, bulk earthworks, foundation excavation, site servicing and stockpiling of materials, and will conform to the ESC Guide for Urban Construction (2019). These measures will include:

- A temporary sediment control fence will be placed along the perimeter of the site prior to grading.
- Temporary sediment ponds and/or traps will be provided at each outlet
- Temporary gravel mud mat will be provided at the construction vehicle access point to minimize off-site tracking of sediments
- All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

3 STORM DRAINAGE

3.1. EXISTING CONDITIONS

As illustrated on **Drawing 1.2** (provided in **Appendix A**), the drainage from the 13.86 ha subject site under existing conditions is ultimately conveyed to the main branch of the West Credit River along the north boundary of the site, and towards tributary CR1-1 of the West Credit River along the east boundary of the site.

A substantial portion of the subject site drains to two (2) existing Provincially Significant Wetlands (PSWs) prior to discharging to the West Credit River. As per **Drawing 1.2**, under existing conditions approximately 7.56 ha drains to PSW Unit 5a (including 6.04 ha of the subject site), and 2.16 ha drains to PSW Unit 4a (including 1.38 ha of the subject site).

3.2. PROPOSED CONDITIONS

As illustrated on **Drawing 4.0** (provided in **Appendix A**), the post-development storm drainage conditions are as follows:

- A total catchment area of 7.35 ha is conveyed to the North SWM facility in Block 29 via the proposed storm sewer system, including 0.86 ha of external road drainage from the future urbanized 8th Line;
- A total catchment area of 0.38 ha is conveyed to the East SWM facility in Block 31 via the proposed storm sewer system;
- A total rooftop area of 3.95 ha is conveyed to the North SWM facility in Block 29 via the proposed 3rd pipe cleanwater collector system;
- A total rooftop area of 0.96 ha is conveyed to the East SWM facility in Block 31 via the proposed 3rd pipe cleanwater collector system; and
- 1.92 ha of drainage from rear lots and the proposed park block is to drain uncontrolled to the NHS and ultimately to the main branch and tributary CR1-1 of the West Credit River.

The land use breakdown and imperviousness calculations for the post-development drainage catchments are provided in **Appendix B**.

3.2.1. Minor System

A storm sewer system is proposed throughout the subject site to convey flows from the 5-year return period event, as per Town of Erin standards. The storm sewers have been sized using the Rational Method and Town of Erin intensity-duration-frequency (IDF) parameters and runoff coefficients.

The proposed minor system storm sewer plan is illustrated on **Drawing 3.1**, provided in **Appendix A**. Contributing drainage area to the minor system does not account for the roof drainage which will be directed to the clean water collection system. Storm sewer design calculations are also included in **Appendix B**.

3.2.2. Major System

A continuous overland flow route has been provided through the subject site in order to safely convey major system flows in excess of the minor system up to, and including, the 100-year storm event to the proposed north SWM facility.

For all classes of roads, the proposed major system will confirm to the following Town of Erin design criteria:

- The maximum overland flow depth or static ponding for local roads shall not exceed 0.15 m above the crown of the road; and
- The product of depth of water (m) at the gutter times the velocity of flow (m/s) shall not exceed 0.65 m^2/s.

3.2.3. Cleanwater Collector System

A cleanwater collector 3rd pipe sewer system is proposed throughout the subject site to convey roof drainage from the 5-year return period event to both the North and East SWM facilities. The runoff from a total of 0.96 ha of roof area is proposed to be conveyed to the East SWM facility, and the runoff from a total area of 3.95 ha is proposed to be conveyed to the North SWM facility.

The cleanwater collector system has been sized using the Rational Method and Town of Erin intensity-duration-frequency (IDF) parameters and runoff coefficients.

The proposed cleanwater collector system is illustrated on **Drawing 3.1**, provided in **Appendix A**. Storm sewer design calculations for the 3rd pipe systems are also included in **Appendix B**.

4 STORMWATER MANAGEMENT

4.1. DESIGN CRITERIA

The following SWM requirements for the subject site were established, as per local SWM criteria:

- Quantity Control: Control of post-development flows for the 2 through 100-year storm events to pre-development levels for for the 24-hour SCS Type II storm distribution. The hydrology of the subject site is to be assessed based on the intensity-duration-frequency (IDF) curves from the MTO IDF tool.
- Climate change Considerations: The baseline analysis for quantity control is to be completed with the 2010 year IDF curves for both existing and proposed conditions. A 50-year projection to the IDF is then to be applied (ie. 2072 year IDF) for post-development conditions to compare the future projected post-development flows with the baseline pre-development conditions.
- Quality Control: Enhanced Level of control based on MOE (2003) Guidelines (ie. 80% Total Suspended Solids removal) through the implementation of end-of-pipe SWM facilities and/or LID measures.
- Erosion Control: Extended detention of the 25 mm rainfall event for a minimum of 48 hours.
- Site Water Balance: Site-specific criteria established through a hydrogeological assessment including water budget calculations with the objective of mitigating development impacts to infiltration through the implementation of Low Impact Development (LID) measures or other best management practices to retain, detain and/or infiltrate stormwater on an annual basis for the overall site.
- Feature-Based Water Balance: Feature-specific criteria for the two (2) existing wetlands downstream of the subject site were also established with the objective of mitigating development impacts to the wetlands through the implementation of LID measures.

Pre-development target flows for the subject site were established using a VO6 hydrologic model. The target flow rates applied to the subject site are summarized in **Table 4.1** below.

Table 4.1 – Pre-Development Target Flows

Storm Event	Pre-Development Target Flow (m^3/s)
2-year	0.221
5-year	0.385
10-year	0.515
25-year	0.693
50-year	0.839
100-year	0.994

4.2. PROPOSED CONDITIONS

4.2.1. Quantity Control

The VO6 hydrologic model was used to size the two (2) proposed SWM facilities. As noted in **Section 4.1**, the MTO 2010 year IDF was used as the baseline for the quantity control analysis for both pre and post-development conditions.

The VO6 model considered the flows from the uncontrolled rear-lot and park areas (1.92 ha) that cannot be directed to the SWM facilities. Target release rates for both SWM facilities were established such that the combination of the uncontrolled site flows and controlled release rates from the SWM facilities do not exceed the total pre-development target flows, as per **Section 4.1**.

The VO6 model was used to calculate post-development runoff from the proposed development and to determine the storage volume necessary to attenuate peak flows such that the total post-development release rates from the subject site match existing target flows.

As previously noted in **Section 3.2**, 3.95 ha of roof drainage is to be collected by the proposed cleanwater collector 3rd pipe system (as shown on **Drawing 3.1** and **Drawing 4.0**) and conveyed to the underground storage facility in the North SWM block. As the proposed 3rd pipe system is designed to convey up to and including the 5-year storm, the underground storage facility in the North SWM block was designed to control up to and including the 5-year flows from the 3.95 ha of roof drainage. For storm events greater than the 5-year return period, discharge from the North cleanwater collector 3rd pipe system is to overflow to the major system and is to be conveyed to the dry pond facility in the North SWM block. The dry pond facility is proposed to control flows from the North SWM block up to and including the 100-year storm event. The proposed design of the North SWM facility, including both the underground storage and dry pond, is illustrated in **Figure 4.1**.

As per **Section 3.2**, 0.96 ha of roof drainage is to be collected by the proposed cleanwater collector 3rd pipe system (as shown on **Drawing 3.1** and **Drawing 4.0**) and conveyed to the dry pond in the East SWM facility. A total 0.38 ha of rear-lot drainage is also proposed to be conveyed to and accommodated by the East SWM facility. The dry pond is proposed to control flows from the East SWM facility up to and including the 100-year storm event. The proposed design of the East SWM facility is illustrated in **Figure 4.2**.

A summary of the uncontrolled flows, controlled release rates and storage volumes required for each SWM facility is provided in **Table 4.2** below. The VO6 model output is included in **Appendix B**.

Table 4.2 – SWM Summary (24-hour SCS, 2010 Year MTO IDF)

Storm Event	Pre-Development Target Flows (m^3/s)	Post-Development Uncontrolled Flows (m^3/s)	North SWM Facility (Block 29)				East SWM Facility (Block 31)		Total Post-Development Flows (m^3/s)
			Controlled Release Rate – Underground Storage (m^3/s)	Total Storage Required – Underground Storage (m^3)	Controlled Release Rate – Dry Pond (m^3/s)	Total Storage Required – Dry Pond (m^3)	Controlled Release Rate – Dry Pond (m^3/s)	Total Storage Required – Dry Pond (m^3)	
2-Year	0.221	0.109	0.032	1490	0.060	1185	0.014	448	0.196
5-Year	0.385	0.154	0.088	1842	0.168	1480	0.047	547	0.345
10-Year	0.515	0.185	0.088	1842	0.248	1991	0.056	631	0.498
25-Year	0.693	0.225	0.088	1842	0.407	2621	0.091	722	0.685
50-Year	0.839	0.274	0.088	1842	0.470	3058	0.092	797	0.838
100-Year	0.994	0.310	0.088	1842	0.579	3652	0.109	874	0.988

4.2.1.1. Cimate Change Considerations

As previously noted in **Section 4.1**, the quantity control design of any SWM facility must account for climate change considerations, as per the Town guidelines. A 50-year projection was applied to the MTO

IDF curves in order to establish the projected IDF curves for 2072. Both the baseline (2010) and projected (2072) storm IDFs from the MTO IDF tool are provided in **Appendix B**, for reference. The post-development conditions were simulated in the VO6 model using the projected future storm IDF. The future projections of the post-development peak flows were then assessed and compared to the baseline (2010) pre-development target flows. The results of the 50-year projection climate change scenario from the VO6 hydrology model are summarized in **Table 4.3**, for which the VO6 model output is provided in **Appendix B**.

Table 4.3 – SWM Summary (24-hour SCS, 2072 Year MTO IDF)

Storm Event	Pre-Development Target Flows (m^3/s)	Post-Development Uncontrolled Flows (m^3/s)	North SWM Facility (Block 29)				East SWM Facility (Block 31)		Total Post-Development Flows (m^3/s)
			Controlled Release Rate – Underground Storage (m^3/s)	Total Storage Required – Undergrond Storage (m^3)	Controlled Release Rate – Dry Pond (m^3/s)	Total Storage Required – Dry Pond (m^3)	Controlled Release Rate – Dry Pond (m^3/s)	Total Storage Required – Dry Pond (m^3)	
2-Year	0.221	0.154	0.032	1737	0.060	1442	0.014	524	0.215
5-Year	0.385	0.211	0.088	1914	0.168	1966	0.047	621	0.353
10-Year	0.515	0.256	0.088	1914	0.248	2802	0.056	719	0.534
25-Year	0.693	0.301	0.088	1914	0.407	3116	0.091	802	0.674
50-Year	0.839	0.363	0.088	1914	0.470	3829	0.092	880	0.904
100-Year	0.994	0.408	0.088	1914	0.579	4158	0.109	963	0.993

As per the model results summarized in **Table 4.3**, there are slight exceedances of the target flows for the 10-year and 50-year storm events for the future projected IDF. However, the pre-development target flows are still met for the remaining storm events under the future projected post-development conditions, therefore demonstrating that the proposed SWM facilities can adequately accommodate future climate change considerations.

4.2.2. Quality Control

Both proposed SWM facilities were sized to provide a total 80% removal of Total Suspended Solids (TSS), as per to Table 3.2 in the MOE's Stormwater Planning and Design Manual.

Quality control for the North SWM facility is to be provided by a treatment train approach using the combined treatment from two (2) proposed oil/grit separator (OGS) units and the dry pond facility. The proposed OGS is to provide 50% TSS removal and the dry pond is to provide 60% TSS removal, resulting in an overall treatment of 80% TSS removal for the North SWM facility. The water quality sizing of the proposed dry pond in the North SWM block does not account for the roof drainage from the cleanwater collector system being discharged to the SWM facility, as the roof drainage is assumed to be inherently clean runoff which does not require additional water quality treatment.

Quality control for the East SWM facility is to be provided by infiltration, via the stone media layer at the base of the proposed dry pond. The storage volume to be provided by the proposed infiltration media at the East SWM facility was also sized to provide 80% TSS removal. The water quality sizing of the proposed infiltration facility in the East SWM facility does not account for the roof drainage from the cleanwater collector system being discharged to the SWM facility, as the roof drainage is assumed to be inherently clean runoff which does not require additional water quality treatment.

The quality control requirements for both proposed SWM facilities are summarized in **Table 4.4** and **4.5** below, for which the detailed sizing calculations are provided in **Appendix B**.

Table 4.4 – Quality Control Summary (North SWM Facility – Dry Pond, Basic Level Treatment)

Area (ha)	Imperviousness (%)	Unit Volume Requirement (m^3/ha)	Dry Pond Volume Required (m^3)	Dry Pond Volume Provided (m^3)
7.35	44	118	865	4,642

Table 4.5 – Quality Control Summary (East SWM Facility – Infiltration, Enhanced Level Treatment)

Area (ha)	Imperviousness (%)	Unit Volume Requirement (m^3/ha)	Infiltration Volume Required (m^3)	Infiltration Volume Provided (m^3)
0.38	79	38	14	150

4.2.3. Erosion Control

As per the *Meander Belt Width and Erosion Hazard Assessment for the Credit River – Erin Branch* prepared by GEO Morphix Ltd. (January 2020), there is little to no erosion along the channel in the downstream watercourse, where the channel banks were noted as well vegetated and there was no evidence of erosion or channel migration. Therefore, no site-specific erosion criteria apply for this section of the West Credit River downstream of the subject site.

In-stream erosion impact mitigation is to be addressed for the subject site through the incorporation of Low Impact Development (LID) measures in the two (2) proposed end-of-pipe SWM facilities. As noted in the Town's Engineering Design Standards, retaining the first 5 mm of precipitation on-site not only produces water balance benefits, but also provides downstream erosion benefits. As discussed further in **Section 5.2**, LID measures are proposed in the SWM facilities to provide infiltration of 15 mm over the rooftop area collected by the cleanwater 3rd pipe system in order to meet the water balance requirements. As summarized in **Table 4.6** below, the infiltration storage provided in both of the proposed SWM facilities provides a total infiltration volume exceeding the 5 mm retention volume over the total site area, therefore providing downstream erosion benefits.

Table 4.6 – Erosion Control Summary

Pond ID	Total Catchment Area to SWM (ha)	Retention Volume for Erosion Control (mm)	Retention Volume for Erosion Control (m^3)	Total Roof Area to Infiltration (ha)	Minimum Infiltration Volume Provided (mm)	Minimum Infiltration Volume Provided (m^3)
North SWM Facility (Block 29)	11.30	5	565	3.95	15	593
East SWM Facility (Block 31)	1.34		67	0.96		144

4.3. STORMWATER MANAGEMENT SUMMARY

4.3.1. SWM Facility Characteristics

Two multi-function SWM facilities are proposed within the subject site. The North SWM Facility and East SWM Facility details are illustrated on **Drawing 4.1** and **Drawing 4.2**, respectively.

The North SWM facility has been designed in accordance with all applicable SWM criteria to include the following features:

- Underground Storage Facility: Provides quantity control and storage attenuation for the roof drainage to the North SWM facility up to and including the 5-year storm event. The storage facility also provides extended detention of the 25 mm storm event for erosion control. The stone base of the underground storage facility provides infiltration storage for water balance requirements.
- Dry Pond: Provides quantity control and storage attenuation for up to and including the 100-year storm event. The dry pond also provides extended detention of the 25 mm storm event for erosion control and contributes to the overall quality control treatment of drainage to the North SWM facility in conjunction with the proposd OGS units.
- OGS: Two (2) proposed OGS units contribute to the overall quality control treatment of drainage to the North SWM facility in conjunction with the proposd dry pond.

The East SWM facility has been designed in accordance with all applicable SWM criteria to include the following features:

- Infiltration: A layer of clear media is provided at the base of the East SWM facility in order to provide infiltration storage for water balance requirements. The infiltration facility also provides quality control treatment of drainage to the East SWM block.
- Dry Pond: Provides quantity control and storage attenuation for up to and including the 100-year storm event. The dry pond facility also provides extended detention of the 25 mm storm event for erosion control.

4.3.2. General SWM Facility Design Guidance

As per the Town of Erin design criteria and engineering standards, the following design considerations are to be implemented as part of the detailed design of the proposed SWM facilities:

- A maximum overall depth of 2.0 m for dry pond facilities;
- Maintenance access roads are required to all inlet structures, outlet structures and emergency spillways;
- Where feasible, two (2) access points shall be provided from the municipal road allowance such that the access road is looped to key hydraulic features. In situations where this is not practical, dead end access roads shall be designed with a hammerhead turning area;
- Access roads shall provide a minimum width of 3.0 m and maximum grade of 8%;
- At locations where overland flow routes or emergency spillways cross the maintenance access, reinforcing measures shall be incorporated;
- Pond berms shall be designed with a minimum top width of 3.0 m (where trails and access roads are not located) with a 3:1 maximum side slope on the outside of the berm; and
- Pond berms exceeding 2.0 m in height from the top of berm to toe of slope, the berm must be designed by a qualified professional engineer.

5 WATER BALANCE

5.1. DESIGN CRITERIA

A Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis for the subject site was completed by Terra-Dynamics Consulting Inc. (Terra-Dynamics), in support of the Draft Plan of Subdivision. The study prepared by Terra-Dynamics includes an impact assessment of the existing downgradient features, including Provincially Significant Wetlands (PSWs) located north of the subject site, as well as an overall site-specific water balance analysis to identify an annual infiltration deficit based on pre and post-development groundwater recharge rates.

As per the hydrogeological assessment by Terra-Dynamics, the 15 mm runoff from a minimum roof area of 2.26 ha is required to balance PSW 5a and the 15 mm runoff from a minimum roof area of 0.79 ha is required to balance PSW 4a. As per the proposed cleanwater collector system design discussed in **Section 3.2.3**, it is proposed to direct 3.95 ha of roof drainage to the North SWM facility, which discharges immediately upgradient of PSW 5a, and it is proposed to direct 0.96 ha of roof drainage to the East SWM facility, which discharges immediately upgradient of PSW 4a. Therefore, the minimum feature-based water balance requirements for the two (2) existing PSW features located adjacent to the subject site are met under post-development conditions.

The Water Balance Assessment by Terra-Dyammics also identifies an annual infiltration deficit as a result of the proposed development, which is also to be mitigated by the proposed end-of-pipe infiltration facility LID features within the SWM blocks.

The Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis completed by Terra-Dynamics is provided in **Appendix C**.

5.2. LOW IMPACT DEVELOPMENT MEASURES

As per the Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis by Terra-Dynamics, water balance measures are proposed within the subject site and will consist of the following:

- A 3rd pipe cleanwater collection system to convey 0.96 ha of clean roof drainage to the East SWM facilty;
- An infiltration gallery proposed within the East SWM facility to infiltrate a minimum of 15 mm over the 0.96 ha roof area collected by the 3rd pipe system, by providing a total infiltration storage volume of 150 m^3 in the clear stone base of the East SWM facility;
- A 3rd pipe cleanwater collection system to convey 3.95 ha of clean roof drainage to the North SWM facilty; and
- An infiltration gallery proposed within the North SWM facility to infiltrate a minimum of 15 mm over the 3.95 ha roof area collected by the 3rd pipe system, by providing a total infiltration storage volume of 620 m^3 in the clear stone base of the underground storage facility.

As per the assessment by Terra-Dynamics, the above-mentioned LID measures will be able to maintain the required groundwater recharge rates upgradient of the existing PSWs, as well as maintaining a significant amount of the annual pre-development infiltration volume over the subject site area.

The configuration of the proposed 3rd pipe systems is shown on **Drawing 3.1**, and the proposed details for the two (2) LID features are provided on the North SWM Facility and East SWM facility plans shown on **Drawing 4.1** and **Drawing 4.2**, provided in **Appendix A**.

6 WATER DISTRIBUTION SYSTEM

6.1. EXISTING CONDITIONS

The subject site and all proposed works are within Pressure Zone IV of the Town of Erin water distribution system. There is no existing water infrastructure within the subject site. A watermain currently exists on 8th Line that will supply the proposed development. The conceptual location of the existing water infrastructure on 8th Line is shown on **Drawing 6.1** provided in **Appendix A**.

As per the Town's Water Class EA Study prepared by Triton Engineering, new municipal wells and additional fire storage reservoirs will have to be construced in order to accommodate all proposed developments within the Town of Erin. The Town has retained a consultant to develop a new water model for the existing and future systems.

6.2. PROPOSED CONDITIONS

Two (2) connections to the existing watermain on 8th Line will be required via Street A and Street B. The subject site will be serviced internally by local watermains. Internal watermain sizes are to be confirmed following completion of the water model updates by the Town's consultant for the existing watermain system on 8th Line. Further coordination with the Town will also be required regarding the timing of the new infrastructure. Pending the model results from the Town's consultant, the existing watermain on 8th Line may need to be upgraded to a larger diameter watermain in conjunction with the adjacent proposed developments.

All proposed units will be provided with individual water service connections in accordance with the Town's design criteria. Refer to **Drawing 6.1** (provided in **Appendix A**) for the proposed water servicing configuration for the subject site.

Details regarding hydrant and valve chamber requirements will be determined through detailed design of the subdivision. Hydrant testing and water modelling will also be conducted as part of the detailed engineering design to confirm adequate fire flow is available.

7 SANITARY SERVICING

7.1. EXISTING CONDITIONS

There is currently no existing wastewater infrastructure within the subject site or on 8th Line adjacent to the Empire Erin development.

7.2. DESIGN CRITERIA

Wastewater sewers will be designed in accordance with the latest Town of Erin standards and specifications as listed below:

- Average Flow - 290 L/person/day
- Infiltration – 90 L/day/capita
- Population Density, Single Family Dwelling – 2.8 persons/unit
- Population Density, Townhouse – 2.8 persons/unit

7.3. PROPOSED CONDITIONS

The subject site will be serviced by a network of local gravity sewers designed in accordance with Town of Erin standards and specifications. A connection to the Town's sanitary sewer on 8th Line will be required via Street A. The proposed sanitary servicing for the subject site is to be coordinated with the proposed Mattamy development located west of 8th Line.

If a gravity outlet to the proposed Town trunk sewer is not a feasible servicing solution, Empire and Mattamy are to investigate the alternative solution of using a sewage pump station and sanitary forcemain for conveyance of sanitary flows to the Town's trunk sewer along Main Street, where Dundas Street could be potentially utilized as the sanitary forecemain corridor.

The two (2) options for the proposed wastewater servicing plan are conceptually illustrated on **Drawing 7.1** provided in **Appendix A**. Sanitary design calculations are also included in **Appendix B**.

8 ROADS

Approximately 3.53 ha of internal road right-of-way (ROW) is proposed throughout the subject site. The proposed ROW cross sections follow the standard cross sections identified in the 2020 Town of Erin design criteria. In addition to providing passage of traffic through the Empire Erin development, the proposed road ROWs are able to sufficiently accommodate all proposed services and utilities, as well as to convey overland flow for major storm conditions.

East side of the existing 8th Line will be urbanized by Empire Erin in conjunction with their development as per the standard 26.0m ROW section (std. 104). The extent of 8th Line urbanization to be confirmed by the Town prior to draft plan approval.

Standard ROWs proposed for roads in the subject site are summarized in **Table 8.1**. **Figures 8.1A** to **8.1C** provide typical road cross section details for each of these ROWs. It should be noted that the proposed cleanwater collector system and dual minor storm system were added to the Town's typical road ROW details were applicable, as it relates to the servicing design of the subject site.

Table 8.1 – Proposed Road ROW Details

ROW Width (m)	Total ROW Length (m)	Streets
18.0	841	Streets B - E
20.0	1,100	Street A
26.0	653	8th Line (External)

9 CONCLUSION

This FSR report has demonstrated that:

- The proposed site grading design generally adheres to the Town of Erin grading standards and specifications.
- Stormwater quantity, quality and erosion controls for the subject site will be provided by the two proposed SWM facilities in accordance with all applicable guidelines and standards.
- Water balance is to be provided by end-of-pipe infiltration facilities in the two (2) proposed SWM blocks which are sized to infiltrate 15 mm over the total rooftop area of the subject site.
- Water servicing to the subject site will be provided via two connections to the existing watermain on 8th Line.
- There are two (2) potential options for the proposed sanitary system to service the subject site, pending confirmation from the Town on the availability of the Town's trunk sewer within the Elora-Cataract Trail to service the subject Empire site, as well as the neighbouring Mattamy development.
- Erosion and sediment control measures will be implemented during all construction works and will be maintained and inspected regularly.

Report Prepared by:

Kate Rothwell, M.Eng., P. Eng.
Senior Water Resources Engineer

APPENDIX A

DRAWINGS & FIGURES

- Figure 1.0 – Location Map
- Drawing 1.2 – Pre-Development Drainage Plan
- Drawing 2.2A – Proposed Draft Plan
- Drawing 2.2B – Preliminary Grading Plan
- Drawing 2.2C – Preliminary Grading Plan (Cross Sections 1-1 to 7-7)
- Drawing 2.2D – Preliminary Grading Plan (Cross Sections 9-10-11-13)
- Drawing 2.2E – Preliminary Cut-Fill Plan
- Drawing 3.1 – Post-Development Storm Drainage Plan
- Drawing 4.0 – Stormwater Management Plan
- Drawing 4.1 – North SWM Facility
- Drawing 4.2 – East SWM Facility
- Drawing 6.1 – Watermain Plan
- Drawing 7.1 – Sanitary Drainage Plan
- Figure 8.1A – Modified 18.0m ROW Cross Section
- Figure 8.1B – Modified 20.0m ROW Cross Section
- Figure 8.1C – Modified 26.0m ROW Cross Section

Functional Servicing Report 5525 8th Line (Empire- Erin, Wellington)

LEGEND:

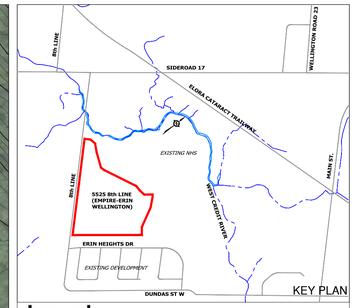
SUBJECT LANDS

FIGURE 1.0
LOCATION MAP

URBANTECH

March 2022

Scale: N.T.S.



Legend:

- Property Boundary
- Existing Watercourse
- 414.00 — Existing Contour Elevation
- Existing Overland Flow
- Existing Wetland
- Pre-Development Drainage Area Boundary to Wetland
- A=2.16 ha — Drainage Area in hectares

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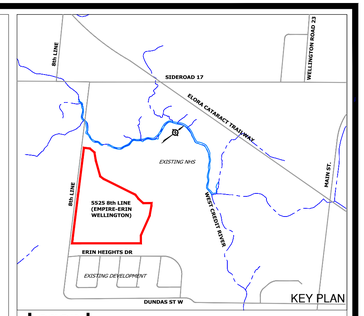
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

PRE-DEVELOPMENT DRAINAGE PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1250	1.2

File: P:\Projects\21-684 - 5525 8th Line (Empire- Erin, Wellington)\Reports\Functional Servicing Report\Drawings & Figures\DWG 1.2 - Pre-Development Drainage Plan.dwg - Revised by <USER> - Mon, Feb 14 2022 - 2:15



Legend:

ADDITIONAL INFORMATION

Required Under Section 51(17)
Of The Planning Act R.S.O. 1990 c.P.13

(a) SHOWN ON DRAFT PLAN
(b) SHOWN ON DRAFT AND KEY PLANS
(c) SHOWN ON KEY PLAN
(d) LAND TO BE USED IN ACCORDANCE WITH LAND USE SCHEDULE
(e) SHOWN ON DRAFT PLAN
(f) SHOWN ON DRAFT PLAN
(g) SHOWN ON DRAFT AND KEY PLANS
(h) MUNICIPAL PIPED WATER TO BE PROVIDED
(i) SOIL IS SANDY SILT AND CLAYEY SILT
(j) SHOWN ON DRAFT PLAN
(k) ALL MUNICIPAL SERVICES TO BE PROVIDED
(l) SHOWN ON DRAFT PLAN

SCHEDULE OF LAND USE

	Proposed Land Use	Reference	Area (Ha.)
1)	Residential Singles 11.6m	Blocks 21,24,26,28	2.622
2)	Residential Singles 10.1m	Blocks 11,17,18,19,23,25	1.682
3)	Residential Singles 8.2m	Blocks 4,7,8,10,14,15,20,22,27	2.059
4)	Rear Lane Residential Singles 8.2m	Block 2	0.202
5)	Street Townhouses 6.1m	Blocks 5,6,9,12,13,16	1.339
6)	Rear Lane Street Townhouses 6.1m	Blocks 1,3	0.375
7)	Stormwater Management	Block 29	0.770
8)	Park	Block 30	0.691
9)	Open Space	Blocks 31,32,33	0.589
10)	Roads		3.530
	Total Site Area		**13.859**

Proposed Summary Yield	
Unit Mix	**Units**
Residential Singles 11.6m	58
Residential Singles 10.1m	51
Residential Singles 8.2 m	78
Rear Lane Residential Singles 8.2 m	10
Street Townhouses 6.1 m	66
Rear Lane Street Townhouses 5.0m	25
Total Dwelling Units	**288**

No.	REVISION	DATE
3		
2		
1		

REVISIONS

OWNER'S CERTIFICATE

WE, BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE ARMSTRONG PLANNING and PROJECT MANAGEMENT TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL.

SIGNED _____ DATE _____

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE SUBJECT LANDS AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN ON THIS PLAN.

SIGNED _____ DATE _____

S. GOONEWARDENA, O.L.S.
R-PE SURVEYING LTD.
643 CHRISLEA ROAD, SUITE 7
WOODBRIDGE, ONTARIO L4L 8A3 TEL.
(416)-635-5000

DRAFT PLAN OF SUBDIVISION

PART OF LOT 19,
REGISTRAR'S COMPILED PLAN 686
(FORMERLY VILLAGE OF ERIN)
TOWN OF ERIN
COUNTY OF WELLINGTON

armstrong planning | project management

		SCALE	1:750
DESIGN	DRAWN	PROJECT No.	21.2842.00
APPROVED	DATE February 7, 2022	DRAWING No.	1

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Functional Servicing Report
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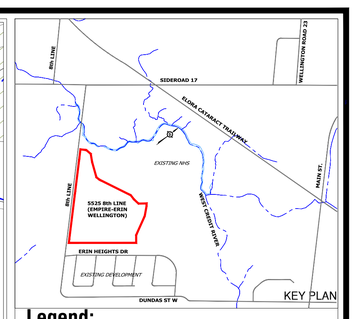
(Empire- Erin, Wellington)

PROPOSED DRAFT PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1000	**2.2A**

File: P:\Projects\21-684 - 5525 8th Line (Empire- Erin, Wellington)\Reports\Functional Servicing Report\Drawings & Figures\DWG 2.2A - Proposed Draft Plan.dwg - Revised by <DZEC> : Mon, Feb 14 2022 - 1:52pm



Legend:

- SUBJECT LANDS
- EXISTING CONTOUR ELEVATION
- EXISTING ELEVATION
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING WETLAND
- EXISTING WOODLAND
- EXISTING POND
- NHS BUFFER
- PROPOSED ELEVATION
- PROPOSED OVERLAND FLOW DIRECTION
- INTERPRETED GROUNDWATER ELEVATION CONTOUR
- PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
- PROPOSED RETAINING WALL
- SWM POND BLOCK RESTORATION AREA
- UNDERGROUND STORAGE TANK OR STONE INFILTRATION TRENCH
- PROPOSED GRAVEL ACCESS
- FILTREXX SILT SOXX
- RIP-RAP SPILLWAY
- F FRONT DRAINING LOT
- S SPLIT DRAINING LOT
- LO LOOK OUT CONDITION
- WO WALK OUT CONDITION
- WU FRONT WALK UP CONDITION

NOTES:

1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY UP TO DUNDAS STREET TO THE TOWN SATISFACTION. DETAILS TO BE FURTHER COORDINATED WITH THE TOWN.
2. CVC PERMISSION WILL BE REQUIRED FOR PROPOSED GRADING AND RESTORATION WITHIN THE NHS BUFFER.
3. REFER TO DRAWINGS 2.2C TO 2.2D FOR GRADING CROSS SECTIONS 1-1 TO 13-13.
4. REFER TO DRAWINGS 5.1 AND 5.2 FOR SWM POND BLOCK DETAILS AND CROSS SECTIONS.

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Functional Servicing Report
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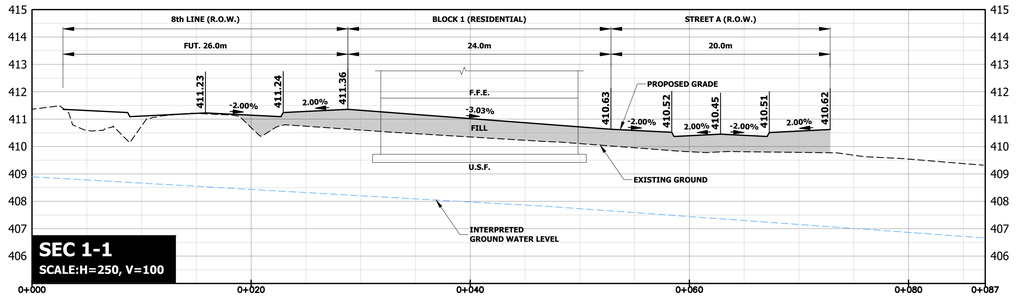
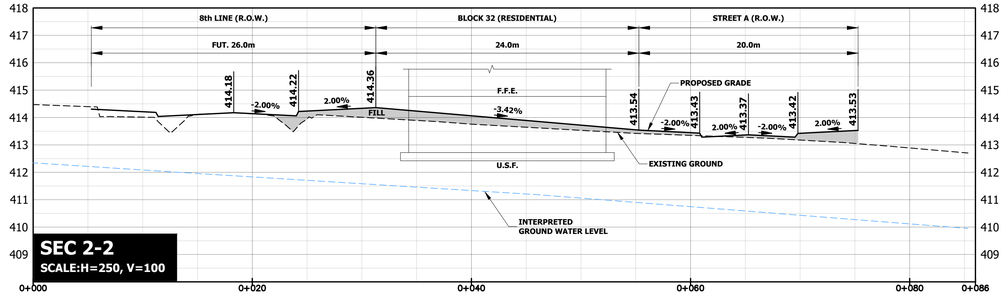
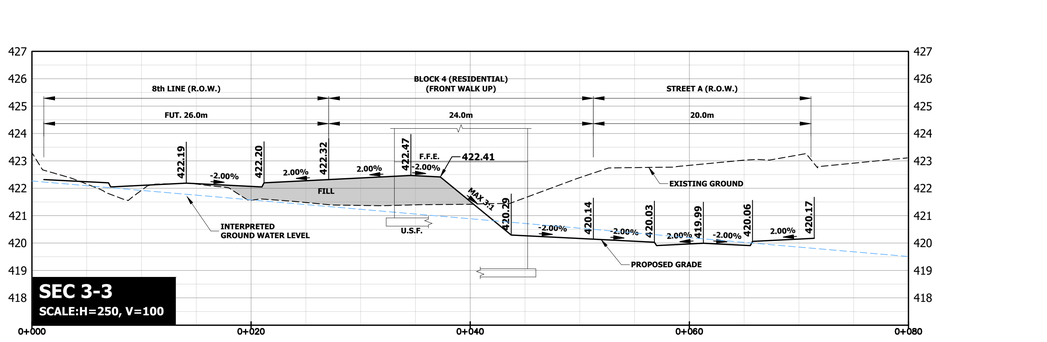
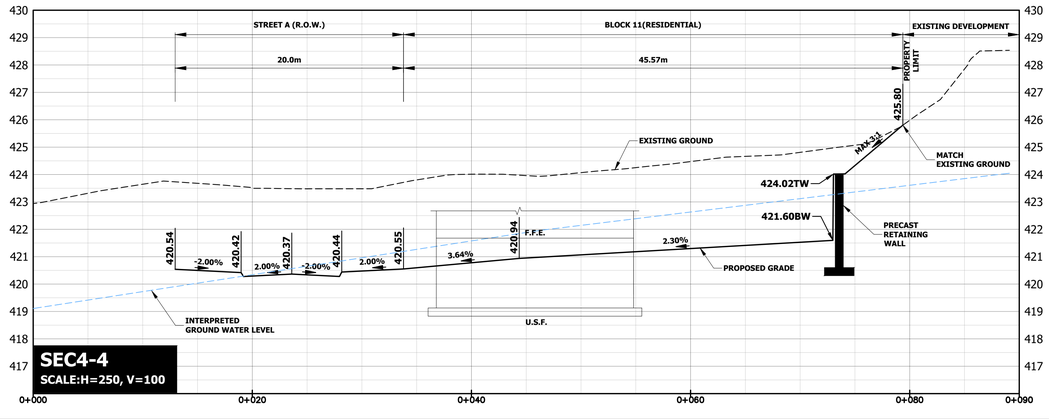
PRELIMINARY GRADING PLAN

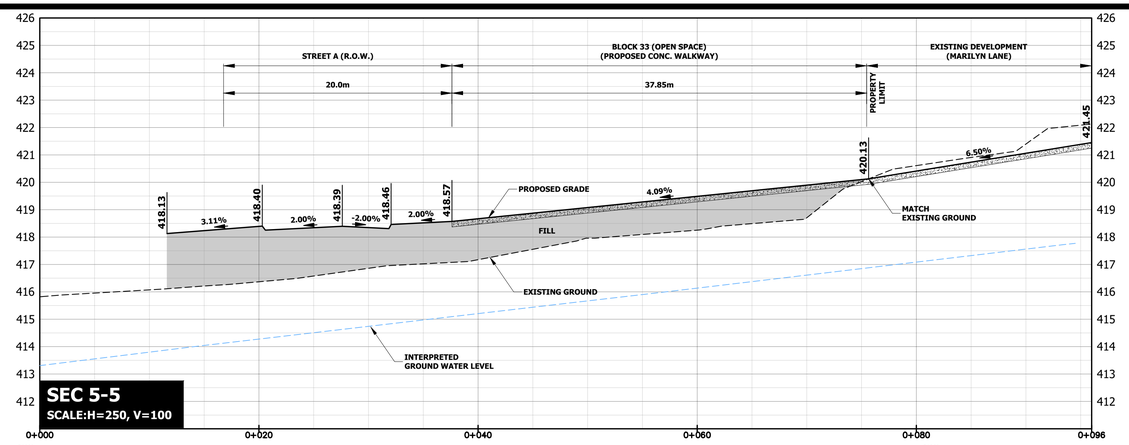
PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:750	**2.2B**

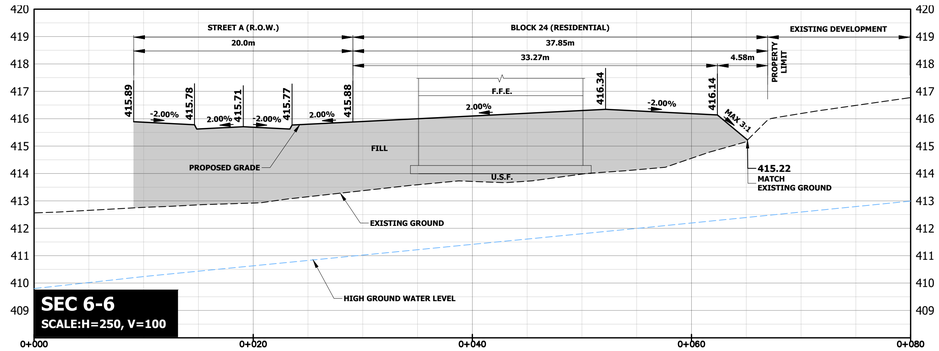


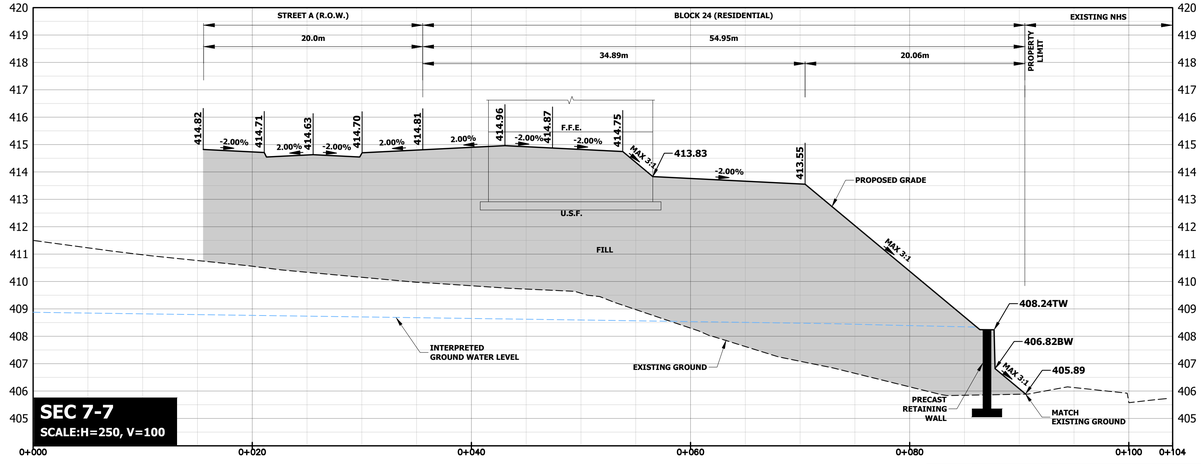












NOTE:
FOR SECTION LOCATIONS PLEASE REFER TO GRADING PLAN DRAWING 2.2B.

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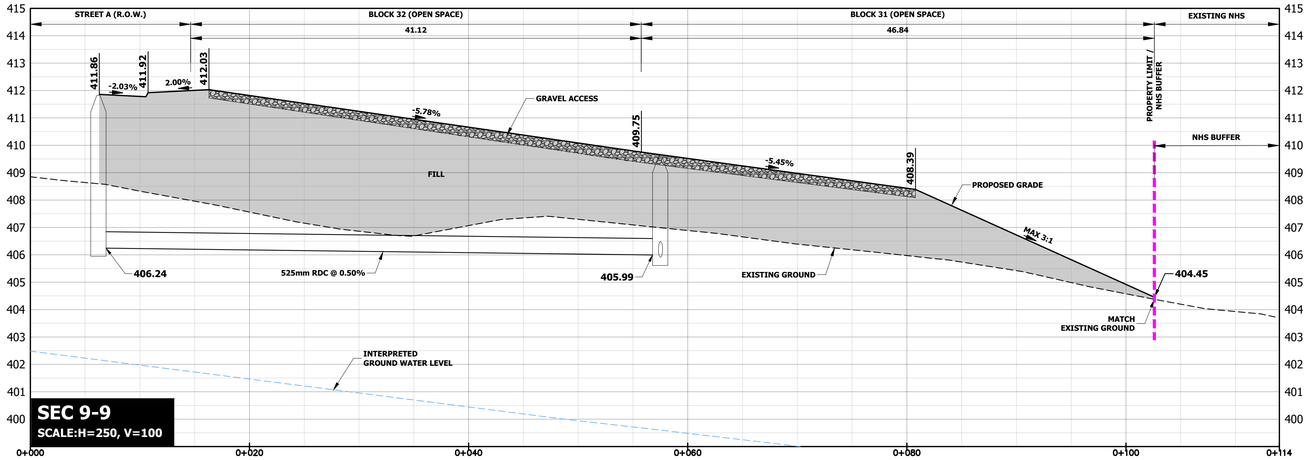
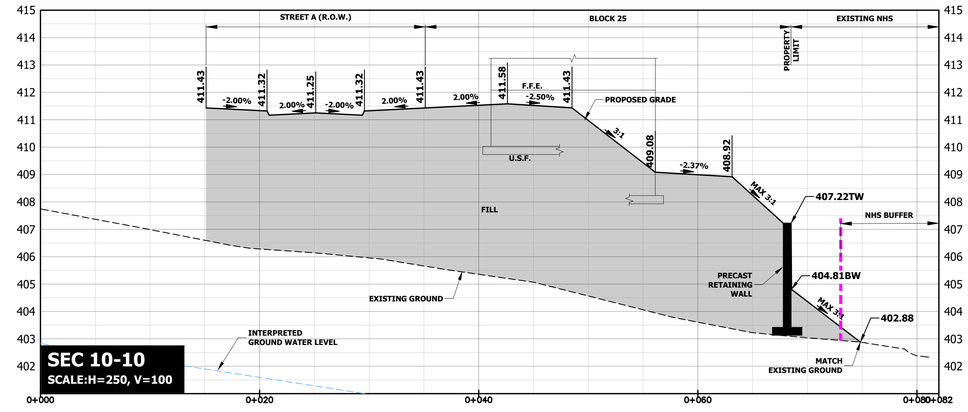
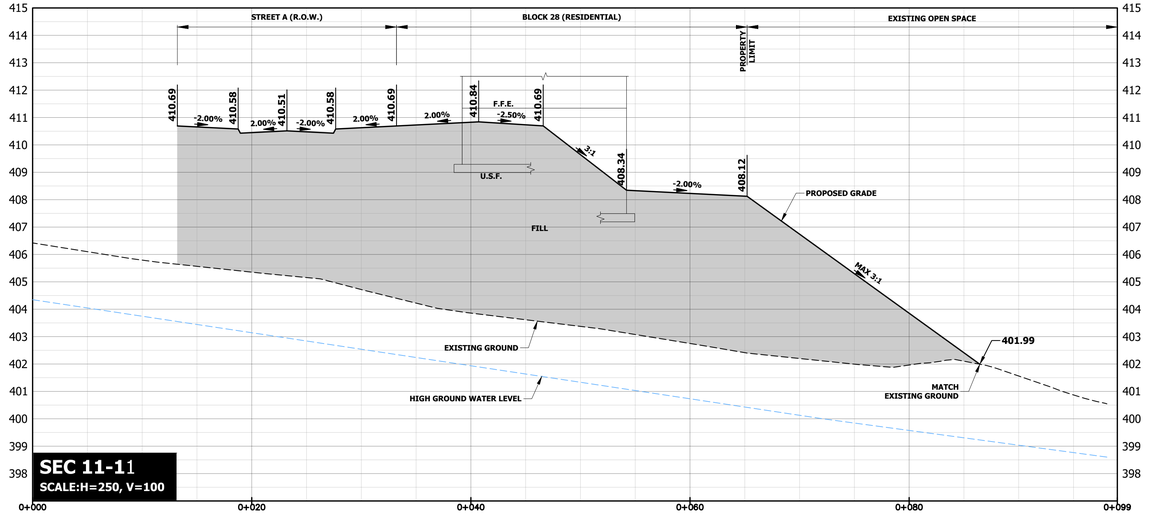
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

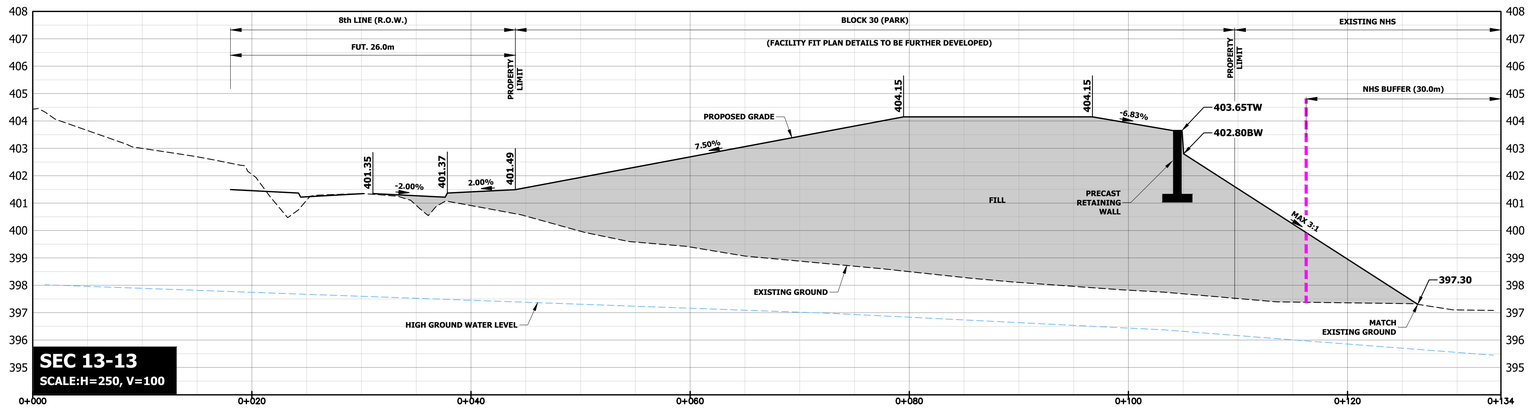
PRELIMINARY GRADING PLAN
CROSS SECTIONS 1-1 to 7-7

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	AS SHOWN	**2.2C**









NOTE:
FOR SECTION LOCATIONS PLEASE REFER TO GRADING PLAN DRAWING 2.2B.

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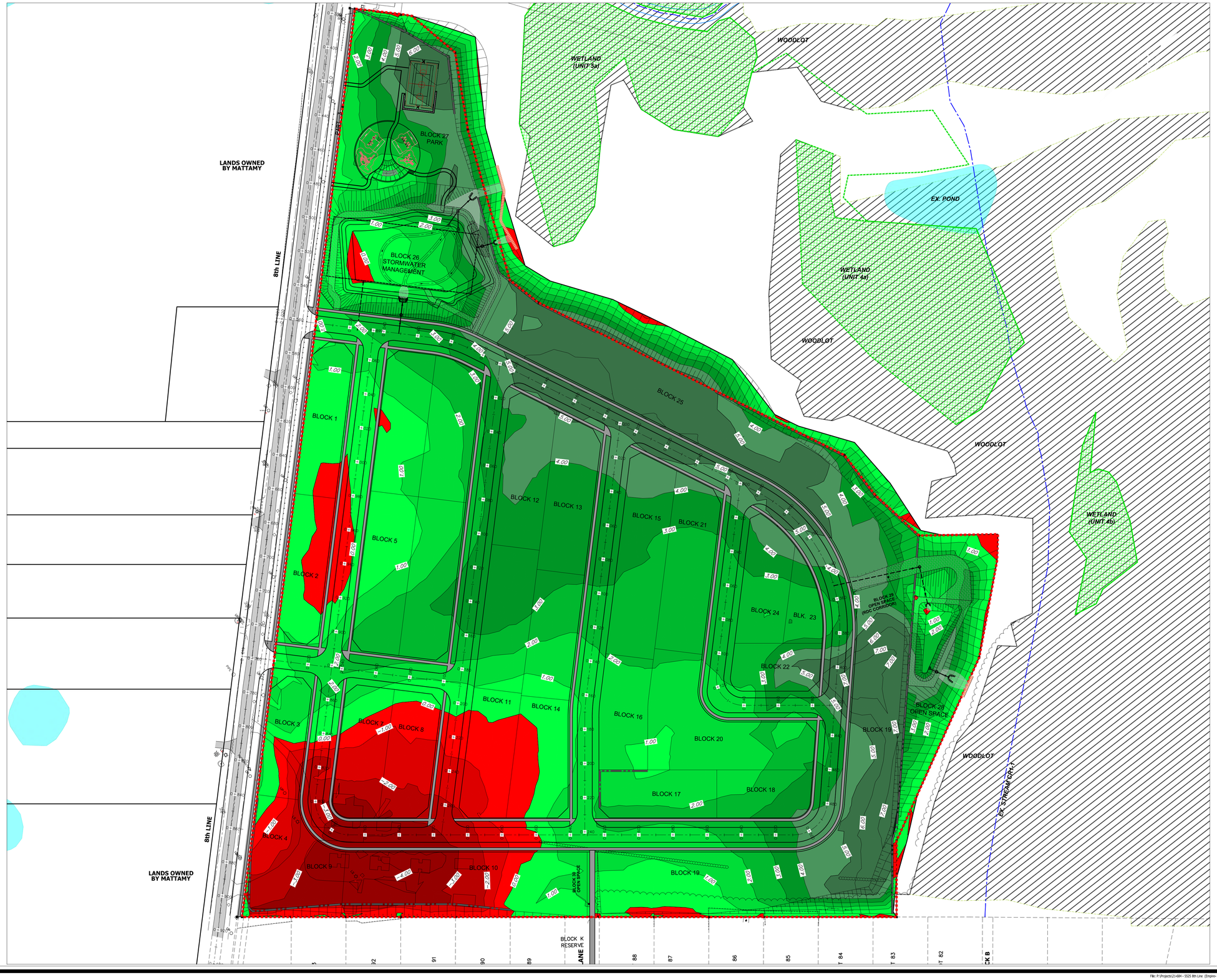
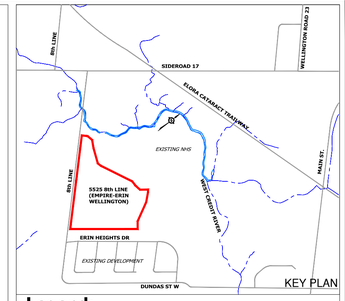
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

PRELIMINARY GRADING PLAN
CROSS SECTIONS 9-10-11-13

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	AS SHOWN	**2.2D**





Legend:

SUBJECT LANDS

INTERPOLATED DEPTH BETWEEN ORIGINAL GROUND AND PROPOSED GRADE SURFACE

-3.000	-4.331	CUT
-2.000	-3.000	CUT
-1.000	-2.000	CUT
-0.000	-1.000	CUT
0.000	0.000	0.000
0.000	1.000	FILL
1.000	2.000	FILL
2.000	3.000	FILL
3.000	4.000	FILL
4.000	5.000	FILL
5.000	7.723	FILL

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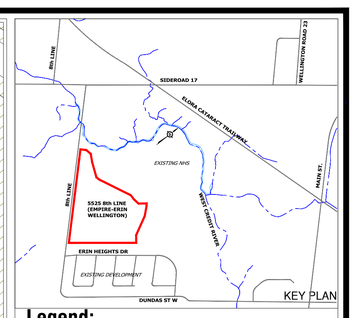
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

PRELIMINARY CUT-FILL PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	N.T.S.	**2.2E**



Legend:

- SUBJECT LANDS
- SUBJECT LANDS EXISTING CONTOUR ELEVATION
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING WETLAND
- EXISTING WOODLAND
- EXISTING POND
- NHS BUFFER
- PROPOSED OVERLAND FLOW DIRECTION
- PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
- SWM POND BLOCK RESTORATION AREA
- UNDERGROUND STORAGE TANK OR STONE INFILTRATION TRENCH
- MINOR SYSTEM DRAINAGE BOUNDARY (TO STORMWATER MANAGEMENT POND)
- 1.26 / 0.60 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- 0.50ha / 0.90 — ROOF DRAIN COLLECTOR DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- STORM SEWER FLOW DIRECTION AND MANHOLE
- CLEAN WATER SEWER FOR CONVEYANCE OF ROOF DRAINAGE
- ROOF DRAIN COLLECTOR DRAINAGE AREA TO EAST POND (ROOF AREA = 0.69% x LOT AREA)
- ROOF DRAIN COLLECTOR DRAINAGE AREA TO NORTH STORAGE TANK (ROOF AREA = 0.69% x LOT AREA)
- MH 118 / TOP 413.32m / SW 411.08m / NW 410.89m — **STORM MH ID**, PROPOSED GROUND ELEVATION, PROPOSED SEWER OBVERTS (UNLESS SPECIFIED AS INVERT)
- MH 309C / TOP 411.82m / SW 408.13m / NW 408.08m — **CLEAN WATER MH ID**, PROPOSED GROUND ELEVATION, PROPOSED SEWER OBVERTS (UNLESS SPECIFIED AS INVERT)

NOTES:

1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY TO THE TOWN'S SATISFACTION. FURTHER COORDINATION WITH THE TOWN IS NEEDED TO ESTABLISH LIMITS OF URBANIZATION BASED ON THE HOLDOUT PROPERTIES ALONG THE 8th LINE FRONTAGE.
2. PROPOSED SWM FACILITIES WITHIN THE EMPIRE AND MATTAMY DEVELOPMENTS TO CAPTURE GRAVITY 8th LINE STORM OUTLETS ALONG BOTH PROPERTY FRONTAGES. EACH DEVELOPMENT TO CAPTURE HALF OF THE URBANIZED ROW CROSS SECTION.
3. EMPIRE'S 8th LINE FRONTAGE NORTH OF STREET A INTERSECTION CANNOT BE CAPTURED IN THE PROPOSED SWM FACILITY DUE TO GRADING CONSTRAINTS. THIS SECTION OF 8TH LINE ROW WILL BE DISCHARGED TO THE EXISTING CREEK IN THE VICINITY OF EXISTING BRIDGE STRUCTURE. FURTHER DESIGN COORDINATION WITH THE TOWN IS REQUIRED.
4. MINOR SYSTEM DRAINAGE TO BE DIRECTED TO A DRY POND IN THE NORTH SWM POND BLOCK 29. ROOF DRAIN COLLECTORS TO BE CONNECTED TO THE INFILTRATION FACILITIES WITHIN SWM POND BLOCKS 29 AND 31 FOR GROUNDWATER RECHARGE.
5. REFER TO GRADING PLAN DWG 2.1 AND STORMWATER MANAGEMENT PLAN DWG 5.0 FOR MAJOR SYSTEM FLOW DIRECTION.
6. REFER TO DRAWINGS 5.1 AND 5.2 FOR DETAILS OF PROPOSED SWM FACILITIES.
7. REFER TO FSR DRAWINGS BY DSEL FOR DETAILS OF THE PROPOSED MATTAMY DEVELOPMENT.
8. ROOF AREA ASSUMED TO BE 69% OF THE LOT AREA.

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Functional Servicing Report
5525 8th Line
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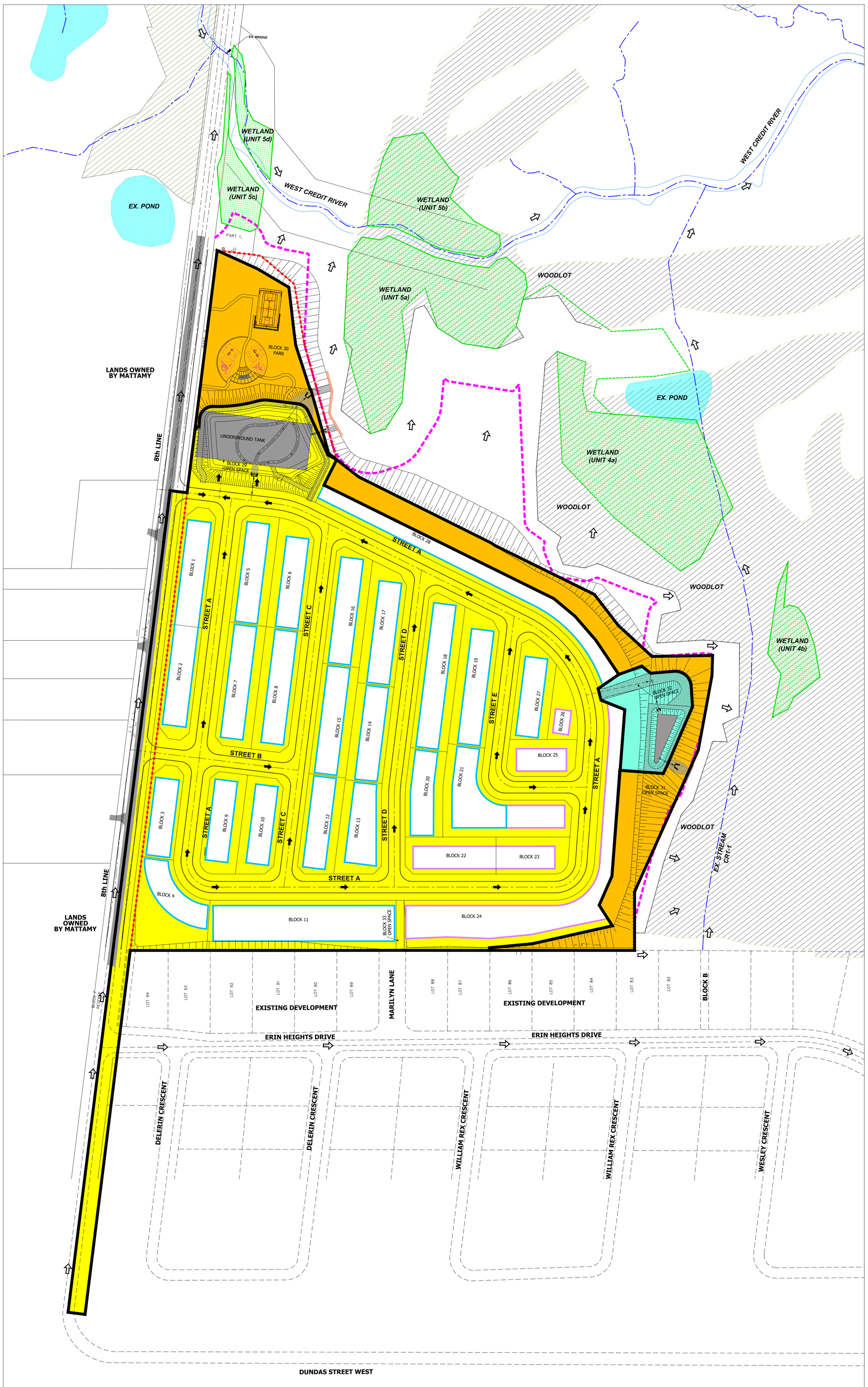
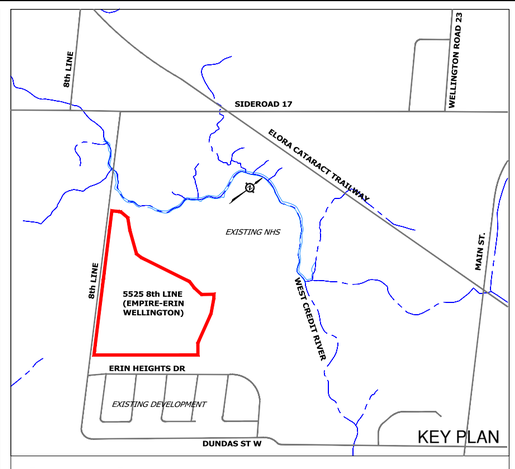
POST-DEVELOPMENT STORM DRAINAGE PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1000	**3.1**





Legend:

- SUBJECT LANDS
- SUBJECT LANDS EXISTING CONTOUR ELEVATION (414.00)
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING WETLAND
- EXISTING WOODLAND
- EXISTING POND
- NHS BUFFER
- PROPOSED OVERLAND FLOW DIRECTION
- UNDERGROUND STORAGE TANK OR STONE INFILTRATION TRENCH
- CONTRIBUTING DRAINAGE AREA TO NORTH SWM FACILITY (BLOCK 29) (AREA: 7.35Ha, IMP: 44%)
- CONTRIBUTING DRAINAGE AREA TO EAST SWM FACILITY (BLOCK 31) (AREA: 0.38Ha, IMP: 79%)
- UNCONTROLLED DRAINAGE AREA DISCHARGE TO WATERCOURSE (AREA: 1.92Ha, IMP: 31%)
- CONTRIBUTING DRAINAGE AREA TO EAST SWM FACILITY (BLOCK 31) VIA ROOF DRAINAGE COLLECTOR (AREA: 0.96Ha, IMP: 100%)
- CONTRIBUTING DRAINAGE AREA TO UNDERGROUND TANK (BLOCK 29) VIA ROOF DRAINAGE COLLECTOR (AREA: 3.95Ha, IMP: 100%)

NOTES:

1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY TO THE TOWN'S SATISFACTION. FURTHER COORDINATION WITH THE TOWN IS NEEDED TO ESTABLISH LIMITS OF URBANIZATION BASED ON THE HOLDOUT PROPERTIES ALONG THE 8th LINE FRONTAGE.
2. PROPOSED SWM FACILITIES WITHIN THE EMPIRE AND MATTAMY DEVELOPMENTS TO CAPTURE GRAVITY 8th LINE STORM OUTLETS ALONG BOTH PROPERTY FRONTAGES. EACH DEVELOPMENT TO CAPTURE HALF OF THE URBANIZED ROW CROSS SECTION.
3. EMPIRE'S 8th LINE FRONTAGE NORTH OF STREET A INTERSECTION CANNOT BE CAPTURED IN THE PROPOSED SWM FACILITY DUE TO GRADING CONSTRAINTS. THIS SECTION OF 8TH LINE ROW WILL BE DISCHARGED TO THE EXISTING CREEK IN THE VICINITY OF EXISTING BRIDGE STRUCTURE. FURTHER DESIGN COORDINATION WITH THE TOWN IS REQUIRED.
4. MINOR SYSTEM DRAINAGE TO BE DIRECTED TO A DRY POND IN THE NORTH SWM POND BLOCK 29. ROOF DRAIN COLLECTORS TO BE CONNECTED TO THE INFILTRATION FACILITIES WITHIN SWM POND BLOCKS 29 AND 31 FOR GROUNDWATER RECHARGE.
5. REFER TO GRADING PLAN DWG 2.1 AND STORMWATER MANAGEMENT PLAN DWG 5.0 FOR MAJOR SYSTEM FLOW DIRECTION.
6. REFER TO DRAWINGS 5.1 AND 5.2 FOR DETAILS OF PROPOSED SWM FACILITIES.
7. REFER TO FSR DRAWINGS BY DSEL FOR DETAILS OF THE PROPOSED MATTAMY DEVELOPMENT.
8. ROOF AREA ASSUMED TO BE 69% OF THE LOT AREA.

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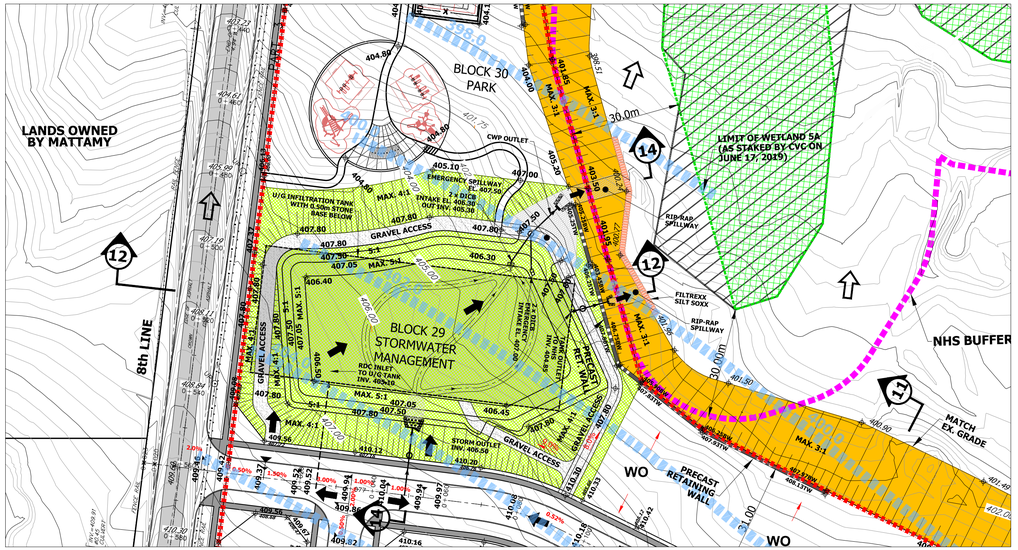
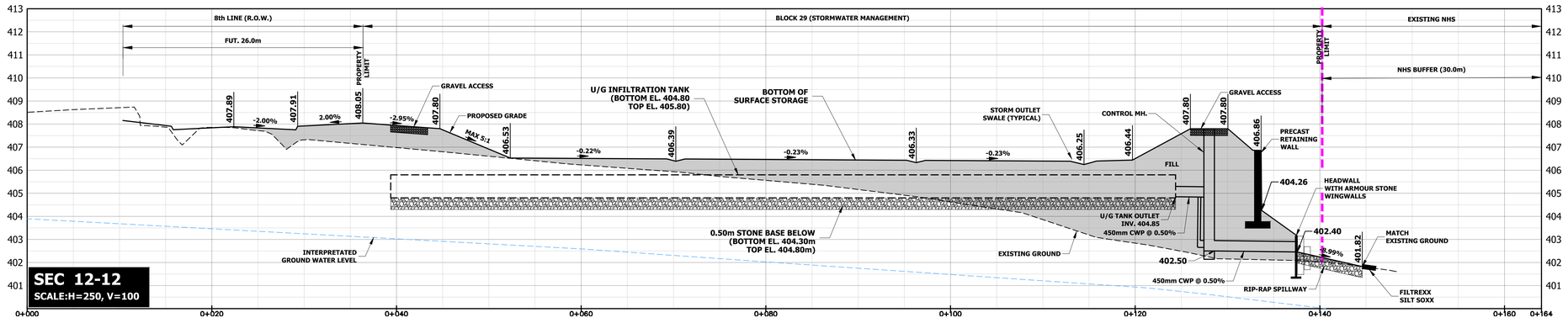
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

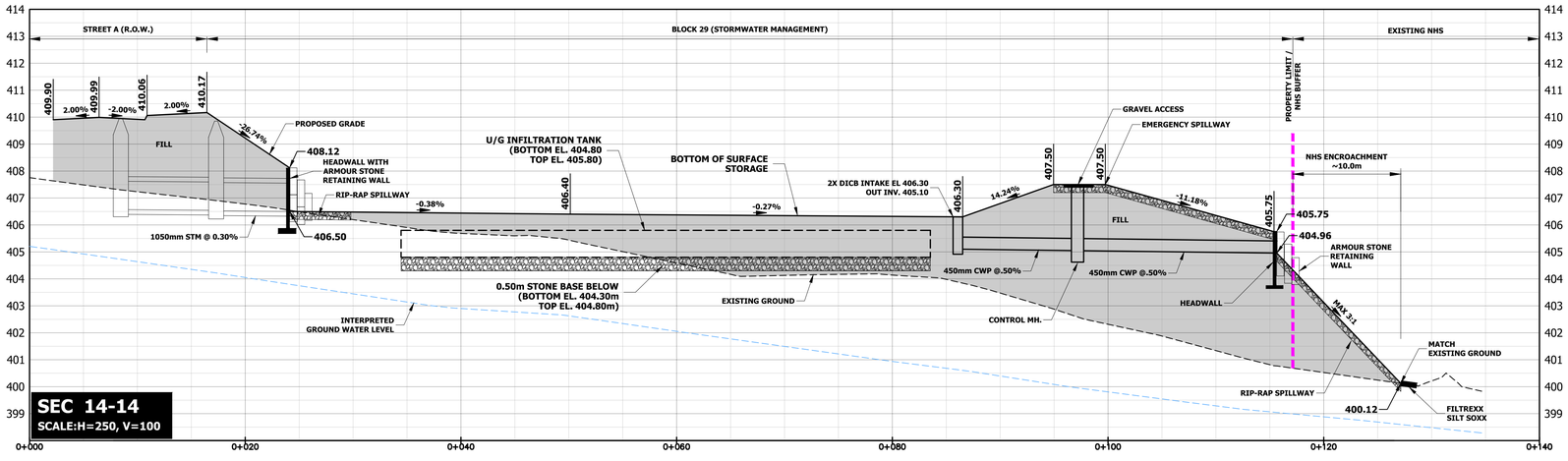
STORMWATER MANAGEMENT PLAN

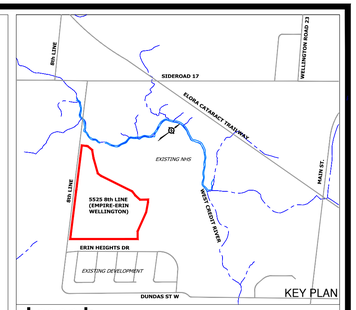
PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1500	**4.0**



SWM BLOCK 29 TABLE		
	REQUIRED	PROVIDED
ROOF DRAINAGE AREA	2.26ha (FOR WATER BALANCE)	~3.95ha
INFILTRATION STORAGE VOLUME	1,481.0cu.m STONE MEDIA (VOID SPACE RATIO 0.4)	1,550.0cu.m
UNDERGROUND TANK STORAGE VOLUME (5 YR. QUANTITY CONTROL FOR ROOF DRAINAGE)	1,914.0cu.m	2,975.0cu.m
100YR SURFACE AREA STORAGE (INCL. CLIMATE CHANGE PROJECTION)	4,158.0cu.m	4,642.0cu.m







Legend:

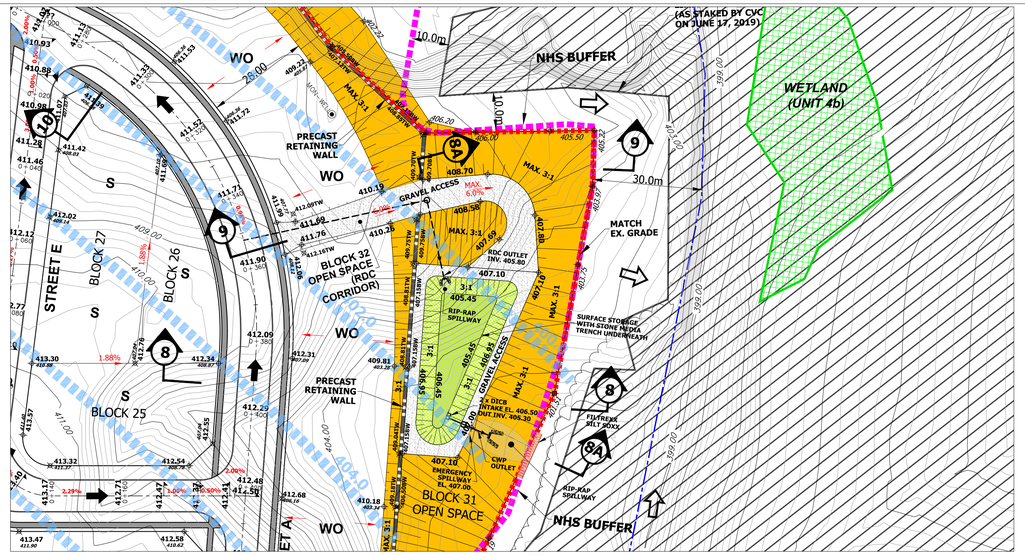
- EXISTING CONTOUR ELEVATION (414.00)
- EXISTING ELEVATION (415.29)
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING WETLAND
- EXISTING WOODLAND
- NHS BUFFER
- PROPOSED ELEVATION (418.62)
- PROPOSED OVERLAND FLOW DIRECTION
- INTERPRETED GROUNDWATER ELEVATION CONTOUR (410.0)
- PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
- PROPOSED RETAINING WALL
- SWM POND BLOCK RESTORATION AREA
- UNDERGROUND STORAGE TANK WITH STONE INFILTRATION TRENCH BELOW

URBANTECH

Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

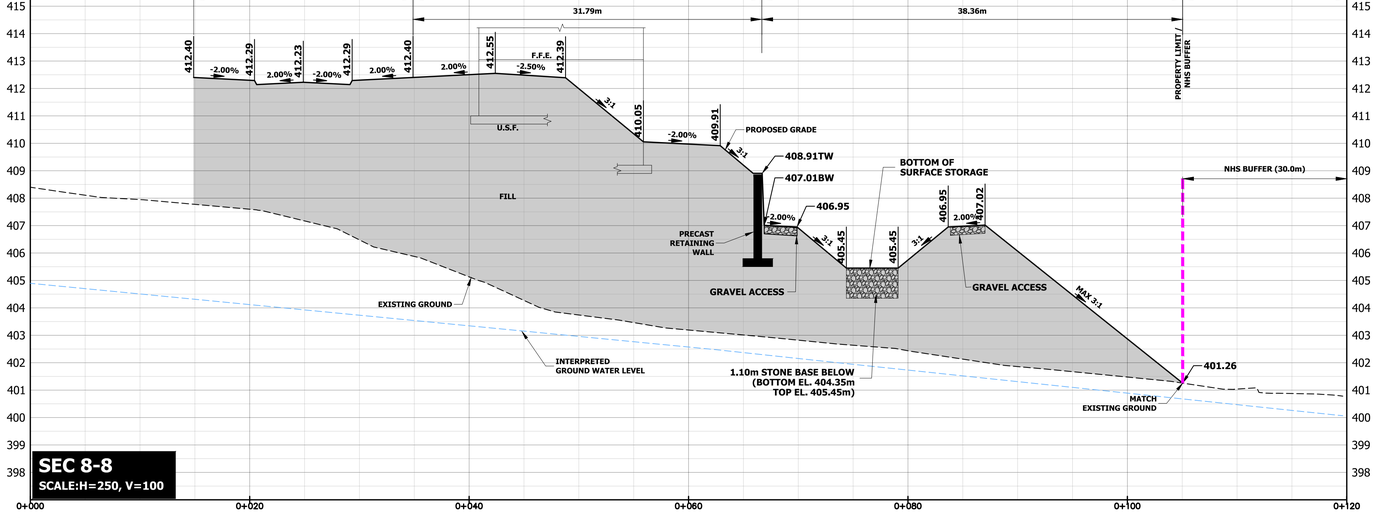
NORTH SWM FACILITY

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	AS SHOWN	4.1

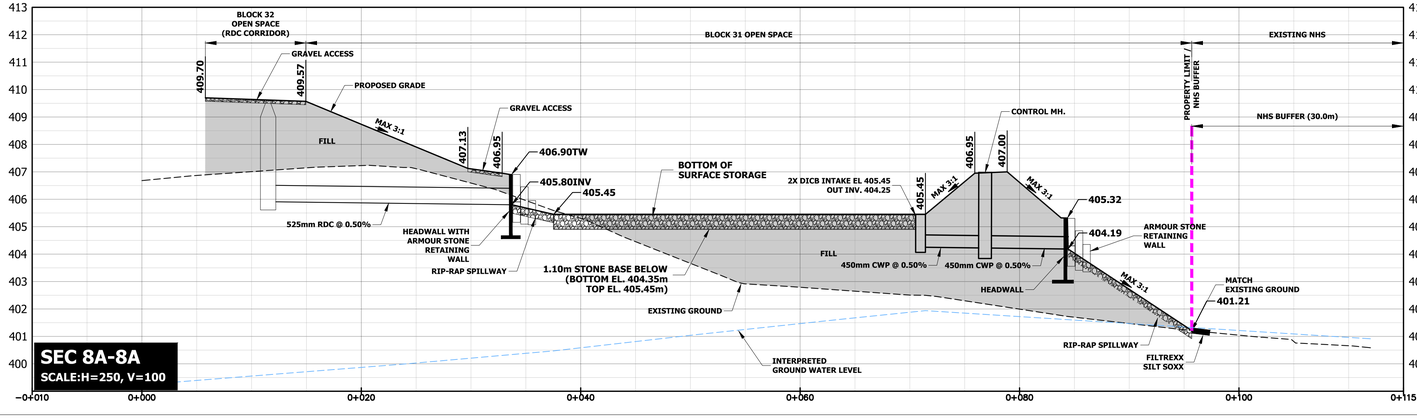


PLAN VIEW - SCALE 1:750

SWM BLOCK 31 TABLE		
	REQUIRED	PROVIDED
ROOF DRAINAGE AREA	0.79ha (FOR WATER BALANCE)	~0.96ha
INFILTRATION STORAGE VOLUME	360cu.m STONE MEDIA (VOID SPACE RATIO 0.4)	375cu.m
100YR SURFACE AREA STORAGE (INCL. CLIMATE CHANGE PROJECTION)	963cu.m	975cu.m



SEC 8-8
SCALE:H=250, V=100



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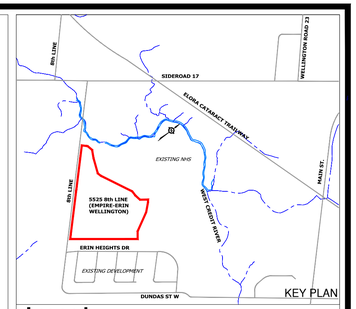


KEY PLAN

Legend:

- EXISTING CONTOUR ELEVATION (414.00)
- EXISTING ELEVATION (415.29)
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING WETLAND
- EXISTING WOODLAND
- NHS BUFFER
- 418.62 — PROPOSED ELEVATION
- PROPOSED OVERLAND FLOW DIRECTION
- 410.0 — INTERPRETED GROUNDWATER ELEVATION CONTOUR
- PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
- PROPOSED RETAINING WALL
- SURFACE STORAGE RESTORATION AREA
- STONE INFILTRATION TRENCH

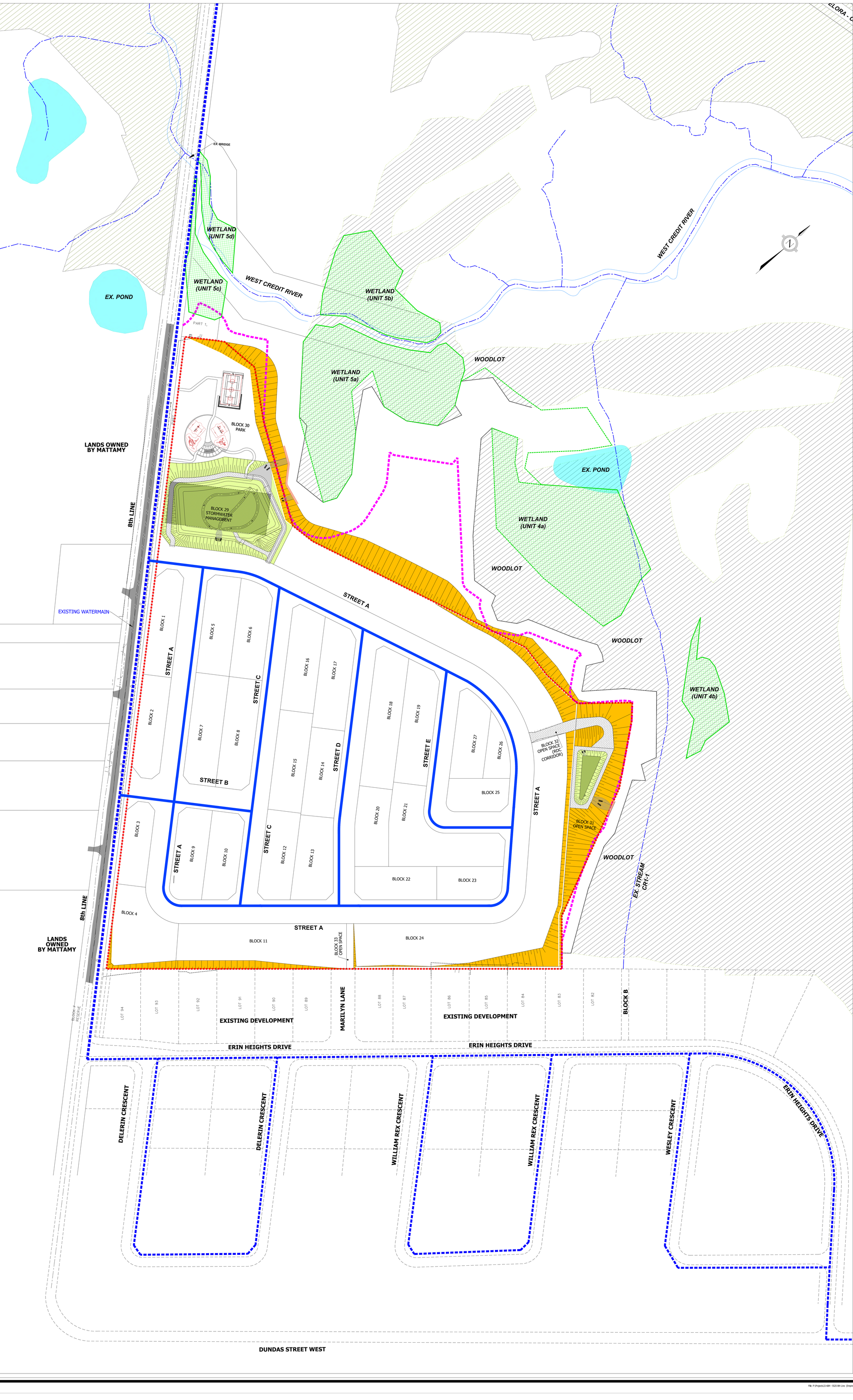
URBANTECH

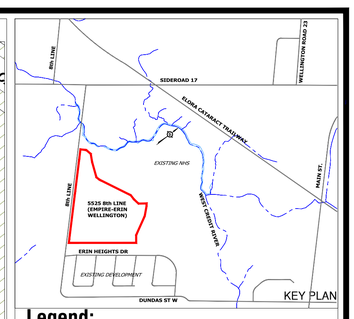
Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

EAST SWM FACILITY

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	AS SHOWN	4.2

File: P:\Projects\21-684 - 5525 8th Line (Empire- Erin, Wellington)\Reports\Functional Servicing Report\Drawings & Figures\DWG 4.2 - East SWM Facility.dwg - Revised by <GZEC> - Mon, Feb 28 2022 - 4:42pm





Legend:

- SUBJECT LANDS
- EXISTING WATERMAIN
- PROPOSED WATERMAIN

NOTES:

1. AS PER THE TOWN'S WATER CLASS EA, PREPARED BY TRITON ENGINEERING, NEW MUNICIPAL WELLS AND ADDITIONAL FIRE STORAGE RESERVOIRS WILL HAVE TO BE CONSTRUCTED TO ACCOMMODATE ALL PROPOSED DEVELOPMENTS WITHIN ERIN AND HILLSBURGH. FURTHER COORDINATION WITH THE TOWN WILL BE REQUIRED REGARDING THE TIMING OF THE NEW INFRASTRUCTURE.
2. TOWN HAS RETAINED A CONSULTANT TO DEVELOP A NEW WATER MODEL FOR THE EXISTING AND FUTURE WATER SYSTEMS. PENDING THE MODELING RESULTS, THE EXISTING WATERMAIN ON 8th LINE AND/OR DUNDAS STREET MAY NEED TO BE UPGRADED TO A LARGER DIAMETER MAIN IN CONJUNCTION WITH THE ADJACENT PROPOSED DEVELOPMENTS.
3. INTERNAL WATERMAIN SIZES TO BE CONFIRMED FOLLOWING COMPLETION OF THE WATER MODEL UPDATES BY THE TOWN'S CONSULTANT.

URBANTECH

Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

WATERMAIN PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1500	**6.1**

Legend:

- SUBJECT LANDS
- INTERNAL SANITARY DRAINAGE BOUNDARY
- POTENTIAL EXTERNAL SANITARY DRAINAGE BOUNDARY
- 1.00Ha / 2.8 / 35 — SANITARY DRAINAGE AREA (HECTARES); POPULATION; DENSITY (PERSONS PER UNIT)
- EXTERNAL AREA 1 / A=20.60ha / P = 280 — AREA ID; EXTERNAL SANITARY DRAINAGE AREA (HECTARES); POPULATION
- SANITARY SEWER FLOW DIRECTION AND MANHOLE
- EXTERNAL SANITARY SEWER FLOW DIRECTION AND MANHOLE (OPTION 1-GRAVITY SYSTEM)
- EXTERNAL SANITARY SEWER FLOW DIRECTION AND MANHOLE (OPTION 2-FORCEMAIN)
- EXTERNAL SANITARY TRUNK FLOW DIRECTION AND MANHOLE (BY TOWN)
- MH 23 / TOP 256.53m / SW 255.72m / NW 255.72m — PROPOSED SANITARY MH ID; PROPOSED GROUND ELEVATION; PROPOSED SEWER OBVERTS (UNLESS SPECIFIED AS INVERT)

NOTES:

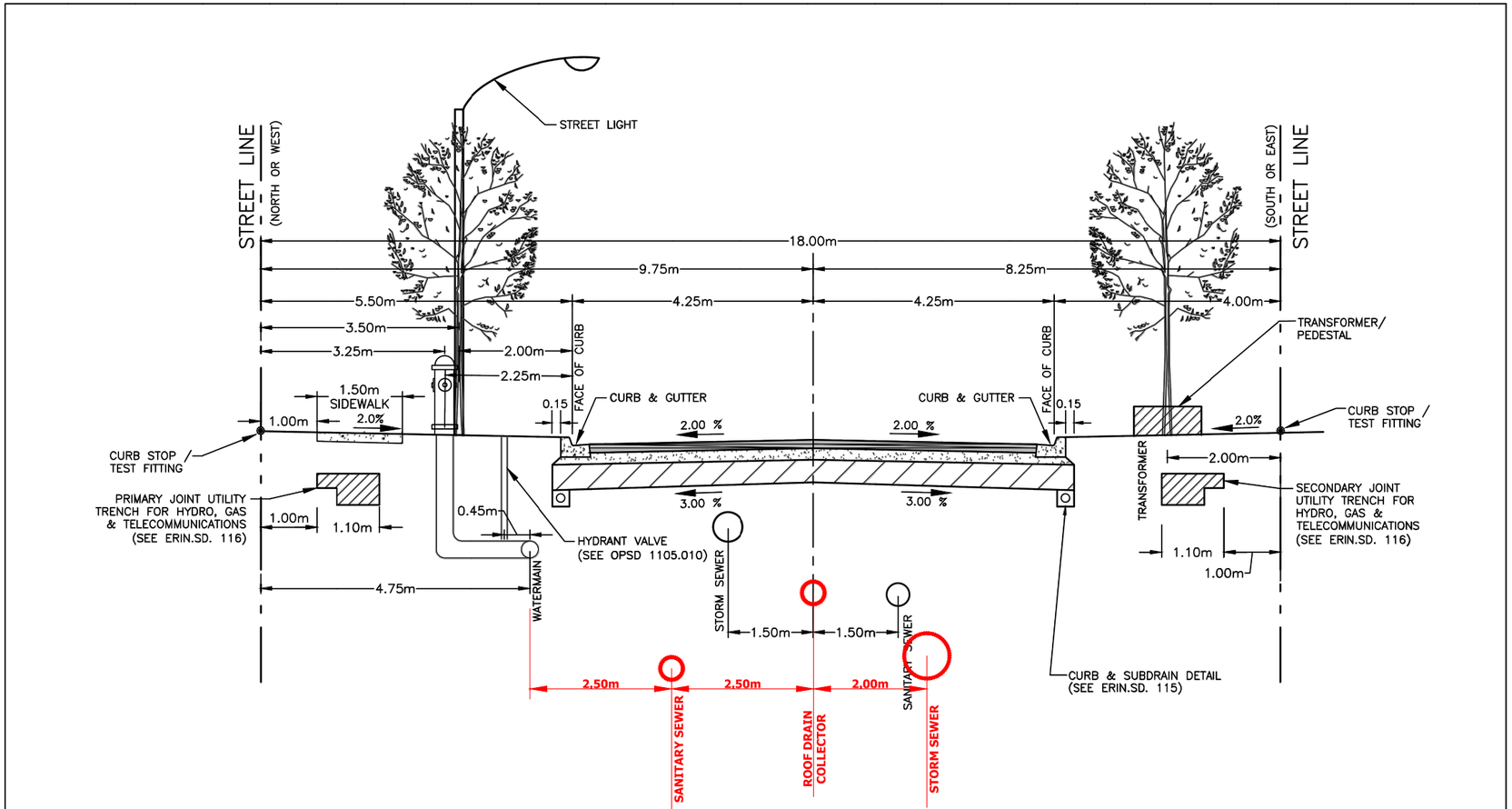
1. EMPIRE SANITARY SERVICING TO BE COORDINATED WITH THE PROPOSED MATTAMY DEVELOPMENT WEST OF 8th LINE.
2. TOWN TO CONFIRM WHETHER EMPIRE AND MATTAMY WILL BE ABLE TO PROVIDE A GRAVITY SANITARY OUTLET TO THE PROPOSED TOWN TRUNK SEWER WITHIN THE ELORA-CATARACT TRAIL.
3. IF GRAVITY OUTLET IS NOT A FEASIBLE SERVICING SOLUTION, EMPIRE AND MATTAMY TO EXPLORE A SEWAGE PUMP STATION OPTION FOR CONVEYANCE OF FLOWS TO THE TOWN'S TRUNK SEWER ALONG MAIN STREET. DUNDAS STREET COULD BE POTENTIALLY UTILIZED AS THE SANITARY FORCEMAIN CORRIDOR.
4. REGARDLESS OF THE ULTIMATE SERVICING SOLUTION (GRAVITY vs. FORCEMAIN), TOWN TO CONFIRM WHETHER EMPIRE DEVELOPMENT SHOULD PROVIDE CAPACITY FOR FUTURE WASTEWATER SYSTEM WITHIN EXISTING ERIN HEIGHTS DEVELOPMENT.

URBANTECH

Functional Servicing Report
5525 8th Line
(Empire- Erin, Wellington)

SANITARY DRAINAGE PLAN

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Mar. 2022	1:1500	7.1



NOTE:

1. 18.0m CORRIDOR ONLY TO BE USED ON SUBDIVISIONS WITH DRAFT PLAN APPROVAL AS OF APRIL 2021.

TOWN OF ERIN

URBAN MINOR LOCAL
(8.5m ROAD ON 18.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

ERIN SD. 101

Functional Servicing Report 5525 8th Line (Empire- Erin, Wellington)

Legend:

NOTES:

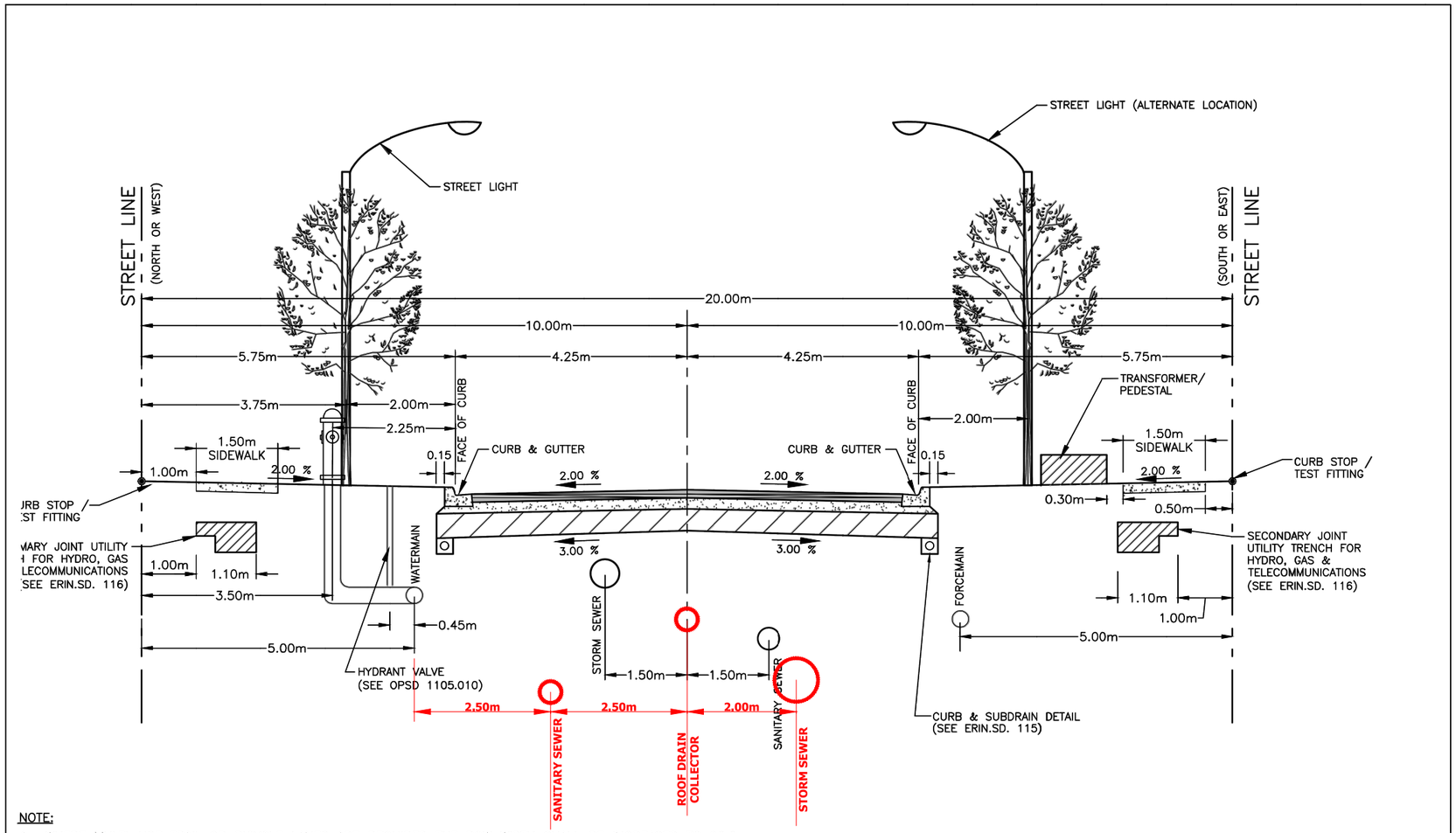
* MODIFIED CIVIL INFRASTRUCTURE LAYOUT PROPOSED TO ACCOMMODATE ROOF DRAIN COLLECTOR.
* ALTERNATIVE PIPE LOCATION TO BE CONFIRMED BY THE TOWN.

FIGURE 8.1A
MODIFIED 18.0m ROW
CROSS SECTION

URBANTECH

March 2022

Scale: N.T.S.



NOTE:

1. WHERE MULTI–USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

TOWN OF ERIN

URBAN/ SUBURBAN ROAD SECTION (8.5m ROAD ON 20.0m RIGHT–OF–WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

ERIN SD. 102

Functional Servicing Report 5525 8th Line (Empire- Erin, Wellington)

Legend:

NOTES:

* MODIFIED CIVIL INFRASTRUCTURE LAYOUT PROPOSED TO ACCOMMODATE ROOF DRAIN COLLECTOR.
* ALTERNATIVE PIPE LOCATION TO BE CONFIRMED BY THE TOWN.

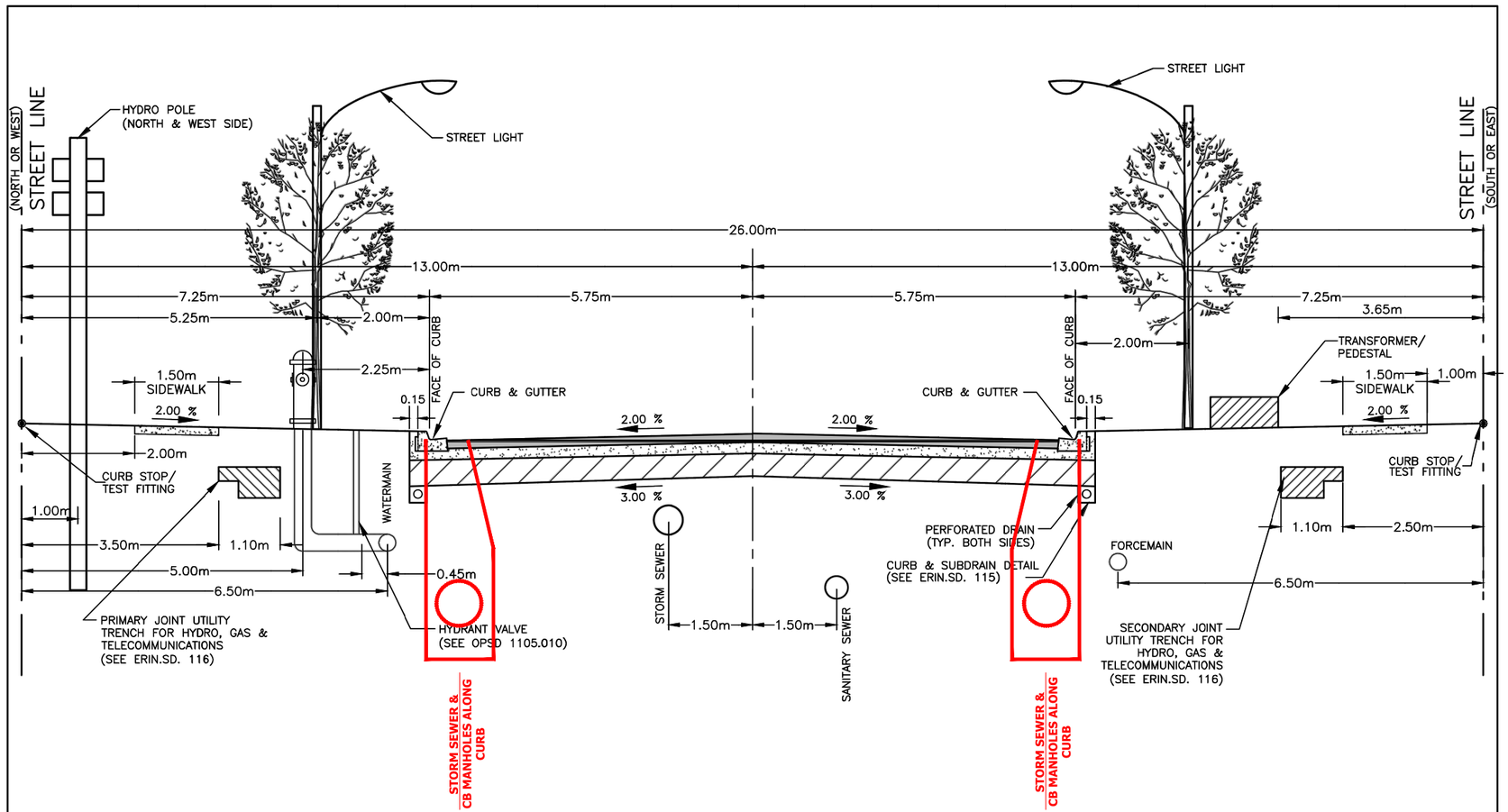
FIGURE 8.1B
MODIFIED 20.0m ROW CROSS SECTION

URBANTECH

March 2022

Scale: N.T.S.

File: P:\Projects\23-684 - 5525 8th Line (Empire- Erin, Wellington)\Reports\Functional Servicing Report\Drawings & Figures\FIG 8.1B - 20.0m ROW.dwg - Revised by <DZEC> : Mon, Feb 28 2022 - 4:32pm



NOTE:

1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 30.0m

TOWN OF ERIN

3-LANE MAJOR COLLECTOR (11.5m ROAD ON 26.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

ERIN SD. 104

Functional Servicing Report 5525 8th Line (Empire- Erin, Wellington)

Legend:

NOTES:

*EXISTING 8th LINE TO BE WIDENED TO A 26.0m ROW CROSS SECTION AS PER TOWN STD. 104.

* SURFACE DRAINAGE FROM THE EAST HALF OF THE URBANIZED ROW TO BE CAPTURED BY THE FUTURE SWM FACILITY WITHIN THE PROPONENT'S DEVELOPMENT. WEST HALF OF THE ROW TO BE DIRECTED TO A FUTURE SWM FACILITY BY OTHERS

* ALTERNATIVE STORM SEWER LOCATION ALONG THE FUTURE CURB TO BE CONFIRMED BY THE TOWN.

FIGURE 8.1C
MODIFIED 26.0m ROW
CROSS SECTION

URBANTECH

March 2022

Scale: N.T.S.

APPENDIX B

DESIGN CALCULATIONS

- Landuse Breakdown & Imperviousness Calculations
- Storm Sewer Design Sheets
- Cleanwater Collector System Design Sheets
- MTO Storm IDF (2010 and 2072)
- VO Model Inputs
- VO Model Output
- Water Quality Sizing Calculations
- Sanitary Sewer Design Sheet

URBANTECH®

DRAINAGE AREAS - A1 POST

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684
Date: 12/05/2022

Prepared by: KR
Submission: 1

A1 POST

Land Use Type	Area (ha)	Total Imperviousness (%)	Imp Area (ha)	Pervious Area (ha)
SWM[1]	0.90	10%	0.09	0.81
Park[2]	0.62	21%	0.13	0.49
Pathyway / SWM Access	0.00	100%	0.00	0.00
Rear-Lot Grading / Sloping	0.12	0%	0.00	0.12
Lots[3]	2.21	10%	0.22	1.99
External 23m ROW	0.82	80%	0.66	0.16
Internal 20m ROW[4]	2.68	79%	2.11	0.57
Total	*7.35*	*44%*	*3.21*	*4.14*

[1]Assumes dry pond, OR park on top of underground SWM tank (10% impervious land cover) for North SWM block; pervious LID feature for East SWM block

[2]As per Town design criteria for Runoff Coef. (C = 0.35)

[3]As per Town design criteria for Runoff Coef. (C = 0.75)

[4]As per Town design criteria - Erin SD 102 (20m ROW)

Lots - Land Cover	% Lot Area	Total Lot Area (ha)	Imp Area (ha)	Pervious Area (ha)
Roof	0%	0.00	0.00	0.00
Driveway	10%	0.22	0.22	0.00
Yard	90%	1.99	0.00	1.99
Total	*100%*	*2.21*	*0.22*	*1.99*

20m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	8.5	42.5%	1.14	0.00
Sidewalk[2]	3.0	15.0%	0.40	0.00
Boulevard[3]	8.5	21.3%	0.00	0.57
Driveway[4]	*N/A*	*21.3%*	0.57	0.00
Total	*20.0*	*100.0%*	*2.11*	*0.57*

[1]As per Town design criteria - Erin SD 102 (20m ROW)

[2]As per Town design criteria - Erin SD 102 (20m ROW)

[3]Assumes total boulevard area is 50% landscape and 50% driveway overall

[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

23m ROW - LAND COVER				
23m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	11.0	47.8%	0.39	0.00
Sidewalk[2]	3.0	13.0%	0.11	0.00
Boulevard[3]	9.0	19.6%	0.00	0.16
Driveway[4]	N/A	19.6%	0.16	0.00
Total	*23.0*	*100.0%*	*0.66*	*0.16*

[1]As per Town design criteria - Erin SD 102 (20m ROW)

[2]As per Town design criteria - Erin SD 102 (20m ROW)

[3]Assumes total boulevard area is 50% landscape and 50% driveway overall

[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

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urbantech.com

DRAINAGE AREAS - A2 POST

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684
Date: 12/05/2022

Prepared by: KR
Submission: 1

A2 POST

Land Use Type	Area (ha)	Total Imperviousness (%)	Imp Area (ha)	Pervious Area (ha)
SWM[1]	0.16	10%	0.02	0.14
Park[2]	0.00	21%	0.00	0.00
Pathyway / SWM Access	0.20	100%	0.20	0.00
Rear-Lot Grading / Sloping	0.00	0%	0.00	0.00
Lots[3]	0.11	79%	0.08	0.02
Internal 20m ROW[4]	0.00	79%	0.00	0.00
Total	***0.38***	***79%***	***0.30***	***0.08***

[1]Assumes dry pond, OR park on top of underground SWM tank (10% impervious land cover) for North SWM block; pervious LID feature for East SWM block

[2]As per Town design criteria for Runoff Coef. (C = 0.35)

[3]As per Town design criteria for Runoff Coef. (C = 0.75)

[4]As per Town design criteria - Erin SD 102 (20m ROW)

Lots - Land Cover	% Lot Area	Total Lot Area (ha)	Imp Area (ha)	Pervious Area (ha)
Roof	69%	0.07	0.07	0.00
Driveway	10%	0.01	0.01	0.00
Yard	21%	0.02	0.00	0.02
Total	***100%***	***0.11***	***0.08***	***0.02***

20m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	8.5	42.5%	0.00	0.00
Sidewalk[2]	3.0	15.0%	0.00	0.00
Boulevard[3]	8.5	21.3%	0.00	0.00
Driveway[4]	*N/A*	*21.3%*	0.00	0.00
Total	***20.0***	***100.0%***	***0.00***	***0.00***

[1]As per Town design criteria - Erin SD 102 (20m ROW)

[2]As per Town design criteria - Erin SD 102 (20m ROW)

[3]Assumes total boulevard area is 50% landscape and 50% driveway overall

[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

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urbantech.com

DRAINAGE AREAS - A1 POST (ROOF)

Project Name: 5525 8th Line (Empire, Erin) Prepared by: KR
Municipality: Town of Erin
Project No.: 21-684 Submission: 1
Date: 12/05/2022

A1 POST (ROOF)

Land Use Type	Area (ha)	Total Imperviousness (%)	Imp Area (ha)	Pervious Area (ha)
SWM[1]	0.00	10%	0.00	0.00
Park[2]	0.00	21%	0.00	0.00
Pathyway / SWM Access	0.00	100%	0.00	0.00
Rear-Lot Grading / Sloping	0.00	0%	0.00	0.00
Lots[3]	3.95	100%	3.95	0.00
Internal 20m ROW[4]	0.00	79%	0.00	0.00
Total	*3.95*	*100%*	*3.95*	*0.00*

[1]Assumes dry pond, OR park on top of underground SWM tank (10% impervious land cover) for North SWM block; pervious LID feature for East SWM block
[2]As per Town design criteria for Runoff Coef. (C = 0.35)
[3]As per Town design criteria for Runoff Coef. (C = 0.75)
[4]As per Town design criteria - Erin SD 102 (20m ROW)

Lots - Land Cover	% Lot Area	Total Lot Area (ha)	Imp Area (ha)	Pervious Area (ha)
Roof	100%	3.95	3.95	0.00
Driveway	0%	0.00	0.00	0.00
Yard	0%	0.00	0.00	0.00
Total	*100%*	*3.95*	*3.95*	*0.00*

20m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	8.5	42.5%	0.00	0.00
Sidewalk[2]	3.0	15.0%	0.00	0.00
Boulevard[3]	8.5	21.3%	0.00	0.00
Driveway[4]	*N/A*	*21.3%*	0.00	0.00
Total	*20.0*	*100.0%*	*0.00*	*0.00*

[1]As per Town design criteria - Erin SD 102 (20m ROW)
[2]As per Town design criteria - Erin SD 102 (20m ROW)
[3]Assumes total boulevard area is 50% landscape and 50% driveway overall
[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

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DRAINAGE AREAS - A2 POST (ROOF)

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684
Date: 12/05/2022

Prepared by: KR
Submission: 1

A2 POST (ROOF)

Land Use Type	Area (ha)	Total Imperviousness (%)	Imp Area (ha)	Pervious Area (ha)
SWM[1]	0.00	10%	0.00	0.00
Park[2]	0.00	21%	0.00	0.00
Pathyway / SWM Access	0.00	100%	0.00	0.00
Rear-Lot Grading / Sloping	0.00	0%	0.00	0.00
Lots[3]	0.96	100%	0.96	0.00
Internal 20m ROW[4]	0.00	79%	0.00	0.00
Total	***0.96***	***100%***	***0.96***	***0.00***

[1]Assumes dry pond, OR park on top of underground SWM tank (10% impervious land cover) for North SWM block; pervious LID feature for East SWM block

[2]As per Town design criteria for Runoff Coef. (C = 0.35)

[3]As per Town design criteria for Runoff Coef. (C = 0.75)

[4]As per Town design criteria - Erin SD 102 (20m ROW)

Lots - Land Cover	% Lot Area	Total Lot Area (ha)	Imp Area (ha)	Pervious Area (ha)
Roof	100%	0.96	0.96	0.00
Driveway	0%	0.00	0.00	0.00
Yard	0%	0.00	0.00	0.00
Total	***100%***	***0.96***	***0.96***	***0.00***

20m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	8.5	42.5%	0.00	0.00
Sidewalk[2]	3.0	15.0%	0.00	0.00
Boulevard[3]	8.5	21.3%	0.00	0.00
Driveway[4]	*N/A*	*21.3%*	0.00	0.00
Total	***20.0***	***100.0%***	***0.00***	***0.00***

[1]As per Town design criteria - Erin SD 102 (20m ROW)

[2]As per Town design criteria - Erin SD 102 (20m ROW)

[3]Assumes total boulevard area is 50% landscape and 50% driveway overall

[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

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DRAINAGE AREAS - A3 POST (UNCONTROLLED)

Project Name: 5525 8th Line (Empire, Erin) Prepared by: KR
Municipality: Town of Erin
Project No.: 21-684 Submission: 1
Date: 12/05/2022

A3 POST (UNCONTROLLED)

Land Use Type	Area (ha)	Total Imperviousness (%)	Imp Area (ha)	Pervious Area (ha)
SWM[1]	0.13	10%	0.01	0.12
Park[2]	0.61	21%	0.13	0.48
Pathyway / SWM Access	0.00	100%	0.00	0.00
Rear-Lot Grading / Sloping	0.61	0%	0.00	0.61
Lots[3]	0.58	79%	0.46	0.12
Internal 20m ROW[4]	0.00	79%	0.00	0.00
Total	***1.92***	***31%***	***0.60***	***1.32***

[1]Assumes dry pond, OR park on top of underground SWM tank (10% impervious land cover) for North SWM block; pervious LID feature for East SWM block
[2]As per Town design criteria for Runoff Coef. (C = 0.35)
[3]As per Town design criteria for Runoff Coef. (C = 0.75)
[4]As per Town design criteria - Erin SD 102 (20m ROW)

Lots - Land Cover	% Lot Area	Total Lot Area (ha)	Imp Area (ha)	Pervious Area (ha)
Roof	69%	0.40	0.40	0.00
Driveway	10%	0.06	0.06	0.00
Yard	21%	0.12	0.00	0.12
Total	***100%***	***0.58***	***0.46***	***0.12***

20m ROW - Land Cover	Width (m)	% ROW Area	Imp Area (ha)	Pervious Area (ha)
Road[1]	8.5	42.5%	0.00	0.00
Sidewalk[2]	3.0	15.0%	0.00	0.00
Boulevard[3]	8.5	21.3%	0.00	0.00
Driveway[4]	*N/A*	*21.3%*	0.00	0.00
Total	***20.0***	***100.0%***	***0.00***	***0.00***

[1]As per Town design criteria - Erin SD 102 (20m ROW)
[2]As per Town design criteria - Erin SD 102 (20m ROW)
[3]Assumes total boulevard area is 50% landscape and 50% driveway overall
[4]Assumes total boulevard area is 50% landscape and 50% driveway overall

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STORM SEWER DESIGN SHEET

5 Year Storm

5525 Eighth Line

Town of Erin

PROJECT DETAILS

Project No: 21-684
Date: 9-Feb-22
Designed by: SL
Checked by: DZ

DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	A / (Tc+B)^c
Mannings 'n'=	0.013			
Starting Tc =	10	min	A =	1170
			B =	5.8
Factor of Safety =	25	%	c =	0.843

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
DRAINAGE TO SWM POND																				
STREET C	101	102	1.05	0.65	0.68	0.68	114.2	0.217			0.217	238.8	3.00	375	0.304	2.75	10.00	1.45	11.45	71%
STREET C	102	125				0.68	106.1	0.201			0.201	25.4	0.50	525	0.304	1.40	11.45	0.30	11.75	66%
STREET D	103	104	0.82	0.65	0.53	0.53	114.2	0.169			0.169	58.0	3.00	375	0.304	2.75	10.00	0.35	10.35	56%
STREET D	104	105				0.53	112.1	0.166			0.166	143.6	2.50	375	0.277	2.51	10.35	0.95	11.31	60%
STREET D	105	124				0.53	106.8	0.158			0.158	25.3	0.50	450	0.202	1.27	11.31	0.33	11.64	78%
STREET A	106	111	1.71	0.65	1.11	1.11	114.2	0.353			0.353	16.5	1.00	600	0.614	2.17	10.00	0.13	10.13	57%
STREET A	111	112				1.11	113.4	0.350			0.350	59.1	1.00	600	0.614	2.17	10.13	0.45	10.58	57%
STREET A	112	113				1.11	110.8	0.342			0.342	84.0	1.00	600	0.614	2.17	10.58	0.64	11.22	56%
STREET A	113	114				1.11	107.2	0.331			0.331	125.8	3.00	600	1.063	3.76	11.22	0.56	11.78	31%
STREET A	114	115				1.11	104.4	0.322			0.322	18.8	2.50	600	0.971	3.43	11.78	0.09	11.87	33%
STREET A	115	117				1.11	103.9	0.321			0.321	69.4	2.00	600	0.868	3.07	11.87	0.38	12.25	37%
STREET E	116	117					114.2					61.6	2.00	300	0.137	1.93	10.00	0.53	10.53	
STREET A	117	118				1.11	102.1	0.315			0.315	44.5	0.50	600	0.434	1.54	12.25	0.48	12.73	73%
STREET A	118	119				1.11	99.8	0.308			0.308	27.8	0.50	600	0.434	1.54	12.73	0.30	13.03	71%
STREET A	119	120	0.68	0.65	0.44	1.55	98.5	0.425			0.425	39.3	0.50	675	0.594	1.66	13.03	0.39	13.43	72%
STREET A	120	123				1.55	96.8	0.418			0.418	40.8	0.50	675	0.594	1.66	13.43	0.41	13.84	70%
STREET E	116	121	0.57	0.65	0.37	0.37	114.2	0.118			0.118	12.9	2.00	375	0.248	2.25	10.00	0.10	10.10	47%
STREET E	121	122				0.37	113.6	0.117			0.117	93.9	2.00	375	0.248	2.25	10.10	0.70	10.79	47%
STREET E	122	123				0.37	109.6	0.113			0.113	25.6	0.50	450	0.202	1.27	10.79	0.34	11.13	56%
STREET A	123	124				1.92	95.1	0.508			0.508	78.9	0.50	750	0.787	1.78	13.84	0.74	14.58	65%
STREET A	124	125				2.46	92.2	0.629			0.629	78.4	0.50	750	0.787	1.78	14.58	0.73	15.31	80%
STREET A	125	126				3.14	89.5	0.780			0.780	33.0	0.50	825	1.015	1.90	15.31	0.29	15.60	77%
STREET A	126	OGS 2				3.14	88.4	0.771			0.771	16.0	0.50	825	1.015	1.90	15.60	0.14	15.74	76%
STREET A	OGS 2	127				3.14	88.0	0.767			0.767	16.0	0.50	825	1.015	1.90	15.74	0.14	15.88	76%
STREET A	106	107	1.02	0.65	0.66	0.66	114.2	0.210			0.210	17.1	3.00	375	0.304	2.75	10.00	0.10	10.10	69%
STREET A	107	108				0.66	113.6	0.209			0.209	251.5	3.00	375	0.304	2.75	10.10	1.52	11.63	69%
STREET A	108	110				0.66	105.2	0.194			0.194	25.2	0.50	525	0.304	1.40	11.63	0.30	11.93	64%
STREET A	109	110	0.86	0.65	0.56	0.56	114.2	0.177			0.177	36.4	0.30	525	0.236	1.09	10.00	0.56	10.56	75%
STREET A	110	OGS 1				1.22	103.7	0.352			0.352	8.2	0.30	675	0.460	1.29	11.93	0.11	12.03	76%

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3760 14th Avenue, Suite 301 Markham, Ontario L3R 3T7
TEL: 905.946.9461 FAX: 905.946.9595
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STORM SEWER DESIGN SHEET

5 Year Storm

5525 Eighth Line

Town of Erin

PROJECT DETAILS

Project No: 21-684
Date: 9-Feb-22
Designed by: SL
Checked by: DZ

DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	A / (Tc+B)^c
Mannings 'n'=	0.013			
Starting Tc =	10	min	A =	1170
			B =	5.8
Factor of Safety =	25	%	c =	0.843

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
STREET A	OGS 1	127				1.22	103.1	0.350			0.350	8.9	0.30	675	0.460	1.29	12.03	0.12	12.15	76%
STREET A	127	128				4.36	87.5	1.060			1.060	8.8	0.30	1050	1.496	1.73	15.88	0.08	15.97	71%
SWM POND	128	HW 1				4.36	87.2	1.056			1.056	9.3	0.30	1050	1.496	1.73	15.97	0.09	16.06	71%

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CLEANWATER COLLECTOR SYSTEM DESIGN SHEET

5 Year Storm

5525 Eighth Line

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Mannings 'n'=	0.013			
Starting Tc =	10	min	A =	1170
			B =	5.8
Factor of Safety =	20	%	c =	0.843

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
TO EAST SWM POND																				
STREET A	304C	305C	0.96	0.90	0.86	0.86	114.2	0.274			0.274	127.2	3.00	450	0.494	3.10	10.00	0.68	10.68	56%
STREET A	305C	306C				0.86	110.2	0.265			0.265	17.7	2.50	450	0.451	2.83	10.68	0.10	10.79	59%
STREET A	306C	308C				0.86	109.6	0.263			0.263	65.2	2.00	450	0.403	2.54	10.79	0.43	11.22	65%
STREET E	307C	308C					114.2					62.0	2.00	300	0.137	1.93	10.00	0.53	10.53	
STREET A	308C	309C				0.86	107.3	0.258			0.258	38.5	0.50	600	0.434	1.54	11.22	0.42	11.63	59%
STREET A	309C	310C				0.86	105.1	0.252			0.252	31.7	0.50	600	0.434	1.54	11.63	0.34	11.98	58%
STREET A	310C	311C				0.86	103.4	0.248			0.248	51.3	0.50	600	0.434	1.54	11.98	0.56	12.53	57%
STREET A	311C	HW 1C				0.86	100.8	0.242			0.242	22.2	0.50	600	0.434	1.54	12.53	0.24	12.78	56%
TO STORAGE TANK																				
STREET A	301C	302C	0.44	0.90	0.40	0.40	114.2	0.126			0.126	17.4	1.00	375	0.175	1.59	10.00	0.18	10.18	72%
STREET A	302C	303C				0.40	113.1	0.124			0.124	54.4	1.00	375	0.175	1.59	10.18	0.57	10.75	71%
STREET A	303C	316C				0.40	109.8	0.121			0.121	83.8	1.00	375	0.175	1.59	10.75	0.88	11.63	69%
STREET A	310 C	312C	0.28	0.90	0.25	0.25	114.2	0.080			0.080	41.0	0.50	375	0.124	1.12	10.00	0.61	10.61	64%
STREET A	312C	315C				0.25	110.6	0.077			0.077	42.1	0.50	375	0.124	1.12	10.61	0.63	11.23	62%
STREET E	307 C	313C	0.50	0.90	0.45	0.45	114.2	0.143			0.143	12.9	2.00	375	0.248	2.25	10.00	0.10	10.10	58%
STREET E	313C	314C				0.45	113.6	0.142			0.142	97.1	2.00	375	0.248	2.25	10.10	0.72	10.82	57%
STREET E	314C	315C				0.45	109.5	0.137			0.137	24.2	0.50	450	0.202	1.27	10.82	0.32	11.13	68%
STREET D	316C	317C	0.82	0.90	0.74	1.13	105.1	0.331			0.331	58.1	3.00	450	0.494	3.10	11.63	0.31	11.95	67%
STREET D	317C	318C				1.13	103.6	0.326			0.326	143.7	2.50	450	0.451	2.83	11.95	0.84	12.79	72%
STREET D	318C	319C				1.13	99.6	0.314			0.314	24.0	0.50	600	0.434	1.54	12.79	0.26	13.05	72%
STREET C	320C	321C	0.95	0.90	0.86	0.86	114.2	0.271			0.271	238.9	3.00	450	0.494	3.10	10.00	1.28	11.28	55%
STREET C	321C	322C				0.86	106.9	0.254			0.254	24.0	0.50	600	0.434	1.54	11.28	0.26	11.54	58%
STREET A	315C	319C				0.70	107.2	0.209			0.209	78.6	0.50	525	0.304	1.40	11.23	0.93	12.17	69%
STREET A	319C	322C				1.84	98.4	0.502			0.502	78.4	0.50	750	0.787	1.78	13.05	0.73	13.78	64%
STREET A	322C	323C				2.69	95.3	0.712			0.712	30.7	0.50	825	1.015	1.90	13.78	0.27	14.05	70%
STREET A	323C	326C				2.69	94.2	0.704			0.704	46.8	0.50	825	1.015	1.90	14.05	0.41	14.46	69%

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DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	A / (Tc+B)^c
Mannings 'n'=	0.013			
Starting Tc =	10	min	A =	1170
			B =	5.8
Factor of Safety =	20	%	c =	0.843

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
STREET A	301 C	324C	0.96	0.90	0.86	0.86	114.2	0.274			0.274	14.9	3.00	450	0.494	3.10	10.00	0.08	10.08	56%
STREET A	324C	325C				0.86	113.7	0.273			0.273	251.5	3.00	450	0.494	3.10	10.08	1.35	11.43	55%
STREET A	325C	326C				0.86	106.2	0.255			0.255	23.2	0.50	600	0.434	1.54	11.43	0.25	11.68	59%
STREET A	326C	327C				3.56	92.6	0.914			0.914	9.4	1.00	825	1.435	2.69	14.46	0.06	14.52	64%
STREET A	327C	TANK				3.56	92.4	0.912			0.912	31.1	1.00	825	1.435	2.69	14.52	0.19	14.72	64%

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Ontario IDF CURVE LOOKUP

Active coordinate

43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Retrieved: Tue, 11 Jan 2022 02:22:49 GMT

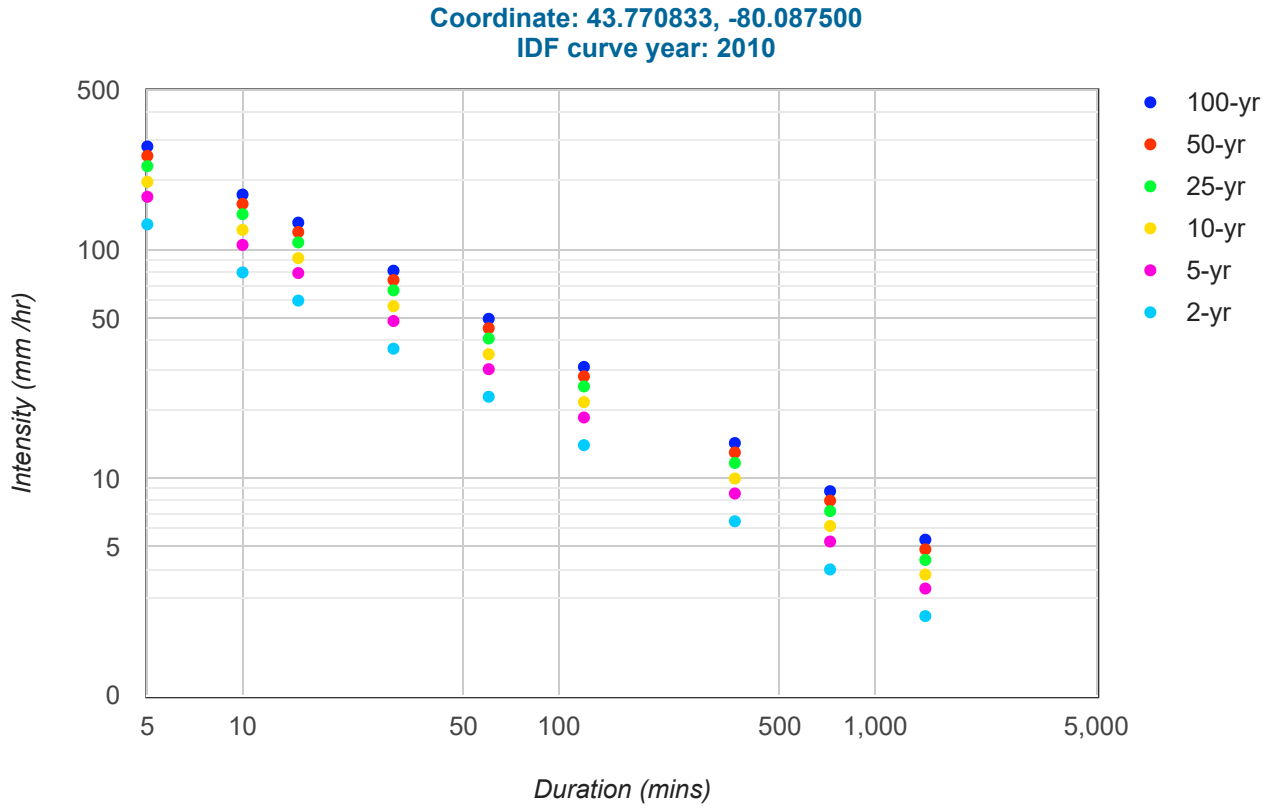
Location summary

These are the locations in the selection.

IDF Curve: 43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Retrieved: Tue, 11 Jan 2022 02:22:49 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	22.8	30.1	35.0	41.0	45.5	50.0
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	129.5	79.8	60.1	37.0	22.8	14.0	6.5	4.0	2.5
5-yr	171.0	105.3	79.3	48.9	30.1	18.5	8.6	5.3	3.3
10-yr	198.8	122.5	92.2	56.8	35.0	21.6	10.0	6.2	3.8
25-yr	232.9	143.5	108.0	66.6	41.0	25.3	11.7	7.2	4.4
50-yr	258.4	159.2	119.9	73.9	45.5	28.0	13.0	8.0	4.9
100-yr	284.0	174.9	131.8	81.2	50.0	30.8	14.3	8.8	5.4

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.8	13.3	15.0	18.5	22.8	28.1	39.1	48.2	59.3
5-yr	14.2	17.6	19.8	24.4	30.1	37.1	51.6	63.6	78.3
10-yr	16.6	20.4	23.1	28.4	35.0	43.1	60.0	73.9	91.1
25-yr	19.4	23.9	27.0	33.3	41.0	50.5	70.3	86.6	106.7
50-yr	21.5	26.5	30.0	36.9	45.5	56.1	78.0	96.1	118.4
100-yr	23.7	29.2	32.9	40.6	50.0	61.6	85.7	105.6	130.1

Terms of Use

Ontario IDF CURVE LOOKUP

Active coordinate

43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Retrieved: Tue, 11 Jan 2022 16:22:23 GMT

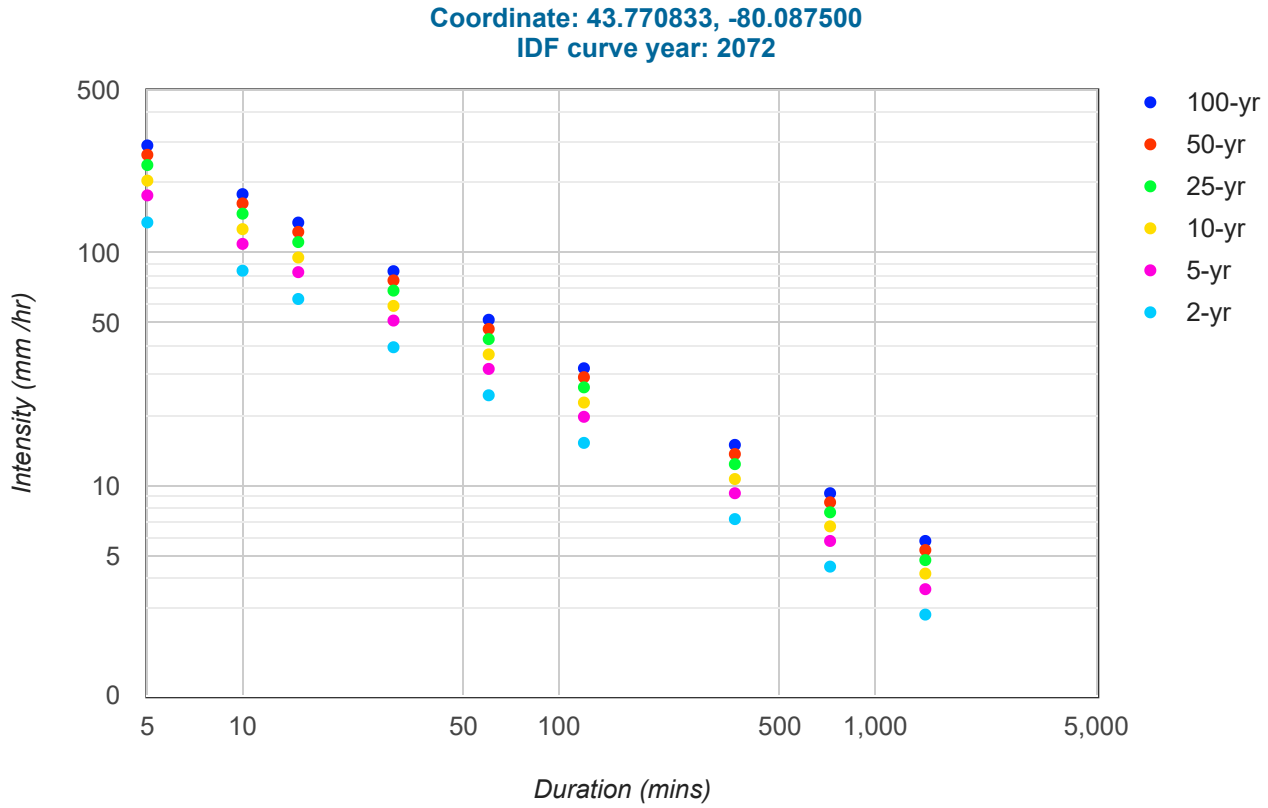
Location summary

These are the locations in the selection.

IDF Curve: 43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 43° 46' 15" N, 80° 5' 14" W (43.770833,-80.087500)

Retrieved: Tue, 11 Jan 2022 16:22:23 GMT

Data year: 2010
IDF curve year: 2072

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	135.4	84.0	63.5	39.4	24.5	15.3	7.2	4.5	2.8
5-yr	176.9	109.5	82.8	51.3	31.8	19.8	9.3	5.8	3.6
10-yr	204.7	126.7	95.7	59.3	36.7	22.8	10.7	6.7	4.2
25-yr	238.8	147.6	111.5	69.0	42.7	26.5	12.4	7.7	4.8
50-yr	264.3	163.4	123.3	76.3	47.2	29.3	13.7	8.5	5.3
100-yr	289.9	179.1	135.2	83.6	51.7	32.0	15.0	9.3	5.8

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	11.3	14.0	15.9	19.7	24.5	30.6	43.2	54.0	67.2
5-yr	14.7	18.3	20.7	25.6	31.8	39.6	55.8	69.6	86.4
10-yr	17.1	21.1	23.9	29.6	36.7	45.6	64.2	80.4	100.8
25-yr	19.9	24.6	27.9	34.5	42.7	53.0	74.4	92.4	115.2
50-yr	22.0	27.2	30.8	38.1	47.2	58.6	82.2	102.0	127.2
100-yr	24.2	29.9	33.8	41.8	51.7	64.0	90.0	111.6	139.2

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Last Modified: September 2016

TIME TO PEAK (AIRPORT METHOD) CALCULATIONS

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684
Date: 05/12/2022

Prepared by: KR
Submission: 1

Parameter	Value	Description
L =	372	Catchment or watershed length (m)
Upstream Elev. =	426	Upstream Elevation (m)
Downstream Elev. =	402	Downstream Elevation (m)
Sw =	0.0645	Catchment or watershed slope (m/m)
Tc =	28.9	Airport Method Time of Concentration (min)
Tp =	0.321	Airport Method Time to Peak (min)

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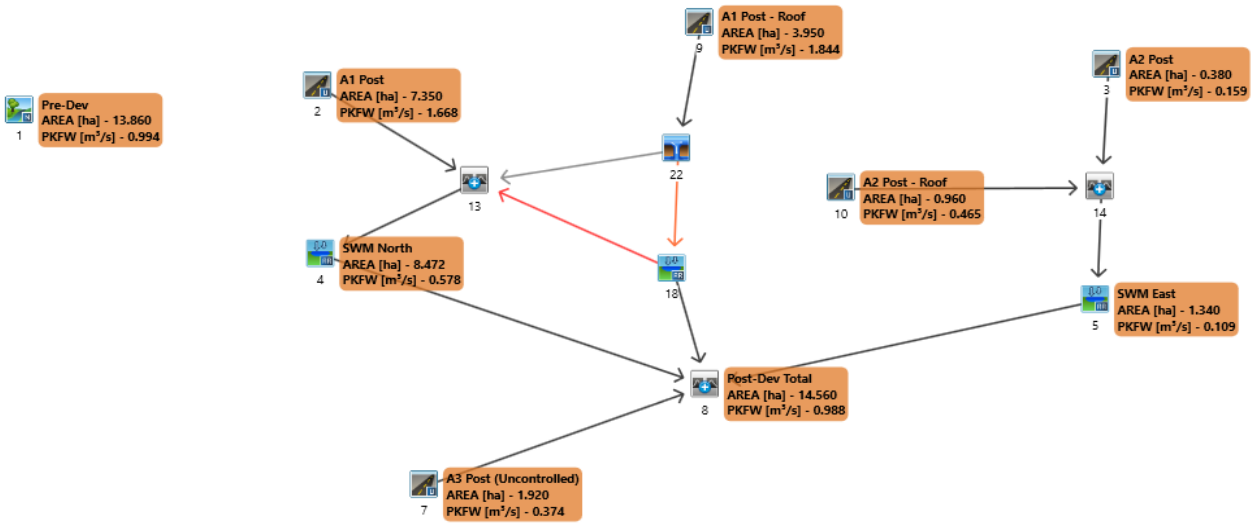
urbantech.com

2010 MTO STORMS VO MODEL OUTPUT			
Project Name:	5525 8th Line (Empire, Erin)	Prepared by:	DL
Municipality:	Town of Erin	Checked by:	KR
Project No.:	21-684	Submission:	1
Date:	12/05/2022		

2010 MTO STORMS VO MODEL OUTPUT SCHEMATIC



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================================================================================
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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\3a
1332fc-226c-4c8a-a138-625c46e05c83\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\3a
1332fc-226c-4c8a-a138-625c46e05c83\sc


DATE: 05-12-2022                          TIME: 08:09:48

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : 100yr24hrSCS2010             **
  **********************************************


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

	0dab1f30-2e98-484a-ba61-e3579c7a4b1b\6a5e60ae
Ptotal=130.10 mm	Comments: 100yr24hrSCS2010

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.31	6.00	2.35	12.00	24.67	18.00	2.33
0.10	1.31	6.10	2.38	12.10	21.70	18.10	2.29
0.20	1.34	6.20	2.41	12.20	18.73	18.20	2.26
0.30	1.34	6.30	2.43	12.30	15.77	18.30	2.22
0.40	1.37	6.40	2.46	12.40	12.80	18.40	2.20
0.50	1.37	6.50	2.48	12.50	10.98	18.50	2.16
0.60	1.39	6.60	2.51	12.60	10.30	18.60	2.13
0.70	1.39	6.70	2.54	12.70	9.63	18.70	2.09
0.80	1.42	6.80	2.56	12.80	8.95	18.80	2.07
0.90	1.42	6.90	2.59	12.90	8.27	18.90	2.03
1.00	1.44	7.00	2.62	13.00	7.75	19.00	2.00
1.10	1.44	7.10	2.64	13.10	7.39	19.10	1.96
1.20	1.47	7.20	2.67	13.20	7.03	19.20	1.94
1.30	1.47	7.30	2.69	13.30	6.66	19.30	1.90
1.40	1.50	7.40	2.72	13.40	6.30	19.40	1.87
1.50	1.50	7.50	2.75	13.50	5.98	19.50	1.83
1.60	1.52	7.60	2.77	13.60	5.72	19.60	1.81
1.70	1.52	7.70	2.80	13.70	5.46	19.70	1.77
1.80	1.55	7.80	2.82	13.80	5.20	19.80	1.74
1.90	1.55	7.90	2.85	13.90	4.94	19.90	1.70
2.00	1.57	8.00	2.93	14.00	4.77	20.00	1.69
2.10	1.57	8.10	3.06	14.10	4.67	20.10	1.68
2.20	1.60	8.20	3.19	14.20	4.59	20.20	1.68
2.30	1.60	8.30	3.32	14.30	4.49	20.30	1.67
2.40	1.63	8.40	3.45	14.40	4.41	20.40	1.67
2.50	1.63	8.50	3.58	14.50	4.31	20.50	1.65
2.60	1.65	8.60	3.71	14.60	4.23	20.60	1.65
2.70	1.65	8.70	3.84	14.70	4.12	20.70	1.64
2.80	1.68	8.80	3.97	14.80	4.05	20.80	1.64
2.90	1.68	8.90	4.10	14.90	3.94	20.90	1.63
3.00	1.70	9.00	4.16	15.00	3.86	21.00	1.63
3.10	1.70	9.10	4.16	15.10	3.76	21.10	1.61
3.20	1.73	9.20	4.16	15.20	3.68	21.20	1.61
3.30	1.73	9.30	4.16	15.30	3.58	21.30	1.60
3.40	1.76	9.40	4.16	15.40	3.50	21.40	1.60
3.50	1.76	9.50	4.27	15.50	3.40	21.50	1.59
3.60	1.78	9.60	4.48	15.60	3.32	21.60	1.59
3.70	1.78	9.70	4.68	15.70	3.21	21.70	1.57
3.80	1.81	9.80	4.89	15.80	3.14	21.80	1.57
3.90	1.81	9.90	5.10	15.90	3.03	21.90	1.56
4.00	1.83	10.00	5.36	16.00	2.98	22.00	1.56
4.10	1.86	10.10	5.67	16.10	2.94	22.10	1.55
4.20	1.89	10.20	5.98	16.20	2.91	22.20	1.55
4.30	1.91	10.30	6.30	16.30	2.88	22.30	1.54
4.40	1.94	10.40	6.61	16.40	2.85	22.40	1.54

4.50	1.96	10.50	7.03	16.50	2.81	22.50	1.52
4.60	1.99	10.60	7.55	16.60	2.78	22.60	1.52
4.70	2.02	10.70	8.07	16.70	2.75	22.70	1.51
4.80	2.04	10.80	8.59	16.80	2.72	22.80	1.51
4.90	2.07	10.90	9.11	16.90	2.68	22.90	1.50
5.00	2.09	11.00	9.99	17.00	2.65	23.00	1.50
5.10	2.12	11.10	11.24	17.10	2.62	23.10	1.48
5.20	2.15	11.20	12.49	17.20	2.59	23.20	1.48
5.30	2.17	11.30	13.74	17.30	2.55	23.30	1.47
5.40	2.20	11.40	14.99	17.40	2.52	23.40	1.47
5.50	2.22	11.50	31.02	17.50	2.48	23.50	1.46
5.60	2.25	11.60	61.82	17.60	2.46	23.60	1.46
5.70	2.28	11.70	99.44	17.70	2.42	23.70	1.44
5.80	2.30	11.80	178.33	17.80	2.39	23.80	1.44
5.90	2.33	11.90	123.78	17.90	2.35	23.90	1.43

CALIB STANDHYD (0002) ID= 1 DT= 6.0 min	Area (ha)= 7.35 Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		178.33	54.21	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.27 (ii)	12.28 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.24	0.08	
			TOTALS	
PEAK FLOW	(cms)=	1.48	0.38	1.668 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	129.10	40.18	79.31
TOTAL RAINFALL	(mm)=	130.10	130.10	130.10
RUNOFF COEFFICIENT	=	0.99	0.31	0.61

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     178.33        54.21
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.71 (ii)    3.60 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.23
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.84         0.01          1.844 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     129.10        40.18         128.21
     TOTAL RAINFALL   (mm)=     130.10       130.10         130.10
     RUNOFF COEFFICIENT   =       0.99         0.31           0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.84     11.90  128.21
     ==================================================
     MAJOR SYS.(ID= 2):   0.31      0.77     11.90  128.21
     MINOR SYS.(ID= 3):   3.64      1.08     11.90  128.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
```

```
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0880      0.1842
                         0.0320     0.1490   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.642      1.076     11.90     128.21
   OUTFLOW: ID= 1 (  0018)      2.828      0.088     11.90     131.50
   OVERFLOW:ID= 3 (  0003)      0.815      1.158     11.90     131.50

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

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1842

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.81   1.158    11.90   131.50
      + ID2= 2 (  0002):     7.35   1.668    11.90    79.31
        ================================================
        ID = 3 (  0013):     8.16   2.826    11.90    84.51

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     8.16   2.826    11.90    84.51
      + ID2= 2 (  0022):     0.31   0.768    11.90   128.21
        ================================================
        ID = 1 (  0013):     8.47   3.594    11.90    86.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                          0.0000     0.0000   |   0.4070      0.2621
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.472      3.594     11.90      86.10
   OUTFLOW: ID= 1 (  0004)      8.472      0.578     12.30      86.10

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.09
                  TIME SHIFT OF PEAK FLOW         (min)= 24.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3652

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     178.33        54.21
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.34 (ii)    4.64 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.21
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.01          0.159 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     129.10        40.18         110.42
     TOTAL RAINFALL   (mm)=     130.10       130.10         130.10
     RUNOFF COEFFICIENT   =       0.99         0.31           0.85

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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            |
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```
| STANDHYD (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     178.33        54.21
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.77 (ii)    2.66 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.46         0.00          0.465 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90         11.90
     RUNOFF VOLUME    (mm)=     129.10        40.18        128.21
     TOTAL RAINFALL   (mm)=     130.10       130.10        130.10
     RUNOFF COEFFICIENT   =       0.99         0.31          0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.465    11.90   128.21
      + ID2= 2 (  0003):     0.38   0.159    11.90   110.42
        ================================================
        ID = 3 (  0014):     1.34   0.624    11.90   123.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0910      0.0722
                         0.0140     0.0448   |   0.0920      0.0797
```

```
                          0.0470     0.0547   |   0.1090      0.0874
                          0.0560     0.0631   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.624     11.90     123.17
   OUTFLOW: ID= 1 (  0005)      1.340      0.109     12.10     122.57

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.41
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0874

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     178.33        54.21
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       2.18 (ii)   11.20 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.27         0.10
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.29         0.14          0.374 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=     129.10        40.18          67.74
     TOTAL RAINFALL   (mm)=     130.10       130.10         130.10
     RUNOFF COEFFICIENT   =       0.99         0.31           0.52

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     2.83   0.088    11.90   131.50
      + ID2= 2 (  0004):     8.47   0.578    12.30    86.10
        ================================================
        ID = 3 (  0008):    11.30   0.666    12.30    97.46

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.666    12.30    97.46
      + ID2= 2 (  0005):     1.34   0.109    12.10   122.57
        ================================================
        ID = 1 (  0008):    12.64   0.771    12.30   100.12

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.771    12.30   100.12
      + ID2= 2 (  0007):     1.92   0.374    11.90    67.74
        ================================================
        ID = 3 (  0008):    14.56   0.988    12.00    95.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.994 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  40.159
     TOTAL RAINFALL   (mm)= 130.100
     RUNOFF COEFFICIENT   =   0.309

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

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\ce
f93730-9f03-4380-84ef-2ea768d59309\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\ce
f93730-9f03-4380-84ef-2ea768d59309\sc


DATE: 05-12-2022                          TIME: 08:09:48

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ********************************************
  ** SIMULATION : 10yr24hrSCS2010            **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\d076b8c1
```

| Ptotal= 91.10 mm | Comments: 10yr24hrSCS2010

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.92	6.00	1.65	12.00	17.27	18.00	1.63
0.10	0.92	6.10	1.67	12.10	15.20	18.10	1.60
0.20	0.94	6.20	1.69	12.20	13.12	18.20	1.59
0.30	0.94	6.30	1.70	12.30	11.04	18.30	1.56
0.40	0.96	6.40	1.72	12.40	8.96	18.40	1.54
0.50	0.96	6.50	1.74	12.50	7.69	18.50	1.51
0.60	0.97	6.60	1.76	12.60	7.22	18.60	1.49
0.70	0.97	6.70	1.78	12.70	6.74	18.70	1.47
0.80	0.99	6.80	1.79	12.80	6.27	18.80	1.45
0.90	0.99	6.90	1.81	12.90	5.79	18.90	1.42
1.00	1.01	7.00	1.83	13.00	5.43	19.00	1.40
1.10	1.01	7.10	1.85	13.10	5.17	19.10	1.38
1.20	1.03	7.20	1.87	13.20	4.92	19.20	1.36
1.30	1.03	7.30	1.89	13.30	4.66	19.30	1.33
1.40	1.05	7.40	1.90	13.40	4.41	19.40	1.31
1.50	1.05	7.50	1.92	13.50	4.19	19.50	1.28
1.60	1.07	7.60	1.94	13.60	4.01	19.60	1.27
1.70	1.07	7.70	1.96	13.70	3.83	19.70	1.24
1.80	1.08	7.80	1.98	13.80	3.64	19.80	1.22
1.90	1.08	7.90	2.00	13.90	3.46	19.90	1.19
2.00	1.10	8.00	2.05	14.00	3.34	20.00	1.18
2.10	1.10	8.10	2.14	14.10	3.27	20.10	1.18
2.20	1.12	8.20	2.23	14.20	3.22	20.20	1.18
2.30	1.12	8.30	2.32	14.30	3.14	20.30	1.17
2.40	1.14	8.40	2.41	14.40	3.09	20.40	1.17
2.50	1.14	8.50	2.51	14.50	3.02	20.50	1.16
2.60	1.16	8.60	2.60	14.60	2.96	20.60	1.16
2.70	1.16	8.70	2.69	14.70	2.89	20.70	1.15
2.80	1.18	8.80	2.78	14.80	2.83	20.80	1.15
2.90	1.18	8.90	2.87	14.90	2.76	20.90	1.14
3.00	1.19	9.00	2.92	15.00	2.71	21.00	1.14
3.10	1.19	9.10	2.92	15.10	2.63	21.10	1.13
3.20	1.21	9.20	2.92	15.20	2.58	21.20	1.13
3.30	1.21	9.30	2.92	15.30	2.51	21.30	1.12
3.40	1.23	9.40	2.92	15.40	2.45	21.40	1.12
3.50	1.23	9.50	2.99	15.50	2.38	21.50	1.11
3.60	1.25	9.60	3.13	15.60	2.32	21.60	1.11
3.70	1.25	9.70	3.28	15.70	2.25	21.70	1.10
3.80	1.27	9.80	3.43	15.80	2.20	21.80	1.10
3.90	1.27	9.90	3.57	15.90	2.12	21.90	1.09
4.00	1.28	10.00	3.75	16.00	2.09	22.00	1.09
4.10	1.30	10.10	3.97	16.10	2.06	22.10	1.08
4.20	1.32	10.20	4.19	16.20	2.04	22.20	1.08
4.30	1.34	10.30	4.41	16.30	2.01	22.30	1.07
4.40	1.36	10.40	4.63	16.40	2.00	22.40	1.07
4.50	1.38	10.50	4.92	16.50	1.97	22.50	1.07

4.60	1.39	10.60	5.28	16.60	1.95	22.60	1.07
4.70	1.41	10.70	5.65	16.70	1.92	22.70	1.06
4.80	1.43	10.80	6.01	16.80	1.90	22.80	1.06
4.90	1.45	10.90	6.38	16.90	1.88	22.90	1.05
5.00	1.47	11.00	7.00	17.00	1.86	23.00	1.05
5.10	1.48	11.10	7.87	17.10	1.83	23.10	1.04
5.20	1.50	11.20	8.75	17.20	1.81	23.20	1.04
5.30	1.52	11.30	9.62	17.30	1.79	23.30	1.03
5.40	1.54	11.40	10.49	17.40	1.77	23.40	1.03
5.50	1.56	11.50	21.72	17.50	1.74	23.50	1.02
5.60	1.58	11.60	43.29	17.60	1.72	23.60	1.02
5.70	1.59	11.70	69.63	17.70	1.69	23.70	1.01
5.80	1.61	11.80	124.87	17.80	1.68	23.80	1.01
5.90	1.63	11.90	86.67	17.90	1.65	23.90	1.00

CALIB	
STANDHYD (0002)	Area (ha)= 7.35
ID= 1 DT= 6.0 min	Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		124.87	28.35	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.77 (ii)	15.45 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.23	0.07	
				TOTALS
PEAK FLOW	(cms)=	1.01	0.18	1.094 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	90.10	21.15	51.49
TOTAL RAINFALL	(mm)=	91.10	91.10	91.10
RUNOFF COEFFICIENT	=	0.99	0.23	0.57

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     124.87        28.35
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       3.13 (ii)    4.15 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.24         0.22
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.26         0.00          1.264 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      90.10        21.15          89.41
     TOTAL RAINFALL   (mm)=      91.10        91.10          91.10
     RUNOFF COEFFICIENT   =       0.99         0.23           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.26     11.90   89.41
     ==================================================
     MAJOR SYS.(ID= 2):   0.08      0.19     11.90   89.41
     MINOR SYS.(ID= 3):   3.87      1.08     11.90   89.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0880      0.1842
                         0.0320     0.1490   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.874      1.076     11.90      89.41
   OUTFLOW: ID= 1 (  0018)      3.599      0.088     12.10      89.02
   OVERFLOW:ID= 3 (  0003)      0.275      0.252     12.00      89.02

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1842

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.28   0.252    12.00    89.02
      + ID2= 2 (  0002):     7.35   1.094    11.90    51.49
        ================================================
        ID = 3 (  0013):     7.63   1.218    12.00    52.84

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     7.63   1.218    12.00    52.84
      + ID2= 2 (  0022):     0.08   0.188    11.90    89.41
        ================================================
        ID = 1 (  0013):     7.70   1.282    11.90    53.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4070      0.2621
```

```
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.701      1.282     11.90      53.20
   OUTFLOW: ID= 1 (  0004)      7.701      0.248     12.40      53.20

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.34
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1991

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     124.87        28.35
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.55 (ii)    5.35 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.19
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.01          0.109 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      90.10        21.15          75.61
     TOTAL RAINFALL   (mm)=      91.10        91.10          91.10
     RUNOFF COEFFICIENT   =       0.99         0.23           0.83

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
```

```
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     124.87        28.35
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.04 (ii)    3.07 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.32         0.00          0.322 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      90.10        21.15          89.41
     TOTAL RAINFALL   (mm)=      91.10        91.10          91.10
     RUNOFF COEFFICIENT   =       0.99         0.23           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.322    11.90    89.41
      + ID2= 2 (  0003):     0.38   0.109    11.90    75.61
        ================================================
        ID = 3 (  0014):     1.34   0.431    11.90    85.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0910      0.0722
                          0.0140     0.0448   |   0.0920      0.0797
                          0.0470     0.0547   |   0.1090      0.0874
```

```
                          0.0560     0.0631   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.431     11.90      85.50
   OUTFLOW: ID= 1 (  0005)      1.340      0.056     12.20      84.90

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.99
                  TIME SHIFT OF PEAK FLOW         (min)= 18.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0631

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     124.87        28.35
               over (min)         6.00        18.00
     Storage Coeff.  (min)=       2.52 (ii)   14.20 (ii)
     Unit Hyd. Tpeak (min)=       6.00        18.00
     Unit Hyd. peak  (cms)=       0.26         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.06          0.226 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.10          11.90
     RUNOFF VOLUME    (mm)=      90.10        21.15          42.52
     TOTAL RAINFALL   (mm)=      91.10        91.10          91.10
     RUNOFF COEFFICIENT   =       0.99         0.23           0.47

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0018):     3.60   0.088    12.10    89.02
      + ID2= 2 (  0004):     7.70   0.248    12.40    53.20
        ================================================
        ID = 3 (  0008):    11.30   0.336    12.40    64.61

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.336    12.40    64.61
      + ID2= 2 (  0005):     1.34   0.056    12.20    84.90
        ================================================
        ID = 1 (  0008):    12.64   0.391    12.40    66.76

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.391    12.40    66.76
      + ID2= 2 (  0007):     1.92   0.226    11.90    42.52
        ================================================
        ID = 3 (  0008):    14.56   0.498    12.00    63.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.515 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  21.139
     TOTAL RAINFALL   (mm)=  91.100
     RUNOFF COEFFICIENT   =   0.232

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

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\04
6bd7ee-7888-4912-8916-2acc1384b5dd\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\04
6bd7ee-7888-4912-8916-2acc1384b5dd\sc


DATE: 05-12-2022                          TIME: 08:09:49

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : 25mm                         **
  ***********************************************


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|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\95e3f70c
| Ptotal= 24.78 mm |    Comments: CHI4HR5M025.stm
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.89	1.00	1.83	2.00	34.69	3.00	2.83
0.08	0.93	1.08	2.02	2.08	19.59	3.08	2.62
0.17	0.97	1.17	2.25	2.17	13.23	3.17	2.44
0.25	1.01	1.25	2.54	2.25	9.84	3.25	2.29
0.33	1.07	1.33	2.93	2.33	7.78	3.33	2.15
0.42	1.12	1.42	3.47	2.42	6.41	3.42	2.03
0.50	1.19	1.50	4.24	2.50	5.43	3.50	1.92
0.58	1.26	1.58	5.46	2.58	4.71	3.58	1.83
0.67	1.34	1.67	7.61	2.67	4.16	3.67	1.74
0.75	1.43	1.75	12.29	2.75	3.72	3.75	1.66
0.83	1.54	1.83	28.03	2.83	3.37	3.83	1.59
0.92	1.67	1.92	71.13	2.92	3.07		

CALIB
STANDHYD (0002)
ID= 1 DT= 6.0 min

Area (ha)= 7.35
Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.23	4.12
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	221.36	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 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
0.100	0.89	1.100	1.86	2.100	32.17	3.10	2.79
0.200	0.94	1.200	2.09	2.200	17.47	3.20	2.56
0.300	0.99	1.300	2.40	2.300	11.53	3.30	2.36
0.400	1.05	1.400	2.80	2.400	8.47	3.40	2.20
0.500	1.11	1.500	3.38	2.500	6.63	3.50	2.05
0.600	1.20	1.600	4.44	2.600	5.31	3.60	1.91
0.700	1.29	1.700	6.18	2.700	4.53	3.70	1.80
0.800	1.39	1.800	9.95	2.800	3.94	3.80	1.70
0.900	1.51	1.900	22.78	2.900	3.48	3.90	1.61
1.000	1.65	2.000	63.95	3.000	3.12		

Max.Eff.Inten.(mm/hr)=		63.95	1.34
over (min)		6.00	48.00
Storage Coeff. (min)=		4.92 (ii)	44.51 (ii)

```
     Unit Hyd. Tpeak (min)=       6.00        48.00
     Unit Hyd. peak  (cms)=       0.20         0.02
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.45         0.01          0.454 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.90           2.00
     RUNOFF VOLUME    (mm)=      23.75         1.37          11.21
     TOTAL RAINFALL   (mm)=      24.75        24.75          24.75
     RUNOFF COEFFICIENT   =       0.96         0.06           0.45

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   6.0 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
              0.100    0.89 | 1.100    1.86 | 2.100   32.17 |  3.10    2.79
              0.200    0.94 | 1.200    2.09 | 2.200   17.47 |  3.20    2.56
              0.300    0.99 | 1.300    2.40 | 2.300   11.53 |  3.30    2.36
              0.400    1.05 | 1.400    2.80 | 2.400    8.47 |  3.40    2.20
              0.500    1.11 | 1.500    3.38 | 2.500    6.63 |  3.50    2.05
              0.600    1.20 | 1.600    4.44 | 2.600    5.31 |  3.60    1.91
              0.700    1.29 | 1.700    6.18 | 2.700    4.53 |  3.70    1.80
              0.800    1.39 | 1.800    9.95 | 2.800    3.94 |  3.80    1.70
              0.900    1.51 | 1.900   22.78 | 2.900    3.48 |  3.90    1.61
              1.000    1.65 | 2.000   63.95 | 3.000    3.12 |

     Max.Eff.Inten.(mm/hr)=      63.95         2.30
               over (min)        6.00         6.00
     Storage Coeff.  (min)=       4.08 (ii)    5.43 (ii)
```

```
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.22         0.19
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.58         0.00          0.584 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.10           2.00
     RUNOFF VOLUME    (mm)=      23.75         1.37          23.52
     TOTAL RAINFALL   (mm)=      24.75        24.75          24.75
     RUNOFF COEFFICIENT   =       0.96         0.06           0.95

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      0.58      2.00   23.52
     ==================================================
     MAJOR SYS.(ID= 2):   0.00      0.00      0.00    0.00
     MINOR SYS.(ID= 3):   3.95      0.58      2.00   23.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1842
                          0.0320     0.1490   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.950      0.584      2.00      23.52
   OUTFLOW: ID= 1 (  0018)      3.950      0.017      3.90      23.23
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

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

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.98
                    TIME SHIFT OF PEAK FLOW         (min)=114.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0811

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0018 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0013 = HYDROGRAPH 0002
        ID1= 1 (  0018):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0002):     7.35   0.454     2.00    11.21
        ================================================
        ID = 3 (  0013):     7.35   0.454     2.00    11.21

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0022 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0013):     7.35   0.454     2.00    11.21
      + ID2= 2 (  0022):     0.00   0.000     0.00     0.00
        ================================================
        ID = 1 (  0013):     7.35   0.454     2.00    11.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.2621
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.350      0.454      2.00      11.21
   OUTFLOW: ID= 1 (  0004)      7.350      0.031      3.20      11.21

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.80
                    TIME SHIFT OF PEAK FLOW         (min)= 72.00
```

MAXIMUM STORAGE USED (ha.m.)= 0.0611

CALIB STANDHYD (0003) ID= 1 DT= 6.0 min	Area (ha)= 0.38 Total Imp(%)= 79.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.30	0.08
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 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
0.100	0.89	1.100	1.86	2.100	32.17	3.10	2.79
0.200	0.94	1.200	2.09	2.200	17.47	3.20	2.56
0.300	0.99	1.300	2.40	2.300	11.53	3.30	2.36
0.400	1.05	1.400	2.80	2.400	8.47	3.40	2.20
0.500	1.11	1.500	3.38	2.500	6.63	3.50	2.05
0.600	1.20	1.600	4.44	2.600	5.31	3.60	1.91
0.700	1.29	1.700	6.18	2.700	4.53	3.70	1.80
0.800	1.39	1.800	9.95	2.800	3.94	3.80	1.70
0.900	1.51	1.900	22.78	2.900	3.48	3.90	1.61
1.000	1.65	2.000	63.95	3.000	3.12		

Max.Eff.Inten.(mm/hr)=		63.95	2.30	
over (min)		6.00	12.00	
Storage Coeff. (min)=		2.02 (ii)	6.99 (ii)	
Unit Hyd. Tpeak (min)=		6.00	12.00	
Unit Hyd. peak (cms)=		0.27	0.13	
				TOTALS
PEAK FLOW	(cms)=	0.05	0.00	0.052 (iii)
TIME TO PEAK	(hrs)=	2.00	2.20	2.00
RUNOFF VOLUME	(mm)=	23.75	1.37	19.05
TOTAL RAINFALL	(mm)=	24.75	24.75	24.75
RUNOFF COEFFICIENT	=	0.96	0.06	0.77

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (0010)	Area (ha)= 0.96	
ID= 1 DT= 6.0 min	Total Imp(%)= 99.00	Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.95	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	80.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 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
0.100	0.89	1.100	1.86	2.100	32.17	3.10	2.79
0.200	0.94	1.200	2.09	2.200	17.47	3.20	2.56
0.300	0.99	1.300	2.40	2.300	11.53	3.30	2.36
0.400	1.05	1.400	2.80	2.400	8.47	3.40	2.20
0.500	1.11	1.500	3.38	2.500	6.63	3.50	2.05
0.600	1.20	1.600	4.44	2.600	5.31	3.60	1.91
0.700	1.29	1.700	6.18	2.700	4.53	3.70	1.80
0.800	1.39	1.800	9.95	2.800	3.94	3.80	1.70
0.900	1.51	1.900	22.78	2.900	3.48	3.90	1.61
1.000	1.65	2.000	63.95	3.000	3.12		

Max.Eff.Inten.(mm/hr)=		63.95	2.30	
over (min)		6.00	6.00	
Storage Coeff. (min)=		2.67 (ii)	4.02 (ii)	
Unit Hyd. Tpeak (min)=		6.00	6.00	
Unit Hyd. peak (cms)=		0.25	0.22	
				TOTALS
PEAK FLOW	(cms)=	0.16	0.00	0.157 (iii)
TIME TO PEAK	(hrs)=	2.00	2.10	2.00
RUNOFF VOLUME	(mm)=	23.75	1.37	23.52
TOTAL RAINFALL	(mm)=	24.75	24.75	24.75
RUNOFF COEFFICIENT	=	0.96	0.06	0.95

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (0014)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0010):	0.96	0.157	2.00	23.52
	+ ID2= 2 (0003):	0.38	0.052	2.00	19.05
	ID = 3 (0014):	1.34	0.209	2.00	22.25

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0005) | OVERFLOW IS OFF
IN= 2---> OUT= 1
DT= 6.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0910	0.0722
0.0140	0.0448	0.0920	0.0797
0.0470	0.0547	0.1090	0.0874
0.0560	0.0631	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0014)	1.340	0.209	2.00	22.25
OUTFLOW: ID= 1 (0005)	1.340	0.008	3.40	21.65

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.70
TIME SHIFT OF PEAK FLOW (min)= 84.00
MAXIMUM STORAGE USED (ha.m.)= 0.0247

CALIB
STANDHYD (0007) | Area (ha)= 1.92
ID= 1 DT= 6.0 min | Total Imp(%)= 31.00 Dir. Conn.(%)= 31.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.60	1.32
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	113.14	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 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
0.100	0.89	1.100	1.86	2.100	32.17	3.10	2.79
0.200	0.94	1.200	2.09	2.200	17.47	3.20	2.56
0.300	0.99	1.300	2.40	2.300	11.53	3.30	2.36
0.400	1.05	1.400	2.80	2.400	8.47	3.40	2.20
0.500	1.11	1.500	3.38	2.500	6.63	3.50	2.05
0.600	1.20	1.600	4.44	2.600	5.31	3.60	1.91
0.700	1.29	1.700	6.18	2.700	4.53	3.70	1.80
0.800	1.39	1.800	9.95	2.800	3.94	3.80	1.70
0.900	1.51	1.900	22.78	2.900	3.48	3.90	1.61
1.000	1.65	2.000	63.95	3.000	3.12		

Max.Eff.Inten.(mm/hr)=	63.95	1.34	
over (min)	6.00	48.00	
Storage Coeff. (min)=	3.29 (ii)	42.88 (ii)	
Unit Hyd. Tpeak (min)=	6.00	48.00	
Unit Hyd. peak (cms)=	0.24	0.03	
			TOTALS
PEAK FLOW (cms)=	0.09	0.00	0.094 (iii)
TIME TO PEAK (hrs)=	2.00	2.90	2.00
RUNOFF VOLUME (mm)=	23.75	1.37	8.30
TOTAL RAINFALL (mm)=	24.75	24.75	24.75
RUNOFF COEFFICIENT =	0.96	0.06	0.34

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (0008)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0018):	3.95	0.017	3.90	23.23
	+ ID2= 2 (0004):	7.35	0.031	3.20	11.21
	==========				
	ID = 3 (0008):	11.30	0.048	3.40	15.41

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0008)

```
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.048     3.40    15.41
      + ID2= 2 (  0005):     1.34   0.008     3.40    21.65
        ================================================
        ID = 1 (  0008):    12.64   0.056     3.40    16.07

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


--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.056     3.40    16.07
      + ID2= 2 (  0007):     1.92   0.094     2.00     8.30
        ================================================
        ID = 3 (  0008):    14.56   0.116     2.00    15.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

         NOTE:  RAINFALL WAS TRANSFORMED TO   6.0 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
               0.100    0.89 | 1.100    1.86 | 2.100   32.17 |  3.10    2.79
               0.200    0.94 | 1.200    2.09 | 2.200   17.47 |  3.20    2.56
               0.300    0.99 | 1.300    2.40 | 2.300   11.53 |  3.30    2.36
               0.400    1.05 | 1.400    2.80 | 2.400    8.47 |  3.40    2.20
               0.500    1.11 | 1.500    3.38 | 2.500    6.63 |  3.50    2.05
               0.600    1.20 | 1.600    4.44 | 2.600    5.31 |  3.60    1.91
               0.700    1.29 | 1.700    6.18 | 2.700    4.53 |  3.70    1.80
               0.800    1.39 | 1.800    9.95 | 2.800    3.94 |  3.80    1.70
               0.900    1.51 | 1.900   22.78 | 2.900    3.48 |  3.90    1.61
               1.000    1.65 | 2.000   63.95 | 3.000    3.12 |

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.044 (i)
     TIME TO PEAK    (hrs)=   2.400
     RUNOFF VOLUME    (mm)=   1.372
     TOTAL RAINFALL   (mm)=  24.749
```

RUNOFF COEFFICIENT = 0.055

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

FINISH

==========

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```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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

***** 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\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\653a02d6-6e25-4587-95a1-01b79f173b0f\sc
Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\653a02d6-6e25-4587-95a1-01b79f173b0f\sc

DATE: 05-12-2022 TIME: 08:09:48

USER:

COMMENTS: _____

```
--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 25yr24hrSCS2010               **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\36df4401
| Ptotal=106.70 mm |    Comments: 25yr24hrSCS2010
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.08	6.00	1.93	12.00	20.23	18.00	1.91
0.10	1.08	6.10	1.95	12.10	17.80	18.10	1.88
0.20	1.10	6.20	1.97	12.20	15.36	18.20	1.86
0.30	1.10	6.30	2.00	12.30	12.93	18.30	1.82
0.40	1.12	6.40	2.02	12.40	10.50	18.40	1.80
0.50	1.12	6.50	2.04	12.50	9.01	18.50	1.77
0.60	1.14	6.60	2.06	12.60	8.45	18.60	1.75
0.70	1.14	6.70	2.08	12.70	7.90	18.70	1.72
0.80	1.16	6.80	2.10	12.80	7.34	18.80	1.70
0.90	1.16	6.90	2.12	12.90	6.79	18.90	1.66
1.00	1.18	7.00	2.14	13.00	6.36	19.00	1.64
1.10	1.18	7.10	2.17	13.10	6.06	19.10	1.61
1.20	1.21	7.20	2.19	13.20	5.76	19.20	1.59
1.30	1.21	7.30	2.21	13.30	5.46	19.30	1.56
1.40	1.23	7.40	2.23	13.40	5.16	19.40	1.54
1.50	1.23	7.50	2.25	13.50	4.91	19.50	1.50
1.60	1.25	7.60	2.27	13.60	4.69	19.60	1.48
1.70	1.25	7.70	2.29	13.70	4.48	19.70	1.45
1.80	1.27	7.80	2.32	13.80	4.27	19.80	1.43
1.90	1.27	7.90	2.34	13.90	4.05	19.90	1.40
2.00	1.29	8.00	2.40	14.00	3.92	20.00	1.39
2.10	1.29	8.10	2.51	14.10	3.83	20.10	1.38
2.20	1.31	8.20	2.61	14.20	3.77	20.20	1.38
2.30	1.31	8.30	2.72	14.30	3.68	20.30	1.37
2.40	1.33	8.40	2.83	14.40	3.62	20.40	1.37
2.50	1.33	8.50	2.93	14.50	3.53	20.50	1.36
2.60	1.36	8.60	3.04	14.60	3.47	20.60	1.36
2.70	1.36	8.70	3.15	14.70	3.38	20.70	1.34
2.80	1.38	8.80	3.25	14.80	3.32	20.80	1.34
2.90	1.38	8.90	3.36	14.90	3.23	20.90	1.33
3.00	1.40	9.00	3.41	15.00	3.17	21.00	1.33
3.10	1.40	9.10	3.41	15.10	3.08	21.10	1.32
3.20	1.42	9.20	3.41	15.20	3.02	21.20	1.32
3.30	1.42	9.30	3.41	15.30	2.93	21.30	1.31
3.40	1.44	9.40	3.41	15.40	2.87	21.40	1.31

3.50	1.44	9.50	3.50	15.50	2.78	21.50	1.30
3.60	1.46	9.60	3.67	15.60	2.72	21.60	1.30
3.70	1.46	9.70	3.84	15.70	2.64	21.70	1.29
3.80	1.48	9.80	4.01	15.80	2.57	21.80	1.29
3.90	1.48	9.90	4.18	15.90	2.49	21.90	1.28
4.00	1.50	10.00	4.40	16.00	2.44	22.00	1.28
4.10	1.53	10.10	4.65	16.10	2.41	22.10	1.27
4.20	1.55	10.20	4.91	16.20	2.39	22.20	1.27
4.30	1.57	10.30	5.16	16.30	2.36	22.30	1.26
4.40	1.59	10.40	5.42	16.40	2.34	22.40	1.26
4.50	1.61	10.50	5.76	16.50	2.30	22.50	1.25
4.60	1.63	10.60	6.19	16.60	2.28	22.60	1.25
4.70	1.65	10.70	6.62	16.70	2.25	22.70	1.24
4.80	1.68	10.80	7.04	16.80	2.23	22.80	1.24
4.90	1.70	10.90	7.47	16.90	2.20	22.90	1.23
5.00	1.72	11.00	8.19	17.00	2.18	23.00	1.23
5.10	1.74	11.10	9.22	17.10	2.14	23.10	1.22
5.20	1.76	11.20	10.24	17.20	2.12	23.20	1.22
5.30	1.78	11.30	11.27	17.30	2.09	23.30	1.21
5.40	1.80	11.40	12.29	17.40	2.07	23.40	1.21
5.50	1.82	11.50	25.44	17.50	2.04	23.50	1.20
5.60	1.85	11.60	50.70	17.60	2.02	23.60	1.20
5.70	1.87	11.70	81.55	17.70	1.98	23.70	1.18
5.80	1.89	11.80	146.25	17.80	1.96	23.80	1.18
5.90	1.91	11.90	101.51	17.90	1.93	23.90	1.17

CALIB			
STANDHYD (0002)	Area (ha)=	7.35	
ID= 1 DT= 6.0 min	Total Imp(%)=	44.00	Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		146.25	37.98	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.53 (ii)	13.93 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.23	0.07	
			TOTALS	
PEAK FLOW	(cms)=	1.20	0.25	1.318 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	105.70	28.25	62.33
TOTAL RAINFALL	(mm)=	106.70	106.70	106.70

```
     RUNOFF COEFFICIENT   =       0.99         0.26           0.58

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     146.25        37.98
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.93 (ii)    3.90 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.49         0.00          1.495 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     105.70        28.25         104.93
     TOTAL RAINFALL   (mm)=     106.70       106.70         106.70
     RUNOFF COEFFICIENT   =       0.99         0.26           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
```

```
     TOTAL HYD.(ID= 1):   3.95      1.50     11.90  104.93
     ================================================
     MAJOR SYS.(ID= 2):   0.17      0.42     11.90  104.93
     MINOR SYS.(ID= 3):   3.78      1.08     11.90  104.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1842
                          0.0320     0.1490   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.778      1.076     11.90     104.93
   OUTFLOW: ID= 1 (  0018)      3.229      0.088     12.00     105.88
   OVERFLOW:ID= 3 (  0003)      0.549      1.050     12.00     105.88

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                  TIME SHIFT OF PEAK FLOW         (min)=  6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1842

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.55   1.050    12.00   105.88
      + ID2= 2 (  0002):     7.35   1.318    11.90    62.33
        ================================================
        ID = 3 (  0013):     7.90   2.214    12.00    65.36

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     7.90   2.214    12.00    65.36
      + ID2= 2 (  0022):     0.17   0.419    11.90   104.93
```

```
        ================================================
        ID = 1 (  0013):     8.07   2.295    12.00    66.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.4070      0.2621
                           0.0600     0.1185   |   0.4700      0.3058
                           0.1680     0.1480   |   0.5790      0.3652
                           0.2480     0.1991   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.071      2.295     12.00      66.20
   OUTFLOW: ID= 1 (  0004)      8.071      0.407     12.30      66.20

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.72
                  TIME SHIFT OF PEAK FLOW         (min)= 18.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.2621

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     146.25        37.98
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.45 (ii)    5.02 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.20
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.12         0.01          0.129 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00         11.90
     RUNOFF VOLUME    (mm)=     105.70        28.25         89.43
     TOTAL RAINFALL   (mm)=     106.70       106.70        106.70
     RUNOFF COEFFICIENT   =       0.99         0.26          0.84

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     146.25        37.98
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.92 (ii)    2.88 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.38         0.00          0.379 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     105.70        28.25         104.93
     TOTAL RAINFALL   (mm)=     106.70       106.70         106.70
     RUNOFF COEFFICIENT   =       0.99         0.26           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.379    11.90   104.93
      + ID2= 2 (  0003):     0.38   0.129    11.90    89.43
        ================================================
        ID = 3 (  0014):     1.34   0.508    11.90   100.53
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0005)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 6.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0910	0.0722
	0.0140	0.0448	0.0920	0.0797
	0.0470	0.0547	0.1090	0.0874
	0.0560	0.0631	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0014)	1.340	0.508	11.90	100.53
OUTFLOW: ID= 1 (0005)	1.340	0.091	12.10	99.93

PEAK FLOW REDUCTION [Qout/Qin](%)= 17.83
TIME SHIFT OF PEAK FLOW (min)= 12.00
MAXIMUM STORAGE USED (ha.m.)= 0.0722

CALIB		
STANDHYD (0007)	Area (ha)= 1.92	
ID= 1 DT= 6.0 min	Total Imp(%)= 31.00	Dir. Conn.(%)= 31.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.60	1.32	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	113.14	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	146.25	37.98	
over	(min)	6.00	18.00	
Storage Coeff.	(min)=	2.36 (ii)	12.76 (ii)	
Unit Hyd. Tpeak	(min)=	6.00	18.00	
Unit Hyd. peak	(cms)=	0.26	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.23	0.08	0.274 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	105.70	28.25	52.26
TOTAL RAINFALL	(mm)=	106.70	106.70	106.70
RUNOFF COEFFICIENT	=	0.99	0.26	0.49

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

```
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.23   0.088    12.00   105.88
      + ID2= 2 (  0004):     8.07   0.407    12.30    66.20
        ================================================
        ID = 3 (  0008):    11.30   0.495    12.30    77.54

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.495    12.30    77.54
      + ID2= 2 (  0005):     1.34   0.091    12.10    99.93
        ================================================
        ID = 1 (  0008):    12.64   0.580    12.30    79.91

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.580    12.30    79.91
      + ID2= 2 (  0007):     1.92   0.274    11.90    52.26
        ================================================
        ID = 3 (  0008):    14.56   0.685    12.20    76.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649
```

```
     PEAK FLOW       (cms)=   0.693 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  28.237
     TOTAL RAINFALL   (mm)= 106.700
     RUNOFF COEFFICIENT   =   0.265

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

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\d4
f67298-9c4e-4e35-a608-6abeb2733ee6\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\d4
f67298-9c4e-4e35-a608-6abeb2733ee6\sc


DATE: 05-12-2022                          TIME: 08:09:49

USER:



COMMENTS: _____________________________________________________________

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```
------------------------
  ********************************************
  ** SIMULATION : 2yr24hrSCS2010              **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\dcbdf715
| Ptotal= 59.30 mm |    Comments: 2yr24hrSCS2010
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.60	6.00	1.07	12.00	11.24	18.00	1.06
0.10	0.60	6.10	1.09	12.10	9.89	18.10	1.04
0.20	0.61	6.20	1.10	12.20	8.54	18.20	1.03
0.30	0.61	6.30	1.11	12.30	7.19	18.30	1.01
0.40	0.62	6.40	1.12	12.40	5.84	18.40	1.00
0.50	0.62	6.50	1.13	12.50	5.00	18.50	0.98
0.60	0.63	6.60	1.14	12.60	4.70	18.60	0.97
0.70	0.63	6.70	1.16	12.70	4.39	18.70	0.95
0.80	0.65	6.80	1.17	12.80	4.08	18.80	0.94
0.90	0.65	6.90	1.18	12.90	3.77	18.90	0.93
1.00	0.66	7.00	1.19	13.00	3.53	19.00	0.91
1.10	0.66	7.10	1.20	13.10	3.37	19.10	0.90
1.20	0.67	7.20	1.22	13.20	3.20	19.20	0.88
1.30	0.67	7.30	1.23	13.30	3.04	19.30	0.87
1.40	0.68	7.40	1.24	13.40	2.87	19.40	0.85
1.50	0.68	7.50	1.25	13.50	2.73	19.50	0.84
1.60	0.69	7.60	1.26	13.60	2.61	19.60	0.82
1.70	0.69	7.70	1.27	13.70	2.49	19.70	0.81
1.80	0.71	7.80	1.29	13.80	2.37	19.80	0.79
1.90	0.71	7.90	1.30	13.90	2.25	19.90	0.78
2.00	0.72	8.00	1.33	14.00	2.18	20.00	0.77
2.10	0.72	8.10	1.39	14.10	2.13	20.10	0.76
2.20	0.73	8.20	1.45	14.20	2.09	20.20	0.76
2.30	0.73	8.30	1.51	14.30	2.05	20.30	0.76
2.40	0.74	8.40	1.57	14.40	2.01	20.40	0.76
2.50	0.74	8.50	1.63	14.50	1.96	20.50	0.75
2.60	0.75	8.60	1.69	14.60	1.93	20.60	0.75
2.70	0.75	8.70	1.75	14.70	1.88	20.70	0.75
2.80	0.76	8.80	1.81	14.80	1.84	20.80	0.75
2.90	0.76	8.90	1.87	14.90	1.80	20.90	0.74
3.00	0.78	9.00	1.90	15.00	1.76	21.00	0.74
3.10	0.78	9.10	1.90	15.10	1.71	21.10	0.74
3.20	0.79	9.20	1.90	15.20	1.68	21.20	0.74
3.30	0.79	9.30	1.90	15.30	1.63	21.30	0.73
3.40	0.80	9.40	1.90	15.40	1.60	21.40	0.73
3.50	0.80	9.50	1.95	15.50	1.55	21.50	0.72

3.60	0.81	9.60	2.04	15.60	1.51	21.60	0.72
3.70	0.81	9.70	2.13	15.70	1.46	21.70	0.72
3.80	0.82	9.80	2.23	15.80	1.43	21.80	0.72
3.90	0.82	9.90	2.32	15.90	1.38	21.90	0.71
4.00	0.84	10.00	2.44	16.00	1.36	22.00	0.71
4.10	0.85	10.10	2.59	16.10	1.34	22.10	0.71
4.20	0.86	10.20	2.73	16.20	1.33	22.20	0.71
4.30	0.87	10.30	2.87	16.30	1.31	22.30	0.70
4.40	0.88	10.40	3.01	16.40	1.30	22.40	0.70
4.50	0.90	10.50	3.20	16.50	1.28	22.50	0.69
4.60	0.91	10.60	3.44	16.60	1.27	22.60	0.69
4.70	0.92	10.70	3.68	16.70	1.25	22.70	0.69
4.80	0.93	10.80	3.91	16.80	1.24	22.80	0.69
4.90	0.94	10.90	4.15	16.90	1.22	22.90	0.68
5.00	0.95	11.00	4.55	17.00	1.21	23.00	0.68
5.10	0.97	11.10	5.12	17.10	1.19	23.10	0.68
5.20	0.98	11.20	5.69	17.20	1.18	23.20	0.68
5.30	0.99	11.30	6.26	17.30	1.16	23.30	0.67
5.40	1.00	11.40	6.83	17.40	1.15	23.40	0.67
5.50	1.01	11.50	14.14	17.50	1.13	23.50	0.66
5.60	1.03	11.60	28.18	17.60	1.12	23.60	0.66
5.70	1.04	11.70	45.32	17.70	1.10	23.70	0.66
5.80	1.05	11.80	81.28	17.80	1.09	23.80	0.66
5.90	1.06	11.90	56.42	17.90	1.07	23.90	0.65

```
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   7.35
|ID= 1 DT= 6.0 min |   Total Imp(%)=  44.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.23         4.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     221.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.28        10.09
               over (min)         6.00        24.00
     Storage Coeff.  (min)=       4.47 (ii)   22.13 (ii)
     Unit Hyd. Tpeak (min)=       6.00        24.00
     Unit Hyd. peak  (cms)=       0.21         0.05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.63         0.06         0.654 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.20         11.90
     RUNOFF VOLUME    (mm)=      58.30         9.25         30.83
     TOTAL RAINFALL   (mm)=      59.30        59.30         59.30
     RUNOFF COEFFICIENT   =       0.98         0.16          0.52
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.28        12.30
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       3.71 (ii)    4.93 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.23         0.20
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.80         0.00          0.798 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      58.30         9.25          57.81
     TOTAL RAINFALL   (mm)=      59.30        59.30          59.30
     RUNOFF COEFFICIENT   =       0.98         0.16           0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      0.80     11.90   57.81
```

```
     ================================================
     MAJOR SYS.(ID= 2):   0.00      0.00      0.00    0.00
     MINOR SYS.(ID= 3):   3.95      0.80     11.90   57.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1842
                          0.0320     0.1490   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.950      0.798     11.90      57.81
   OUTFLOW: ID= 1 (  0018)      3.950      0.032     13.50      57.51
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.01
                  TIME SHIFT OF PEAK FLOW         (min)= 96.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1490

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0018 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0013 = HYDROGRAPH 0002
        ID1= 1 (  0018):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0002):     7.35   0.654    11.90    30.83
        ================================================
        ID = 3 (  0013):     7.35   0.654    11.90    30.83

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0022 <ID= 2> IS DRY.
```

```
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0013):     7.35   0.654    11.90    30.83
      + ID2= 2 (  0022):     0.00   0.000     0.00     0.00
        ================================================
        ID = 1 (  0013):     7.35   0.654    11.90    30.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.2621
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.350      0.654     11.90      30.83
   OUTFLOW: ID= 1 (  0004)      7.350      0.060     12.90      30.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.17
                  TIME SHIFT OF PEAK FLOW         (min)= 60.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1185

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.28        12.30
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       1.84 (ii)    6.35 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.27         0.13
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.00          0.068 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      58.30         9.25          47.99
     TOTAL RAINFALL   (mm)=      59.30        59.30          59.30
```

```
     RUNOFF COEFFICIENT   =       0.98         0.16           0.81

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.28        12.30
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.43 (ii)    3.65 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.26         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.21         0.00          0.207 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      58.30         9.25          57.81
     TOTAL RAINFALL   (mm)=      59.30        59.30          59.30
     RUNOFF COEFFICIENT   =       0.98         0.16           0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.207    11.90    57.81
```

```
      + ID2= 2 (  0003):     0.38   0.068    11.90    47.99
        ================================================
        ID = 3 (  0014):     1.34   0.275    11.90    55.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0910      0.0722
                          0.0140     0.0448   |   0.0920      0.0797
                          0.0470     0.0547   |   0.1090      0.0874
                          0.0560     0.0631   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.275     11.90      55.03
   OUTFLOW: ID= 1 (  0005)      1.340      0.014     12.90      54.42

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.09
                    TIME SHIFT OF PEAK FLOW         (min)= 60.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0448

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.28        10.09
               over (min)         6.00        24.00
     Storage Coeff.  (min)=       2.99 (ii)   20.65 (ii)
     Unit Hyd. Tpeak (min)=       6.00        24.00
     Unit Hyd. peak  (cms)=       0.25         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.02          0.133 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.20          11.90
     RUNOFF VOLUME    (mm)=      58.30         9.25          24.45
     TOTAL RAINFALL   (mm)=      59.30        59.30          59.30
     RUNOFF COEFFICIENT   =       0.98         0.16           0.41
```

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (0008)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0018):		3.95	0.032	13.50	57.51
+ ID2= 2 (0004):		7.35	0.060	12.90	30.83
ID = 3 (0008):		11.30	0.092	13.00	40.16

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0008)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0008):		11.30	0.092	13.00	40.16
+ ID2= 2 (0005):		1.34	0.014	12.90	54.42
ID = 1 (0008):		12.64	0.106	13.00	41.67

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0008)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0008):		12.64	0.106	13.00	41.67
+ ID2= 2 (0007):		1.92	0.133	11.90	24.45
ID = 3 (0008):		14.56	0.196	11.90	39.40

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0001)	Area (ha)= 13.86	Curve Number (CN)= 49.0			
ID= 1 DT= 6.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00			
	U.H. Tp(hrs)= 0.32				

```
     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.221 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=   9.247
     TOTAL RAINFALL   (mm)=  59.300
     RUNOFF COEFFICIENT   =   0.156

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

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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\e8
5d47fb-c42f-41a2-a358-db2f490a1f8d\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\e8
5d47fb-c42f-41a2-a358-db2f490a1f8d\sc


DATE: 05-12-2022                          TIME: 08:09:49

USER:



COMMENTS: _____________________________________________________________
```

```
--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 50yr24hrSCS2010               **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\b67f2b1a
| Ptotal=118.40 mm |    Comments: 50yr24hrSCS2010
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.20	6.00	2.14	12.00	22.45	18.00	2.12
0.10	1.20	6.10	2.17	12.10	19.75	18.10	2.08
0.20	1.22	6.20	2.19	12.20	17.05	18.20	2.06
0.30	1.22	6.30	2.21	12.30	14.35	18.30	2.02
0.40	1.24	6.40	2.24	12.40	11.65	18.40	2.00
0.50	1.24	6.50	2.26	12.50	9.99	18.50	1.97
0.60	1.27	6.60	2.29	12.60	9.38	18.60	1.94
0.70	1.27	6.70	2.31	12.70	8.76	18.70	1.91
0.80	1.29	6.80	2.33	12.80	8.15	18.80	1.88
0.90	1.29	6.90	2.36	12.90	7.53	18.90	1.85
1.00	1.31	7.00	2.38	13.00	7.06	19.00	1.82
1.10	1.31	7.10	2.40	13.10	6.73	19.10	1.79
1.20	1.34	7.20	2.43	13.20	6.39	19.20	1.76
1.30	1.34	7.30	2.45	13.30	6.06	19.30	1.73
1.40	1.36	7.40	2.47	13.40	5.73	19.40	1.70
1.50	1.36	7.50	2.50	13.50	5.45	19.50	1.67
1.60	1.39	7.60	2.52	13.60	5.21	19.60	1.65
1.70	1.39	7.70	2.55	13.70	4.97	19.70	1.61
1.80	1.41	7.80	2.57	13.80	4.74	19.80	1.59
1.90	1.41	7.90	2.59	13.90	4.50	19.90	1.55
2.00	1.43	8.00	2.66	14.00	4.35	20.00	1.54
2.10	1.43	8.10	2.78	14.10	4.25	20.10	1.53
2.20	1.46	8.20	2.90	14.20	4.18	20.20	1.53
2.30	1.46	8.30	3.02	14.30	4.08	20.30	1.52
2.40	1.48	8.40	3.14	14.40	4.01	20.40	1.52
2.50	1.48	8.50	3.26	14.50	3.92	20.50	1.50
2.60	1.50	8.60	3.37	14.60	3.85	20.60	1.50
2.70	1.50	8.70	3.49	14.70	3.75	20.70	1.49
2.80	1.53	8.80	3.61	14.80	3.68	20.80	1.49
2.90	1.53	8.90	3.73	14.90	3.59	20.90	1.48
3.00	1.55	9.00	3.79	15.00	3.52	21.00	1.48
3.10	1.55	9.10	3.79	15.10	3.42	21.10	1.47
3.20	1.57	9.20	3.79	15.20	3.35	21.20	1.47

3.30	1.57	9.30	3.79	15.30	3.26	21.30	1.46
3.40	1.60	9.40	3.79	15.40	3.18	21.40	1.46
3.50	1.60	9.50	3.88	15.50	3.09	21.50	1.44
3.60	1.62	9.60	4.07	15.60	3.02	21.60	1.44
3.70	1.62	9.70	4.26	15.70	2.92	21.70	1.43
3.80	1.65	9.80	4.45	15.80	2.85	21.80	1.43
3.90	1.65	9.90	4.64	15.90	2.76	21.90	1.42
4.00	1.67	10.00	4.88	16.00	2.71	22.00	1.42
4.10	1.69	10.10	5.16	16.10	2.68	22.10	1.41
4.20	1.72	10.20	5.45	16.20	2.65	22.20	1.41
4.30	1.74	10.30	5.73	16.30	2.62	22.30	1.40
4.40	1.76	10.40	6.01	16.40	2.59	22.40	1.40
4.50	1.79	10.50	6.39	16.50	2.56	22.50	1.39
4.60	1.81	10.60	6.87	16.60	2.53	22.60	1.39
4.70	1.84	10.70	7.34	16.70	2.50	22.70	1.37
4.80	1.86	10.80	7.81	16.80	2.47	22.80	1.37
4.90	1.88	10.90	8.29	16.90	2.44	22.90	1.36
5.00	1.91	11.00	9.09	17.00	2.42	23.00	1.36
5.10	1.93	11.10	10.23	17.10	2.38	23.10	1.35
5.20	1.95	11.20	11.37	17.20	2.36	23.20	1.35
5.30	1.98	11.30	12.50	17.30	2.32	23.30	1.34
5.40	2.00	11.40	13.64	17.40	2.30	23.40	1.34
5.50	2.02	11.50	28.23	17.50	2.26	23.50	1.33
5.60	2.05	11.60	56.26	17.60	2.24	23.60	1.33
5.70	2.07	11.70	90.49	17.70	2.20	23.70	1.31
5.80	2.10	11.80	162.29	17.80	2.18	23.80	1.31
5.90	2.12	11.90	112.65	17.90	2.14	23.90	1.30

```
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   7.35
|ID= 1 DT= 6.0 min |   Total Imp(%)=  44.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.23         4.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     221.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     162.29        45.85
               over (min)         6.00        18.00
     Storage Coeff.  (min)=       3.39 (ii)   13.03 (ii)
     Unit Hyd. Tpeak (min)=       6.00        18.00
     Unit Hyd. peak  (cms)=       0.23         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.34         0.32         1.491 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.10         11.90
```

```
     RUNOFF VOLUME    (mm)=     117.40        34.04          70.72
     TOTAL RAINFALL   (mm)=     118.40       118.40         118.40
     RUNOFF COEFFICIENT   =       0.99         0.29           0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     162.29        45.85
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.81 (ii)    3.74 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.23
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.66         0.00          1.669 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     117.40        34.04         116.57
     TOTAL RAINFALL   (mm)=     118.40       118.40         118.40
     RUNOFF COEFFICIENT   =       0.99         0.29           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
```

```
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
-------------------       (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.67     11.90  116.57
     ================================================
     MAJOR SYS.(ID= 2):   0.25      0.59     11.90  116.57
     MINOR SYS.(ID= 3):   3.70      1.08     11.90  116.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1842
                          0.0320     0.1490   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.704      1.076     11.90     116.57
   OUTFLOW: ID= 1 (  0018)      3.072      0.088     12.00     116.21
   OVERFLOW:ID= 3 (  0003)      0.632      0.988     12.00     116.21

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                  TIME SHIFT OF PEAK FLOW         (min)=  6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1842

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

-------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.63   0.988    12.00   116.21
      + ID2= 2 (  0002):     7.35   1.491    11.90    70.72
        ================================================
        ID = 3 (  0013):     7.98   2.306    12.00    74.32

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

-------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 3 (  0013):     7.98   2.306    12.00    74.32
      + ID2= 2 (  0022):     0.25   0.593    11.90   116.57
        ================================================
        ID = 1 (  0013):     8.23   2.511    12.00    75.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.2621
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.228      2.511     12.00      75.58
   OUTFLOW: ID= 1 (  0004)      8.228      0.470     12.30      75.58

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.70
                  TIME SHIFT OF PEAK FLOW         (min)= 18.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3058

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     162.29        45.85
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.39 (ii)    4.82 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.20
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.01          0.144 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     117.40        34.04          99.89
     TOTAL RAINFALL   (mm)=     118.40       118.40         118.40
     RUNOFF COEFFICIENT   =       0.99         0.29           0.84
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     162.29        45.85
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.84 (ii)    2.77 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.42         0.00          0.422 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     117.40        34.04         116.57
     TOTAL RAINFALL   (mm)=     118.40       118.40         118.40
     RUNOFF COEFFICIENT   =       0.99         0.29           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.422    11.90   116.57
      + ID2= 2 (  0003):     0.38   0.144    11.90    99.89
```

```
        ================================================
        ID = 3 (  0014):     1.34   0.566    11.90   111.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0910      0.0722
                          0.0140     0.0448   |   0.0920      0.0797
                          0.0470     0.0547   |   0.1090      0.0874
                          0.0560     0.0631   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.566     11.90     111.84
   OUTFLOW: ID= 1 (  0005)      1.340      0.092     12.10     111.24

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.26
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0797

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     162.29        45.85
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       2.27 (ii)   11.91 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.26         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.26         0.11          0.331 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=     117.40        34.04          59.88
     TOTAL RAINFALL   (mm)=     118.40       118.40         118.40
     RUNOFF COEFFICIENT   =       0.99         0.29           0.51

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.07   0.088    12.00   116.21
      + ID2= 2 (  0004):     8.23   0.470    12.30    75.58
        ================================================
        ID = 3 (  0008):    11.30   0.558    12.30    86.63

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.558    12.30    86.63
      + ID2= 2 (  0005):     1.34   0.092    12.10   111.24
        ================================================
        ID = 1 (  0008):    12.64   0.649    12.30    89.24

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.649    12.30    89.24
      + ID2= 2 (  0007):     1.92   0.331    11.90    59.88
        ================================================
        ID = 3 (  0008):    14.56   0.838    12.00    85.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32
```

```
     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.839 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  34.020
     TOTAL RAINFALL   (mm)= 118.400
     RUNOFF COEFFICIENT   =   0.287

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

--------------------------------------------------------------------------------
================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\83
116756-50e0-4c85-be8a-d7f040a44628\sc
  Summary filename:
C:\Users\krothwell\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\83
116756-50e0-4c85-be8a-d7f040a44628\sc


DATE: 05-12-2022                          TIME: 08:09:48

USER:



COMMENTS: _____________________________________________________________
```

```
--------------------------------------------------------------------------------
------------------------
  ********************************************
  ** SIMULATION : 5yr24hrSCS2010              **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\krothwell\AppD
|                  |              ata\Local\Temp\
|                  |              0dab1f30-2e98-484a-ba61-e3579c7a4b1b\e0a4cfc9
| Ptotal= 78.30 mm |    Comments: 5yr24hrSCS2010
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.79	6.00	1.42	12.00	14.85	18.00	1.40
0.10	0.79	6.10	1.43	12.10	13.06	18.10	1.38
0.20	0.81	6.20	1.45	12.20	11.28	18.20	1.36
0.30	0.81	6.30	1.46	12.30	9.49	18.30	1.34
0.40	0.82	6.40	1.48	12.40	7.70	18.40	1.32
0.50	0.82	6.50	1.50	12.50	6.61	18.50	1.30
0.60	0.84	6.60	1.51	12.60	6.20	18.60	1.28
0.70	0.84	6.70	1.53	12.70	5.79	18.70	1.26
0.80	0.85	6.80	1.54	12.80	5.39	18.80	1.24
0.90	0.85	6.90	1.56	12.90	4.98	18.90	1.22
1.00	0.87	7.00	1.57	13.00	4.67	19.00	1.21
1.10	0.87	7.10	1.59	13.10	4.45	19.10	1.18
1.20	0.88	7.20	1.61	13.20	4.23	19.20	1.17
1.30	0.88	7.30	1.62	13.30	4.01	19.30	1.14
1.40	0.90	7.40	1.64	13.40	3.79	19.40	1.13
1.50	0.90	7.50	1.65	13.50	3.60	19.50	1.10
1.60	0.92	7.60	1.67	13.60	3.45	19.60	1.09
1.70	0.92	7.70	1.68	13.70	3.29	19.70	1.06
1.80	0.93	7.80	1.70	13.80	3.13	19.80	1.05
1.90	0.93	7.90	1.71	13.90	2.98	19.90	1.03
2.00	0.95	8.00	1.76	14.00	2.87	20.00	1.02
2.10	0.95	8.10	1.84	14.10	2.81	20.10	1.01
2.20	0.96	8.20	1.92	14.20	2.76	20.20	1.01
2.30	0.96	8.30	2.00	14.30	2.70	20.30	1.00
2.40	0.98	8.40	2.07	14.40	2.65	20.40	1.00
2.50	0.98	8.50	2.15	14.50	2.59	20.50	0.99
2.60	0.99	8.60	2.23	14.60	2.54	20.60	0.99
2.70	0.99	8.70	2.31	14.70	2.48	20.70	0.99
2.80	1.01	8.80	2.39	14.80	2.44	20.80	0.99
2.90	1.01	8.90	2.47	14.90	2.37	20.90	0.98
3.00	1.03	9.00	2.51	15.00	2.33	21.00	0.98
3.10	1.03	9.10	2.51	15.10	2.26	21.10	0.97
3.20	1.04	9.20	2.51	15.20	2.22	21.20	0.97
3.30	1.04	9.30	2.51	15.30	2.15	21.30	0.96

3.40	1.06	9.40	2.51	15.40	2.11	21.40	0.96
3.50	1.06	9.50	2.57	15.50	2.04	21.50	0.96
3.60	1.07	9.60	2.69	15.60	2.00	21.60	0.96
3.70	1.07	9.70	2.82	15.70	1.93	21.70	0.95
3.80	1.09	9.80	2.94	15.80	1.89	21.80	0.95
3.90	1.09	9.90	3.07	15.90	1.82	21.90	0.94
4.00	1.10	10.00	3.23	16.00	1.79	22.00	0.94
4.10	1.12	10.10	3.41	16.10	1.77	22.10	0.93
4.20	1.14	10.20	3.60	16.20	1.75	22.20	0.93
4.30	1.15	10.30	3.79	16.30	1.73	22.30	0.92
4.40	1.17	10.40	3.98	16.40	1.71	22.40	0.92
4.50	1.18	10.50	4.23	16.50	1.69	22.50	0.92
4.60	1.20	10.60	4.54	16.60	1.68	22.60	0.92
4.70	1.21	10.70	4.85	16.70	1.65	22.70	0.91
4.80	1.23	10.80	5.17	16.80	1.64	22.80	0.91
4.90	1.24	10.90	5.48	16.90	1.61	22.90	0.90
5.00	1.26	11.00	6.01	17.00	1.60	23.00	0.90
5.10	1.28	11.10	6.77	17.10	1.57	23.10	0.89
5.20	1.29	11.20	7.52	17.20	1.56	23.20	0.89
5.30	1.31	11.30	8.27	17.30	1.53	23.30	0.88
5.40	1.32	11.40	9.02	17.40	1.52	23.40	0.88
5.50	1.34	11.50	18.67	17.50	1.50	23.50	0.88
5.60	1.35	11.60	37.21	17.60	1.48	23.60	0.88
5.70	1.37	11.70	59.84	17.70	1.46	23.70	0.87
5.80	1.39	11.80	107.33	17.80	1.44	23.80	0.87
5.90	1.40	11.90	74.49	17.90	1.42	23.90	0.86

```
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   7.35
|ID= 1 DT= 6.0 min |   Total Imp(%)=  44.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.23         4.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     221.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     107.33        17.56
               over (min)         6.00        24.00
     Storage Coeff.  (min)=       4.00 (ii)   18.15 (ii)
     Unit Hyd. Tpeak (min)=       6.00        24.00
     Unit Hyd. peak  (cms)=       0.22         0.06
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.86         0.12          0.900 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.20          11.90
     RUNOFF VOLUME    (mm)=      77.30        15.91          42.92
```

```
     TOTAL RAINFALL   (mm)=      78.30        78.30          78.30
     RUNOFF COEFFICIENT   =       0.99         0.20           0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     107.33        21.27
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       3.32 (ii)    4.41 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.24         0.21
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.07         0.00           1.076 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      77.30        15.91          76.69
     TOTAL RAINFALL   (mm)=      78.30        78.30          78.30
     RUNOFF COEFFICIENT   =       0.99         0.20           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
```

```
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.08     11.90   76.69
     ================================================
     MAJOR SYS.(ID= 2):   0.00      0.00      0.00    0.00
     MINOR SYS.(ID= 3):   3.95      1.08     11.90   76.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1842
                          0.0320     0.1490   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.950      1.076     11.90      76.69
   OUTFLOW: ID= 1 (  0018)      3.950      0.088     12.50      76.39
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

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

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                    TIME SHIFT OF PEAK FLOW         (min)= 36.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1842

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0018 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0013 = HYDROGRAPH 0002
        ID1= 1 (  0018):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0002):     7.35   0.900    11.90    42.92
        ================================================
        ID = 3 (  0013):     7.35   0.900    11.90    42.92

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0022 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0013):     7.35   0.900    11.90    42.92
      + ID2= 2 (  0022):     0.00   0.000     0.00     0.00
        ================================================
        ID = 1 (  0013):     7.35   0.900    11.90    42.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.2621
                          0.0600     0.1185   |   0.4700      0.3058
                          0.1680     0.1480   |   0.5790      0.3652
                          0.2480     0.1991   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.350      0.900     11.90      42.92
   OUTFLOW: ID= 1 (  0004)      7.350      0.167     12.50      42.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.56
                  TIME SHIFT OF PEAK FLOW         (min)= 36.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1480

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     107.33        21.27
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.64 (ii)    5.68 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.18
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.00          0.092 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
```

```
     RUNOFF VOLUME    (mm)=      77.30        15.91          64.40
     TOTAL RAINFALL   (mm)=      78.30        78.30          78.30
     RUNOFF COEFFICIENT   =       0.99         0.20           0.82

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n             =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=     107.33        21.27
               over (min)        6.00         6.00
     Storage Coeff.  (min)=       2.17 (ii)    3.26 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.24
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.28         0.00           0.276 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      77.30        15.91          76.69
     TOTAL RAINFALL   (mm)=      78.30        78.30          78.30
     RUNOFF COEFFICIENT   =       0.99         0.20           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.276    11.90    76.69
      + ID2= 2 (  0003):     0.38   0.092    11.90    64.40
        ================================================
        ID = 3 (  0014):     1.34   0.368    11.90    73.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.0910      0.0722
                           0.0140     0.0448   |   0.0920      0.0797
                           0.0470     0.0547   |   0.1090      0.0874
                           0.0560     0.0631   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.368     11.90      73.20
   OUTFLOW: ID= 1 (  0005)      1.340      0.047     12.20      72.60

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.74
                  TIME SHIFT OF PEAK FLOW         (min)= 18.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0547

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     107.33        17.56
               over (min)         6.00        18.00
     Storage Coeff.  (min)=       2.67 (ii)   16.83 (ii)
     Unit Hyd. Tpeak (min)=       6.00        18.00
     Unit Hyd. peak  (cms)=       0.25         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.04          0.188 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.10          11.90
     RUNOFF VOLUME    (mm)=      77.30        15.91          34.94
     TOTAL RAINFALL   (mm)=      78.30        78.30          78.30
```

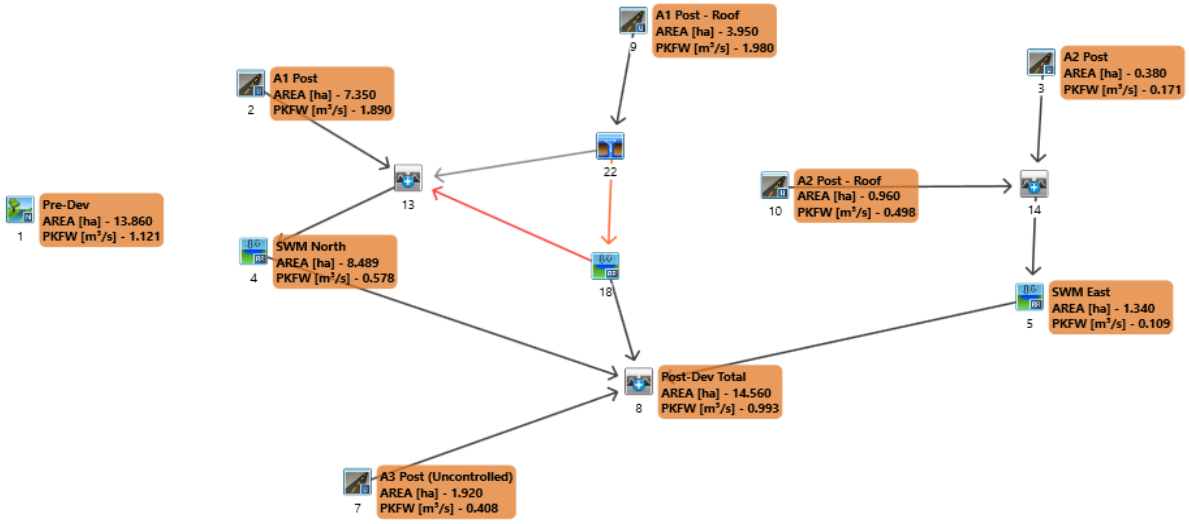
```
     RUNOFF COEFFICIENT   =       0.99         0.20          0.45

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.95   0.088    12.50    76.39
      + ID2= 2 (  0004):     7.35   0.167    12.50    42.92
        ================================================
        ID = 3 (  0008):    11.30   0.255    12.50    54.62

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.255    12.50    54.62
      + ID2= 2 (  0005):     1.34   0.047    12.20    72.60
        ================================================
        ID = 1 (  0008):    12.64   0.300    12.40    56.53

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.300    12.40    56.53
      + ID2= 2 (  0007):     1.92   0.188    11.90    34.94
        ================================================
        ID = 3 (  0008):    14.56   0.345    12.30    53.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
```

```
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.385 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  15.902
     TOTAL RAINFALL   (mm)=  78.300
     RUNOFF COEFFICIENT   =   0.203

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

--------------------------------------------------------------------------------
```

URBANTECH®

2072 MTO STORMS VO MODEL OUTPUT			
Project Name:	5525 8th Line (Empire, Erin)	Prepared by:	DL
Municipality:	Town of Erin	Checked by:	KR
Project No.:	21-684	Submission:	1
Date:	12/05/2022		

2072 MTO STORMS VO MODEL OUTPUT SCHEMATIC



Urbantech® Consulting, A Division of Leighton-Zec Ltd. | 3760 14th Avenue, Suite 301 · Markham · ON · L3R 3T7 | 905.946.9461
urbantech.com

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================================================================================
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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\bca14de5
-05cb-45a0-940f-c90b6e90f60c\scenario
  Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\bca14de5
-05cb-45a0-940f-c90b6e90f60c\scenario


DATE: 05-12-2022                          TIME: 09:41:37

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : 100yr24hrSCS2072             **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dli\AppData\
|                  |              Local\Temp\
```

| | 4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\34c55c47
| Ptotal=139.20 mm | Comments: 100yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.41	6.00	2.52	12.00	26.39	18.00	2.49
0.10	1.41	6.10	2.55	12.10	23.22	18.10	2.45
0.20	1.43	6.20	2.58	12.20	20.04	18.20	2.42
0.30	1.43	6.30	2.60	12.30	16.87	18.30	2.38
0.40	1.46	6.40	2.63	12.40	13.70	18.40	2.35
0.50	1.46	6.50	2.66	12.50	11.75	18.50	2.31
0.60	1.49	6.60	2.69	12.60	11.02	18.60	2.28
0.70	1.49	6.70	2.71	12.70	10.30	18.70	2.24
0.80	1.52	6.80	2.74	12.80	9.58	18.80	2.21
0.90	1.52	6.90	2.77	12.90	8.85	18.90	2.17
1.00	1.55	7.00	2.80	13.00	8.30	19.00	2.14
1.10	1.55	7.10	2.83	13.10	7.91	19.10	2.10
1.20	1.57	7.20	2.85	13.20	7.52	19.20	2.07
1.30	1.57	7.30	2.88	13.30	7.13	19.30	2.03
1.40	1.60	7.40	2.91	13.40	6.74	19.40	2.00
1.50	1.60	7.50	2.94	13.50	6.40	19.50	1.96
1.60	1.63	7.60	2.96	13.60	6.12	19.60	1.93
1.70	1.63	7.70	2.99	13.70	5.85	19.70	1.89
1.80	1.66	7.80	3.02	13.80	5.57	19.80	1.87
1.90	1.66	7.90	3.05	13.90	5.29	19.90	1.82
2.00	1.68	8.00	3.13	14.00	5.11	20.00	1.81
2.10	1.68	8.10	3.27	14.10	5.00	20.10	1.80
2.20	1.71	8.20	3.41	14.20	4.91	20.20	1.80
2.30	1.71	8.30	3.55	14.30	4.80	20.30	1.78
2.40	1.74	8.40	3.69	14.40	4.72	20.40	1.78
2.50	1.74	8.50	3.83	14.50	4.61	20.50	1.77
2.60	1.77	8.60	3.97	14.60	4.52	20.60	1.77
2.70	1.77	8.70	4.11	14.70	4.41	20.70	1.75
2.80	1.80	8.80	4.25	14.80	4.33	20.80	1.75
2.90	1.80	8.90	4.38	14.90	4.22	20.90	1.74
3.00	1.82	9.00	4.45	15.00	4.13	21.00	1.74
3.10	1.82	9.10	4.45	15.10	4.02	21.10	1.73
3.20	1.85	9.20	4.45	15.20	3.94	21.20	1.73
3.30	1.85	9.30	4.45	15.30	3.83	21.30	1.71
3.40	1.88	9.40	4.45	15.40	3.74	21.40	1.71
3.50	1.88	9.50	4.57	15.50	3.63	21.50	1.70
3.60	1.91	9.60	4.79	15.60	3.55	21.60	1.70
3.70	1.91	9.70	5.01	15.70	3.44	21.70	1.68
3.80	1.93	9.80	5.23	15.80	3.35	21.80	1.68
3.90	1.93	9.90	5.46	15.90	3.24	21.90	1.67
4.00	1.96	10.00	5.74	16.00	3.19	22.00	1.67
4.10	1.99	10.10	6.07	16.10	3.15	22.10	1.66
4.20	2.02	10.20	6.40	16.20	3.12	22.20	1.66
4.30	2.05	10.30	6.74	16.30	3.08	22.30	1.64
4.40	2.07	10.40	7.07	16.40	3.05	22.40	1.64

4.50	2.10	10.50	7.52	16.50	3.01	22.50	1.63
4.60	2.13	10.60	8.07	16.60	2.98	22.60	1.63
4.70	2.16	10.70	8.63	16.70	2.94	22.70	1.61
4.80	2.19	10.80	9.19	16.80	2.91	22.80	1.61
4.90	2.21	10.90	9.74	16.90	2.87	22.90	1.60
5.00	2.24	11.00	10.69	17.00	2.84	23.00	1.60
5.10	2.27	11.10	12.03	17.10	2.80	23.10	1.59
5.20	2.30	11.20	13.36	17.20	2.77	23.20	1.59
5.30	2.32	11.30	14.70	17.30	2.73	23.30	1.57
5.40	2.35	11.40	16.04	17.40	2.70	23.40	1.57
5.50	2.38	11.50	33.19	17.50	2.66	23.50	1.56
5.60	2.41	11.60	66.15	17.60	2.63	23.60	1.56
5.70	2.44	11.70	106.39	17.70	2.59	23.70	1.55
5.80	2.46	11.80	190.80	17.80	2.56	23.80	1.55
5.90	2.49	11.90	132.43	17.90	2.52	23.90	1.53

CALIB STANDHYD (0002) ID= 1 DT= 6.0 min	Area (ha)= 7.35 Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		190.80	61.03	
over (min)		6.00	12.00	
Storage Coeff. (min)=		3.18 (ii)	11.78 (ii)	
Unit Hyd. Tpeak (min)=		6.00	12.00	
Unit Hyd. peak (cms)=		0.24	0.09	
			TOTALS	
PEAK FLOW	(cms)=	1.59	0.46	1.890 (iii)
TIME TO PEAK	(hrs)=	11.90	12.00	11.90
RUNOFF VOLUME	(mm)=	138.20	45.19	86.11
TOTAL RAINFALL	(mm)=	139.20	139.20	139.20
RUNOFF COEFFICIENT	=	0.99	0.32	0.62

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     190.80        61.03
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.64 (ii)    3.51 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.97         0.01          1.980 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     138.20        45.19         137.27
     TOTAL RAINFALL   (mm)=     139.20       139.20         139.20
     RUNOFF COEFFICIENT   =       0.99         0.32           0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.98     11.90  137.27
     ==================================================
     MAJOR SYS.(ID= 2):   0.36      0.90     11.90  137.27
     MINOR SYS.(ID= 3):   3.59      1.08     11.80  137.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
```

```
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0880      0.1914
                         0.0320     0.1737   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.593      1.076     11.80     137.27
   OUTFLOW: ID= 1 (  0018)      2.811      0.088     11.90     136.86
   OVERFLOW:ID= 3 (  0003)      0.782      0.988     11.90     136.86

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

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                    TIME SHIFT OF PEAK FLOW         (min)=  6.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1914

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.78   0.988    11.90   136.86
      + ID2= 2 (  0002):     7.35   1.890    11.90    86.11
        ================================================
        ID = 3 (  0013):     8.13   2.878    11.90    90.99

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     8.13   2.878    11.90    90.99
      + ID2= 2 (  0022):     0.36   0.904    11.90   137.27
        ================================================
        ID = 1 (  0013):     8.49   3.782    11.90    92.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                          0.0000     0.0000   |   0.4070      0.3116
                          0.0600     0.1442   |   0.4700      0.3829
                          0.1680     0.1966   |   0.5790      0.4158
                          0.2480     0.2802   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.489      3.782     11.90      92.94
   OUTFLOW: ID= 1 (  0004)      8.489      0.578     12.30      92.94

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.28
                  TIME SHIFT OF PEAK FLOW         (min)= 24.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.4158

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     190.80        61.03
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.31 (ii)    4.52 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.21
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.01          0.171 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     138.20        45.19         118.66
     TOTAL RAINFALL   (mm)=     139.20       139.20         139.20
     RUNOFF COEFFICIENT   =       0.99         0.32           0.85

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     190.80        61.03
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.73 (ii)    2.59 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.50         0.00          0.498 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90         11.90
     RUNOFF VOLUME    (mm)=     138.20        45.19        137.27
     TOTAL RAINFALL   (mm)=     139.20       139.20        139.20
     RUNOFF COEFFICIENT   =       0.99         0.32          0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.498    11.90   137.27
      + ID2= 2 (  0003):     0.38   0.171    11.90   118.66
        ================================================
        ID = 3 (  0014):     1.34   0.669    11.90   131.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0910      0.0802
                          0.0140     0.0524   |   0.0920      0.0880
```

```
                          0.0470     0.0621   |   0.1090      0.0963
                          0.0560     0.0719   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.669     11.90     131.99
   OUTFLOW: ID= 1 (  0005)      1.340      0.109     12.10     131.29

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.26
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0963

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     190.80        61.03
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       2.12 (ii)   10.72 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.27         0.10
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.31         0.16          0.408 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=     138.20        45.19          74.02
     TOTAL RAINFALL   (mm)=     139.20       139.20         139.20
     RUNOFF COEFFICIENT   =       0.99         0.32           0.53

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     2.81   0.088    11.90   136.86
      + ID2= 2 (  0004):     8.49   0.578    12.30    92.94
        ================================================
        ID = 3 (  0008):    11.30   0.666    12.30   103.86

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.666    12.30   103.86
      + ID2= 2 (  0005):     1.34   0.109    12.10   131.29
        ================================================
        ID = 1 (  0008):    12.64   0.772    12.30   106.77

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.772    12.30   106.77
      + ID2= 2 (  0007):     1.92   0.408    11.90    74.02
        ================================================
        ID = 3 (  0008):    14.56   0.993    12.00   102.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   1.121 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  45.158
     TOTAL RAINFALL   (mm)= 139.200
     RUNOFF COEFFICIENT   =   0.324

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

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FINISH

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\35251434
-9354-4bdc-9c58-c4b381b370f8\scenario
  Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\35251434
-9354-4bdc-9c58-c4b381b370f8\scenario


DATE: 05-12-2022                          TIME: 09:41:35

USER:



COMMENTS: _____________________________________________________________


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  ********************************************
  ** SIMULATION : 10yr24hrSCS2072            **
  ********************************************
```

READ STORM	Filename: C:\Users\dli\AppData\Local\Temp\4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\f40950b1
Ptotal=100.80 mm	Comments: 10yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.02	6.00	1.82	12.00	19.11	18.00	1.80
0.10	1.02	6.10	1.84	12.10	16.81	18.10	1.77
0.20	1.04	6.20	1.86	12.20	14.52	18.20	1.75
0.30	1.04	6.30	1.88	12.30	12.22	18.30	1.72
0.40	1.06	6.40	1.91	12.40	9.92	18.40	1.70
0.50	1.06	6.50	1.93	12.50	8.51	18.50	1.67
0.60	1.08	6.60	1.95	12.60	7.98	18.60	1.65
0.70	1.08	6.70	1.97	12.70	7.46	18.70	1.62
0.80	1.10	6.80	1.99	12.80	6.94	18.80	1.60
0.90	1.10	6.90	2.01	12.90	6.41	18.90	1.57
1.00	1.12	7.00	2.03	13.00	6.01	19.00	1.55
1.10	1.12	7.10	2.05	13.10	5.73	19.10	1.52
1.20	1.14	7.20	2.07	13.20	5.44	19.20	1.50
1.30	1.14	7.30	2.09	13.30	5.16	19.30	1.47
1.40	1.16	7.40	2.11	13.40	4.88	19.40	1.45
1.50	1.16	7.50	2.13	13.50	4.64	19.50	1.42
1.60	1.18	7.60	2.15	13.60	4.44	19.60	1.40
1.70	1.18	7.70	2.17	13.70	4.23	19.70	1.37
1.80	1.20	7.80	2.19	13.80	4.03	19.80	1.35
1.90	1.20	7.90	2.21	13.90	3.83	19.90	1.32
2.00	1.22	8.00	2.27	14.00	3.70	20.00	1.31
2.10	1.22	8.10	2.37	14.10	3.62	20.10	1.30
2.20	1.24	8.20	2.47	14.20	3.56	20.20	1.30
2.30	1.24	8.30	2.57	14.30	3.48	20.30	1.29
2.40	1.26	8.40	2.67	14.40	3.42	20.40	1.29
2.50	1.26	8.50	2.77	14.50	3.34	20.50	1.28
2.60	1.28	8.60	2.87	14.60	3.28	20.60	1.28
2.70	1.28	8.70	2.97	14.70	3.20	20.70	1.27
2.80	1.30	8.80	3.07	14.80	3.13	20.80	1.27
2.90	1.30	8.90	3.18	14.90	3.05	20.90	1.26
3.00	1.32	9.00	3.23	15.00	2.99	21.00	1.26
3.10	1.32	9.10	3.23	15.10	2.91	21.10	1.25
3.20	1.34	9.20	3.23	15.20	2.85	21.20	1.25
3.30	1.34	9.30	3.23	15.30	2.77	21.30	1.24
3.40	1.36	9.40	3.23	15.40	2.71	21.40	1.24
3.50	1.36	9.50	3.31	15.50	2.63	21.50	1.23
3.60	1.38	9.60	3.47	15.60	2.57	21.60	1.23
3.70	1.38	9.70	3.63	15.70	2.49	21.70	1.22
3.80	1.40	9.80	3.79	15.80	2.43	21.80	1.22
3.90	1.40	9.90	3.95	15.90	2.35	21.90	1.21
4.00	1.42	10.00	4.15	16.00	2.31	22.00	1.21

4.10	1.44	10.10	4.39	16.10	2.28	22.10	1.20
4.20	1.46	10.20	4.64	16.20	2.26	22.20	1.20
4.30	1.48	10.30	4.88	16.30	2.23	22.30	1.19
4.40	1.50	10.40	5.12	16.40	2.21	22.40	1.19
4.50	1.52	10.50	5.44	16.50	2.18	22.50	1.18
4.60	1.54	10.60	5.85	16.60	2.16	22.60	1.18
4.70	1.56	10.70	6.25	16.70	2.13	22.70	1.17
4.80	1.58	10.80	6.65	16.80	2.11	22.80	1.17
4.90	1.60	10.90	7.06	16.90	2.08	22.90	1.16
5.00	1.62	11.00	7.74	17.00	2.06	23.00	1.16
5.10	1.64	11.10	8.71	17.10	2.03	23.10	1.15
5.20	1.66	11.20	9.68	17.20	2.01	23.20	1.15
5.30	1.68	11.30	10.64	17.30	1.98	23.30	1.14
5.40	1.70	11.40	11.61	17.40	1.96	23.40	1.14
5.50	1.72	11.50	24.03	17.50	1.93	23.50	1.13
5.60	1.74	11.60	47.90	17.60	1.91	23.60	1.13
5.70	1.76	11.70	77.04	17.70	1.87	23.70	1.12
5.80	1.78	11.80	138.17	17.80	1.85	23.80	1.12
5.90	1.80	11.90	95.90	17.90	1.82	23.90	1.11

CALIB	
STANDHYD (0002)	Area (ha)= 7.35
ID= 1 DT= 6.0 min	Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		138.17	34.22	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.62 (ii)	14.45 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.23	0.07	
			TOTALS	
PEAK FLOW	(cms)=	1.13	0.22	1.233 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	99.80	25.48	58.18
TOTAL RAINFALL	(mm)=	100.80	100.80	100.80
RUNOFF COEFFICIENT	=	0.99	0.25	0.58

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 Ia = Dep. Storage (Above)

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

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--------------------
| CALIB            |
| STANDHYD (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.17        34.22
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       3.00 (ii)    3.99 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.24         0.22
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.40         0.00          1.408 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      99.80        25.48          99.06
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.99         0.25           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.41     11.90   99.06
     ==================================================
     MAJOR SYS.(ID= 2):   0.13      0.33     11.90   99.06
     MINOR SYS.(ID= 3):   3.82      1.08     11.90   99.06

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

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--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1914
                          0.0320     0.1737   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.823      1.076     11.90      99.06
   OUTFLOW: ID= 1 (  0018)      3.181      0.088     12.00     106.12
   OVERFLOW:ID= 3 (  0003)      0.642      1.378     12.00     106.12

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                  TIME SHIFT OF PEAK FLOW         (min)=  6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1914

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.64   1.378    12.00   106.12
      + ID2= 2 (  0002):     7.35   1.233    11.90    58.18
        ================================================
        ID = 3 (  0013):     7.99   2.466    12.00    62.03

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     7.99   2.466    12.00    62.03
      + ID2= 2 (  0022):     0.13   0.332    11.90    99.06
        ================================================
        ID = 1 (  0013):     8.12   2.484    12.00    62.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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```
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.3116
                          0.0600     0.1442   |   0.4700      0.3829
                          0.1680     0.1966   |   0.5790      0.4158
                          0.2480     0.2802   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.119      2.484     12.00      62.61
   OUTFLOW: ID= 1 (  0004)      8.119      0.248     12.50      62.61

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.96
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.2802

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.17        34.22
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.49 (ii)    5.14 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.20
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.01          0.121 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      99.80        25.48          84.19
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.99         0.25           0.84

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.17        34.22
               over (min)        6.00         6.00
     Storage Coeff.  (min)=       1.96 (ii)    2.95 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.36         0.00          0.358 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      99.80        25.48          99.06
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.99         0.25           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.358    11.90    99.06
      + ID2= 2 (  0003):     0.38   0.121    11.90    84.19
        ================================================
        ID = 3 (  0014):     1.34   0.479    11.90    94.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
```

DT= 6.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0910	0.0802
	0.0140	0.0524	0.0920	0.0880
	0.0470	0.0621	0.1090	0.0963
	0.0560	0.0719	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0014)	1.340	0.479	11.90	94.84
OUTFLOW: ID= 1 (0005)	1.340	0.056	12.30	94.13

PEAK FLOW REDUCTION [Qout/Qin](%)= 11.68
TIME SHIFT OF PEAK FLOW (min)= 24.00
MAXIMUM STORAGE USED (ha.m.)= 0.0719

CALIB	
STANDHYD (0007)	Area (ha)= 1.92
ID= 1 DT= 6.0 min	Total Imp(%)= 31.00 Dir. Conn.(%)= 31.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.60	1.32	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	113.14	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		138.17	34.22	
over (min)		6.00	18.00	
Storage Coeff. (min)=		2.42 (ii)	13.26 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.26	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.22	0.07	0.256 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	99.80	25.48	48.52
TOTAL RAINFALL	(mm)=	100.80	100.80	100.80
RUNOFF COEFFICIENT	=	0.99	0.25	0.48

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.18   0.088    12.00   106.12
      + ID2= 2 (  0004):     8.12   0.248    12.50    62.61
        ================================================
        ID = 3 (  0008):    11.30   0.336    12.50    74.86

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.336    12.50    74.86
      + ID2= 2 (  0005):     1.34   0.056    12.30    94.13
        ================================================
        ID = 1 (  0008):    12.64   0.391    12.40    76.90

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.391    12.40    76.90
      + ID2= 2 (  0007):     1.92   0.256    11.90    48.52
        ================================================
        ID = 3 (  0008):    14.56   0.534    12.00    73.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.623 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  25.466
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.253
```

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

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```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       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
```


***** 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\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\790e33c5-e84a-4872-89fa-b34397781da2\scenario
Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\790e33c5-e84a-4872-89fa-b34397781da2\scenario

DATE: 05-12-2022 TIME: 09:41:36

USER:

COMMENTS: _____


```
  **********************************************
  ** SIMULATION : 25yr24hrSCS2072               **
  **********************************************
```

READ STORM	Filename: C:\Users\dli\AppData\Local\Temp\4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\aeb299fe
Ptotal=115.20 mm	Comments: 25yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.16	6.00	2.09	12.00	21.84	18.00	2.06
0.10	1.16	6.10	2.11	12.10	19.22	18.10	2.03
0.20	1.19	6.20	2.13	12.20	16.59	18.20	2.00
0.30	1.19	6.30	2.15	12.30	13.96	18.30	1.97
0.40	1.21	6.40	2.18	12.40	11.34	18.40	1.95
0.50	1.21	6.50	2.20	12.50	9.72	18.50	1.91
0.60	1.23	6.60	2.22	12.60	9.12	18.60	1.89
0.70	1.23	6.70	2.25	12.70	8.52	18.70	1.85
0.80	1.26	6.80	2.27	12.80	7.93	18.80	1.83
0.90	1.26	6.90	2.29	12.90	7.33	18.90	1.80
1.00	1.28	7.00	2.32	13.00	6.87	19.00	1.77
1.10	1.28	7.10	2.34	13.10	6.54	19.10	1.74
1.20	1.30	7.20	2.36	13.20	6.22	19.20	1.72
1.30	1.30	7.30	2.38	13.30	5.90	19.30	1.68
1.40	1.32	7.40	2.41	13.40	5.58	19.40	1.66
1.50	1.32	7.50	2.43	13.50	5.30	19.50	1.62
1.60	1.35	7.60	2.45	13.60	5.07	19.60	1.60
1.70	1.35	7.70	2.48	13.70	4.84	19.70	1.57
1.80	1.37	7.80	2.50	13.80	4.61	19.80	1.54
1.90	1.37	7.90	2.52	13.90	4.38	19.90	1.51
2.00	1.39	8.00	2.59	14.00	4.23	20.00	1.50
2.10	1.39	8.10	2.71	14.10	4.14	20.10	1.49
2.20	1.42	8.20	2.82	14.20	4.07	20.20	1.49
2.30	1.42	8.30	2.94	14.30	3.97	20.30	1.47
2.40	1.44	8.40	3.05	14.40	3.91	20.40	1.47
2.50	1.44	8.50	3.17	14.50	3.81	20.50	1.46
2.60	1.46	8.60	3.28	14.60	3.74	20.60	1.46
2.70	1.46	8.70	3.40	14.70	3.65	20.70	1.45
2.80	1.49	8.80	3.51	14.80	3.58	20.80	1.45
2.90	1.49	8.90	3.63	14.90	3.49	20.90	1.44
3.00	1.51	9.00	3.69	15.00	3.42	21.00	1.44
3.10	1.51	9.10	3.69	15.10	3.33	21.10	1.43
3.20	1.53	9.20	3.69	15.20	3.26	21.20	1.43
3.30	1.53	9.30	3.69	15.30	3.17	21.30	1.42
3.40	1.56	9.40	3.69	15.40	3.10	21.40	1.42
3.50	1.56	9.50	3.78	15.50	3.01	21.50	1.41
3.60	1.58	9.60	3.96	15.60	2.94	21.60	1.41
3.70	1.58	9.70	4.15	15.70	2.85	21.70	1.39
3.80	1.60	9.80	4.33	15.80	2.78	21.80	1.39
3.90	1.60	9.90	4.52	15.90	2.68	21.90	1.38
4.00	1.62	10.00	4.75	16.00	2.64	22.00	1.38
4.10	1.65	10.10	5.02	16.10	2.60	22.10	1.37

4.20	1.67	10.20	5.30	16.20	2.58	22.20	1.37
4.30	1.69	10.30	5.58	16.30	2.55	22.30	1.36
4.40	1.72	10.40	5.85	16.40	2.52	22.40	1.36
4.50	1.74	10.50	6.22	16.50	2.49	22.50	1.35
4.60	1.76	10.60	6.68	16.60	2.47	22.60	1.35
4.70	1.79	10.70	7.14	16.70	2.43	22.70	1.34
4.80	1.81	10.80	7.60	16.80	2.41	22.80	1.34
4.90	1.83	10.90	8.06	16.90	2.37	22.90	1.32
5.00	1.85	11.00	8.85	17.00	2.35	23.00	1.32
5.10	1.88	11.10	9.95	17.10	2.32	23.10	1.31
5.20	1.90	11.20	11.06	17.20	2.29	23.20	1.31
5.30	1.92	11.30	12.17	17.30	2.26	23.30	1.30
5.40	1.95	11.40	13.27	17.40	2.23	23.40	1.30
5.50	1.97	11.50	27.46	17.50	2.20	23.50	1.29
5.60	1.99	11.60	54.74	17.60	2.18	23.60	1.29
5.70	2.02	11.70	88.05	17.70	2.14	23.70	1.28
5.80	2.04	11.80	157.90	17.80	2.12	23.80	1.28
5.90	2.06	11.90	109.60	17.90	2.09	23.90	1.27

CALIB	
STANDHYD (0002)	Area (ha)= 7.35
ID= 1 DT= 6.0 min	Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		157.90	43.65	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.43 (ii)	13.26 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.23	0.08	
				TOTALS
PEAK FLOW	(cms)=	1.30	0.30	1.444 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	114.20	32.42	68.40
TOTAL RAINFALL	(mm)=	115.20	115.20	115.20
RUNOFF COEFFICIENT	=	0.99	0.28	0.59

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.90        43.65
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.85 (ii)    3.78 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.62         0.00          1.622 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     114.20        32.42         113.38
     TOTAL RAINFALL   (mm)=     115.20       115.20         115.20
     RUNOFF COEFFICIENT   =       0.99         0.28           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.62     11.90  113.38
     ==================================================
     MAJOR SYS.(ID= 2):   0.23      0.55     11.90  113.38
     MINOR SYS.(ID= 3):   3.72      1.08     11.90  113.38

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

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--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1914
                          0.0320     0.1737   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.722      1.076     11.90     113.38
   OUTFLOW: ID= 1 (  0018)      3.147      0.088     12.00     112.93
   OVERFLOW:ID= 3 (  0003)      0.576      0.988     12.00     112.93

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

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                  TIME SHIFT OF PEAK FLOW         (min)=  6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1914

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.58   0.988    12.00   112.93
      + ID2= 2 (  0002):     7.35   1.444    11.90    68.40
        ================================================
        ID = 3 (  0013):     7.93   2.264    12.00    71.64

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     7.93   2.264    12.00    71.64
      + ID2= 2 (  0022):     0.23   0.546    11.90   113.38
        ================================================
        ID = 1 (  0013):     8.15   2.435    12.00    72.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
```

```
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4070      0.3116
                         0.0600     0.1442   |   0.4700      0.3829
                         0.1680     0.1966   |   0.5790      0.4158
                         0.2480     0.2802   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.153      2.435     12.00      72.80
   OUTFLOW: ID= 1 (  0004)      8.153      0.403     12.40      72.80

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.56
                  TIME SHIFT OF PEAK FLOW         (min)= 24.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3116

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.90        43.65
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.41 (ii)    4.87 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.20
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.01          0.140 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=     114.20        32.42          97.02
     TOTAL RAINFALL   (mm)=     115.20       115.20         115.20
     RUNOFF COEFFICIENT   =       0.99         0.28           0.84

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.90        43.65
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.86 (ii)    2.80 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.41         0.00          0.411 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     114.20        32.42         113.38
     TOTAL RAINFALL   (mm)=     115.20       115.20         115.20
     RUNOFF COEFFICIENT   =       0.99         0.28           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.411    11.90   113.38
      + ID2= 2 (  0003):     0.38   0.140    11.90    97.02
        ================================================
        ID = 3 (  0014):     1.34   0.550    11.90   108.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0910      0.0802
                         0.0140     0.0524   |   0.0920      0.0880
                         0.0470     0.0621   |   0.1090      0.0963
                         0.0560     0.0719   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.550     11.90     108.74
   OUTFLOW: ID= 1 (  0005)      1.340      0.091     12.10     108.04

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.52
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0802

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.90        43.65
               over (min)         6.00        18.00
     Storage Coeff.  (min)=       2.29 (ii)   12.12 (ii)
     Unit Hyd. Tpeak (min)=       6.00        18.00
     Unit Hyd. peak  (cms)=       0.26         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.25         0.10          0.301 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.10          11.90
     RUNOFF VOLUME    (mm)=     114.20        32.42          57.77
     TOTAL RAINFALL   (mm)=     115.20       115.20         115.20
     RUNOFF COEFFICIENT   =       0.99         0.28           0.50

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.15   0.088    12.00   112.93
      + ID2= 2 (  0004):     8.15   0.403    12.40    72.80
        ================================================
        ID = 3 (  0008):    11.30   0.491    12.40    83.98

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.491    12.40    83.98
      + ID2= 2 (  0005):     1.34   0.091    12.10   108.04
        ================================================
        ID = 1 (  0008):    12.64   0.575    12.30    86.53

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.575    12.30    86.53
      + ID2= 2 (  0007):     1.92   0.301    11.90    57.77
        ================================================
        ID = 3 (  0008):    14.56   0.674    12.20    82.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.798 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  32.402
     TOTAL RAINFALL   (mm)= 115.200
     RUNOFF COEFFICIENT   =   0.281

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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

  Output  filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\8f3bd9f9
-d72d-48ee-abfc-c886e411b82a\scenario
  Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\8f3bd9f9
-d72d-48ee-abfc-c886e411b82a\scenario


DATE: 05-12-2022                          TIME: 09:41:36

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
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  ********************************************
  ** SIMULATION : 2yr24hrSCS2072             **
  ********************************************


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```

READ STORM	Filename: C:\Users\dli\AppData\Local\Temp\4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\74739abb
Ptotal= 67.20 mm	Comments: 2yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.68	6.00	1.22	12.00	12.74	18.00	1.20
0.10	0.68	6.10	1.23	12.10	11.21	18.10	1.18
0.20	0.69	6.20	1.24	12.20	9.68	18.20	1.17
0.30	0.69	6.30	1.26	12.30	8.14	18.30	1.15
0.40	0.71	6.40	1.27	12.40	6.61	18.40	1.14
0.50	0.71	6.50	1.28	12.50	5.67	18.50	1.12
0.60	0.72	6.60	1.30	12.60	5.32	18.60	1.10
0.70	0.72	6.70	1.31	12.70	4.97	18.70	1.08
0.80	0.73	6.80	1.32	12.80	4.62	18.80	1.07
0.90	0.73	6.90	1.34	12.90	4.27	18.90	1.05
1.00	0.75	7.00	1.35	13.00	4.01	19.00	1.03
1.10	0.75	7.10	1.36	13.10	3.82	19.10	1.01
1.20	0.76	7.20	1.38	13.20	3.63	19.20	1.00
1.30	0.76	7.30	1.39	13.30	3.44	19.30	0.98
1.40	0.77	7.40	1.40	13.40	3.25	19.40	0.97
1.50	0.77	7.50	1.42	13.50	3.09	19.50	0.95
1.60	0.79	7.60	1.43	13.60	2.96	19.60	0.93
1.70	0.79	7.70	1.44	13.70	2.82	19.70	0.91
1.80	0.80	7.80	1.46	13.80	2.69	19.80	0.90
1.90	0.80	7.90	1.47	13.90	2.55	19.90	0.88
2.00	0.81	8.00	1.51	14.00	2.47	20.00	0.87
2.10	0.81	8.10	1.58	14.10	2.41	20.10	0.87
2.20	0.83	8.20	1.65	14.20	2.37	20.20	0.87
2.30	0.83	8.30	1.71	14.30	2.32	20.30	0.86
2.40	0.84	8.40	1.78	14.40	2.28	20.40	0.86
2.50	0.84	8.50	1.85	14.50	2.22	20.50	0.85
2.60	0.85	8.60	1.92	14.60	2.18	20.60	0.85
2.70	0.85	8.70	1.98	14.70	2.13	20.70	0.85
2.80	0.87	8.80	2.05	14.80	2.09	20.80	0.85
2.90	0.87	8.90	2.12	14.90	2.04	20.90	0.84
3.00	0.88	9.00	2.15	15.00	2.00	21.00	0.84
3.10	0.88	9.10	2.15	15.10	1.94	21.10	0.83
3.20	0.89	9.20	2.15	15.20	1.90	21.20	0.83
3.30	0.89	9.30	2.15	15.30	1.85	21.30	0.83
3.40	0.91	9.40	2.15	15.40	1.81	21.40	0.83
3.50	0.91	9.50	2.20	15.50	1.75	21.50	0.82
3.60	0.92	9.60	2.31	15.60	1.71	21.60	0.82
3.70	0.92	9.70	2.42	15.70	1.66	21.70	0.81
3.80	0.93	9.80	2.53	15.80	1.62	21.80	0.81
3.90	0.93	9.90	2.63	15.90	1.57	21.90	0.81
4.00	0.95	10.00	2.77	16.00	1.54	22.00	0.81
4.10	0.96	10.10	2.93	16.10	1.52	22.10	0.80
4.20	0.97	10.20	3.09	16.20	1.51	22.20	0.80

4.30	0.99	10.30	3.25	16.30	1.49	22.30	0.79
4.40	1.00	10.40	3.41	16.40	1.47	22.40	0.79
4.50	1.01	10.50	3.63	16.50	1.45	22.50	0.79
4.60	1.03	10.60	3.90	16.60	1.44	22.60	0.79
4.70	1.04	10.70	4.17	16.70	1.42	22.70	0.78
4.80	1.06	10.80	4.44	16.80	1.40	22.80	0.78
4.90	1.07	10.90	4.70	16.90	1.38	22.90	0.77
5.00	1.08	11.00	5.16	17.00	1.37	23.00	0.77
5.10	1.10	11.10	5.81	17.10	1.35	23.10	0.77
5.20	1.11	11.20	6.45	17.20	1.34	23.20	0.77
5.30	1.12	11.30	7.10	17.30	1.32	23.30	0.76
5.40	1.14	11.40	7.74	17.40	1.30	23.40	0.76
5.50	1.15	11.50	16.02	17.50	1.28	23.50	0.75
5.60	1.16	11.60	31.93	17.60	1.27	23.60	0.75
5.70	1.18	11.70	51.36	17.70	1.25	23.70	0.75
5.80	1.19	11.80	92.11	17.80	1.24	23.80	0.75
5.90	1.20	11.90	63.93	17.90	1.22	23.90	0.74

```
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   7.35
|ID= 1 DT= 6.0 min |   Total Imp(%)=  44.00   Dir. Conn.(%)=  44.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.23         4.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     221.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      92.11        12.99
               over (min)         6.00        24.00
     Storage Coeff.  (min)=       4.25 (ii)   20.22 (ii)
     Unit Hyd. Tpeak (min)=       6.00        24.00
     Unit Hyd. peak  (cms)=       0.21         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.73         0.08          0.755 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.20          11.90
     RUNOFF VOLUME    (mm)=      66.20        11.85          35.76
     TOTAL RAINFALL   (mm)=      67.20        67.20          67.20
     RUNOFF COEFFICIENT   =       0.99         0.18           0.53

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (0009)	Area (ha)=	3.95			
ID= 1 DT= 6.0 min	Total Imp(%)=	99.00	Dir. Conn.(%)=	99.00	
		IMPERVIOUS	PERVIOUS (i)		
Surface Area	(ha)=	3.91	0.04		
Dep. Storage	(mm)=	1.00	5.00		
Average Slope	(%)=	1.00	2.00		
Length	(m)=	162.28	40.00		
Mannings n	=	0.013	0.250		
Max.Eff.Inten.(mm/hr)=		92.11	15.79		
over (min)		6.00	6.00		
Storage Coeff. (min)=		3.53 (ii)	4.69 (ii)		
Unit Hyd. Tpeak (min)=		6.00	6.00		
Unit Hyd. peak (cms)=		0.23	0.20		
				TOTALS	
PEAK FLOW	(cms)=	0.91	0.00	0.913 (iii)	
TIME TO PEAK	(hrs)=	11.90	12.00	11.90	
RUNOFF VOLUME	(mm)=	66.20	11.85	65.66	
TOTAL RAINFALL	(mm)=	67.20	67.20	67.20	
RUNOFF COEFFICIENT	=	0.99	0.18	0.98	

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

DUHYD (0022)				
Inlet Cap.= 1.076				
#of Inlets= 1				
Total(cms)= 1.1	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
TOTAL HYD.(ID= 1):	3.95	0.91	11.90	65.66
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.95	0.91	11.90	65.66

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1914
                          0.0320     0.1737   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.950      0.913     11.90      65.66
   OUTFLOW: ID= 1 (  0018)      3.950      0.032     13.70      65.31
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

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

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.50
                    TIME SHIFT OF PEAK FLOW         (min)=108.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1737

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0018 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0013 = HYDROGRAPH 0002
        ID1= 1 (  0018):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0002):     7.35   0.755    11.90    35.76
        ====================================================
        ID = 3 (  0013):     7.35   0.755    11.90    35.76

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0022 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0013):     7.35   0.755    11.90    35.76
      + ID2= 2 (  0022):     0.00   0.000     0.00     0.00
        ====================================================
        ID = 1 (  0013):     7.35   0.755    11.90    35.76

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

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--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.3116
                          0.0600     0.1442   |   0.4700      0.3829
                          0.1680     0.1966   |   0.5790      0.4158
                          0.2480     0.2802   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.350      0.755     11.90      35.76
   OUTFLOW: ID= 1 (  0004)      7.350      0.060     13.10      35.76

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.96
                  TIME SHIFT OF PEAK FLOW         (min)= 72.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1442

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      92.11        15.79
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       1.75 (ii)    6.04 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.27         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.00          0.078 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      66.20        11.85          54.78
     TOTAL RAINFALL   (mm)=      67.20        67.20          67.20
     RUNOFF COEFFICIENT   =       0.99         0.18           0.82

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      92.11        15.79
               over (min)        6.00         6.00
     Storage Coeff.  (min)=       2.31 (ii)    3.47 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.26         0.23
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.23         0.00          0.235 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      66.20        11.85          65.66
     TOTAL RAINFALL   (mm)=      67.20        67.20          67.20
     RUNOFF COEFFICIENT   =       0.99         0.18           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.235    11.90    65.66
      + ID2= 2 (  0003):     0.38   0.078    11.90    54.78
        ================================================
        ID = 3 (  0014):     1.34   0.313    11.90    62.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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```
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0910      0.0802
                          0.0140     0.0524   |   0.0920      0.0880
                          0.0470     0.0621   |   0.1090      0.0963
                          0.0560     0.0719   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.313     11.90      62.57
   OUTFLOW: ID= 1 (  0005)      1.340      0.014     13.10      61.87

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.48
                  TIME SHIFT OF PEAK FLOW         (min)= 72.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0524

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n             =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      92.11        12.99
               over (min)        6.00        24.00
     Storage Coeff.  (min)=       2.84 (ii)   18.81 (ii)
     Unit Hyd. Tpeak (min)=       6.00        24.00
     Unit Hyd. peak  (cms)=       0.25         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.03          0.154 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.20          11.90
     RUNOFF VOLUME    (mm)=      66.20        11.85          28.69
     TOTAL RAINFALL   (mm)=      67.20        67.20          67.20
     RUNOFF COEFFICIENT   =       0.99         0.18           0.43

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.95   0.032    13.70    65.31
      + ID2= 2 (  0004):     7.35   0.060    13.10    35.76
        ================================================
        ID = 3 (  0008):    11.30   0.092    13.10    46.09

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.092    13.10    46.09
      + ID2= 2 (  0005):     1.34   0.014    13.10    61.87
        ================================================
        ID = 1 (  0008):    12.64   0.106    13.10    47.76

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.106    13.10    47.76
      + ID2= 2 (  0007):     1.92   0.154    11.90    28.69
        ================================================
        ID = 3 (  0008):    14.56   0.215    11.90    45.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.285 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  11.840
     TOTAL RAINFALL   (mm)=  67.200
```

RUNOFF COEFFICIENT = 0.176

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

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       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
```


***** 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\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\77da2433-f7a3-4774-a4c5-94e09cf5b5c8\scenario
Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\77da2433-f7a3-4774-a4c5-94e09cf5b5c8\scenario

DATE: 05-12-2022 TIME: 09:41:35

USER:

COMMENTS: _____

****
** SIMULATION : 50yr24hrSCS2072 **
****

READ STORM	Filename: C:\Users\dli\AppData\Local\Temp\4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\122c671c
Ptotal=127.20 mm	Comments: 50yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.28	6.00	2.30	12.00	24.12	18.00	2.28
0.10	1.28	6.10	2.33	12.10	21.22	18.10	2.24
0.20	1.31	6.20	2.35	12.20	18.32	18.20	2.21
0.30	1.31	6.30	2.38	12.30	15.42	18.30	2.18
0.40	1.34	6.40	2.40	12.40	12.52	18.40	2.15
0.50	1.34	6.50	2.43	12.50	10.74	18.50	2.11
0.60	1.36	6.60	2.45	12.60	10.07	18.60	2.09
0.70	1.36	6.70	2.48	12.70	9.41	18.70	2.05
0.80	1.39	6.80	2.51	12.80	8.75	18.80	2.02
0.90	1.39	6.90	2.53	12.90	8.09	18.90	1.98
1.00	1.41	7.00	2.56	13.00	7.58	19.00	1.96
1.10	1.41	7.10	2.58	13.10	7.22	19.10	1.92
1.20	1.44	7.20	2.61	13.20	6.87	19.20	1.90
1.30	1.44	7.30	2.63	13.30	6.51	19.30	1.86
1.40	1.46	7.40	2.66	13.40	6.16	19.40	1.83
1.50	1.46	7.50	2.68	13.50	5.85	19.50	1.79
1.60	1.49	7.60	2.71	13.60	5.60	19.60	1.77
1.70	1.49	7.70	2.73	13.70	5.34	19.70	1.73
1.80	1.51	7.80	2.76	13.80	5.09	19.80	1.70
1.90	1.51	7.90	2.79	13.90	4.83	19.90	1.67
2.00	1.54	8.00	2.86	14.00	4.67	20.00	1.65
2.10	1.54	8.10	2.99	14.10	4.57	20.10	1.64
2.20	1.56	8.20	3.12	14.20	4.49	20.20	1.64
2.30	1.56	8.30	3.24	14.30	4.39	20.30	1.63
2.40	1.59	8.40	3.37	14.40	4.31	20.40	1.63
2.50	1.59	8.50	3.50	14.50	4.21	20.50	1.62
2.60	1.62	8.60	3.63	14.60	4.13	20.60	1.62
2.70	1.62	8.70	3.75	14.70	4.03	20.70	1.60
2.80	1.64	8.80	3.88	14.80	3.96	20.80	1.60
2.90	1.64	8.90	4.01	14.90	3.85	20.90	1.59
3.00	1.67	9.00	4.07	15.00	3.78	21.00	1.59
3.10	1.67	9.10	4.07	15.10	3.68	21.10	1.58
3.20	1.69	9.20	4.07	15.20	3.60	21.20	1.58
3.30	1.69	9.30	4.07	15.30	3.50	21.30	1.56
3.40	1.72	9.40	4.07	15.40	3.42	21.40	1.56
3.50	1.72	9.50	4.17	15.50	3.32	21.50	1.55
3.60	1.74	9.60	4.38	15.60	3.24	21.60	1.55
3.70	1.74	9.70	4.58	15.70	3.14	21.70	1.54
3.80	1.77	9.80	4.78	15.80	3.07	21.80	1.54
3.90	1.77	9.90	4.99	15.90	2.96	21.90	1.53

4.00	1.79	10.00	5.24	16.00	2.91	22.00	1.53
4.10	1.82	10.10	5.55	16.10	2.87	22.10	1.51
4.20	1.84	10.20	5.85	16.20	2.85	22.20	1.51
4.30	1.87	10.30	6.16	16.30	2.81	22.30	1.50
4.40	1.90	10.40	6.46	16.40	2.79	22.40	1.50
4.50	1.92	10.50	6.87	16.50	2.75	22.50	1.49
4.60	1.95	10.60	7.38	16.60	2.72	22.60	1.49
4.70	1.97	10.70	7.89	16.70	2.68	22.70	1.48
4.80	2.00	10.80	8.40	16.80	2.66	22.80	1.48
4.90	2.02	10.90	8.90	16.90	2.62	22.90	1.46
5.00	2.05	11.00	9.77	17.00	2.59	23.00	1.46
5.10	2.07	11.10	10.99	17.10	2.56	23.10	1.45
5.20	2.10	11.20	12.21	17.20	2.53	23.20	1.45
5.30	2.12	11.30	13.43	17.30	2.49	23.30	1.44
5.40	2.15	11.40	14.65	17.40	2.47	23.40	1.44
5.50	2.18	11.50	30.32	17.50	2.43	23.50	1.42
5.60	2.20	11.60	60.45	17.60	2.40	23.60	1.42
5.70	2.23	11.70	97.22	17.70	2.37	23.70	1.41
5.80	2.25	11.80	174.35	17.80	2.34	23.80	1.41
5.90	2.28	11.90	121.02	17.90	2.30	23.90	1.40

CALIB STANDHYD (0002) ID= 1 DT= 6.0 min	Area (ha)= 7.35 Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	174.35	52.09	
over	(min)	6.00	18.00	
Storage Coeff.	(min)=	3.29 (ii)	12.46 (ii)	
Unit Hyd. Tpeak	(min)=	6.00	18.00	
Unit Hyd. peak	(cms)=	0.24	0.08	
				TOTALS
PEAK FLOW	(cms)=	1.44	0.37	1.624 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	126.20	38.63	77.16
TOTAL RAINFALL	(mm)=	127.20	127.20	127.20
RUNOFF COEFFICIENT	=	0.99	0.30	0.61

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

```
            CN*  =  49.0    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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     174.35        52.09
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.73 (ii)    3.63 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.25         0.23
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.80         0.01          1.801 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     126.20        38.63         125.32
     TOTAL RAINFALL   (mm)=     127.20       127.20         127.20
     RUNOFF COEFFICIENT   =       0.99         0.30           0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.80     11.90  125.32
     ================================================
     MAJOR SYS.(ID= 2):   0.29      0.72     11.90  125.32
     MINOR SYS.(ID= 3):   3.66      1.08     11.90  125.32
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0018)	OVERFLOW IS ON			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0880	0.1914
	0.0320	0.1737	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0022)	3.656	1.076	11.90	125.32
OUTFLOW: ID= 1 (0018)	2.801	0.088	11.90	132.32
OVERFLOW:ID= 3 (0003)	0.855	1.361	11.90	132.32

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

PEAK FLOW REDUCTION [Qout/Qin](%)= 8.18
TIME SHIFT OF PEAK FLOW (min)= 0.00
MAXIMUM STORAGE USED (ha.m.)= 0.1914

ADD HYD (0013)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0018):	0.86	1.361	11.90	132.32
+ ID2= 2 (0002):	7.35	1.624	11.90	77.16
ID = 3 (0013):	8.21	2.984	11.90	82.91

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0013)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0013):	8.21	2.984	11.90	82.91
+ ID2= 2 (0022):	0.29	0.725	11.90	125.32
ID = 1 (0013):	8.50	3.709	11.90	84.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.4070      0.3116
                          0.0600     0.1442    |   0.4700      0.3829
                          0.1680     0.1966    |   0.5790      0.4158
                          0.2480     0.2802    |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      8.499      3.709     11.90      84.37
   OUTFLOW: ID= 1 (  0004)      8.499      0.469     12.40      84.37

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.65
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3829

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     174.35        52.09
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.35 (ii)    4.68 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.20
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.01          0.155 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     126.20        38.63         107.80
     TOTAL RAINFALL   (mm)=     127.20       127.20         127.20
     RUNOFF COEFFICIENT   =       0.99         0.30           0.85

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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 (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     174.35        52.09
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.79 (ii)    2.69 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.45         0.00          0.454 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=     126.20        38.63         125.32
     TOTAL RAINFALL   (mm)=     127.20       127.20         127.20
     RUNOFF COEFFICIENT   =       0.99         0.30           0.99

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.454    11.90   125.32
      + ID2= 2 (  0003):     0.38   0.155    11.90   107.80
        ================================================
        ID = 3 (  0014):     1.34   0.610    11.90   120.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
```

```
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0910      0.0802
                         0.0140     0.0524   |   0.0920      0.0880
                         0.0470     0.0621   |   0.1090      0.0963
                         0.0560     0.0719   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0014)      1.340      0.610     11.90     120.36
   OUTFLOW: ID= 1 (  0005)      1.340      0.092     12.10     119.65

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.09
                  TIME SHIFT OF PEAK FLOW         (min)= 12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0880

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0007)|   Area    (ha)=   1.92
|ID= 1 DT= 6.0 min |   Total Imp(%)=  31.00   Dir. Conn.(%)=  31.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.60         1.32
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     113.14        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     174.35        52.09
               over (min)         6.00        12.00
     Storage Coeff.  (min)=       2.20 (ii)   11.36 (ii)
     Unit Hyd. Tpeak (min)=       6.00        12.00
     Unit Hyd. peak  (cms)=       0.26         0.10
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.28         0.13         0.363 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00         11.90
     RUNOFF VOLUME    (mm)=     126.20        38.63         65.77
     TOTAL RAINFALL   (mm)=     127.20       127.20        127.20
     RUNOFF COEFFICIENT   =       0.99         0.30          0.52

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     2.80   0.088    11.90   132.32
      + ID2= 2 (  0004):     8.50   0.469    12.40    84.37
        ================================================
        ID = 3 (  0008):    11.30   0.557    12.40    96.26

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.557    12.40    96.26
      + ID2= 2 (  0005):     1.34   0.092    12.10   119.65
        ================================================
        ID = 1 (  0008):    12.64   0.649    12.40    98.74

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.649    12.40    98.74
      + ID2= 2 (  0007):     1.92   0.363    11.90    65.77
        ================================================
        ID = 3 (  0008):    14.56   0.904    12.00    94.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.955 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  38.606
     TOTAL RAINFALL   (mm)= 127.200
     RUNOFF COEFFICIENT   =   0.304
```

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

==========

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       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
```


***** 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\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\244c5516-f5f5-41ad-8b0f-12f2fe4c3b7e\scenario
Summary filename:
C:\Users\dli\AppData\Local\Civica\VH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\244c5516-f5f5-41ad-8b0f-12f2fe4c3b7e\scenario

DATE: 05-12-2022 TIME: 09:41:34

USER:

COMMENTS: _____

****
** SIMULATION : 5yr24hrSCS2072 **
****

READ STORM	Filename: C:\Users\dli\AppData\Local\Temp\4ad2ea3d-d32c-4df4-82af-bad7e22c5ea1\bbe639d5
Ptotal= 86.40 mm	Comments: 5yr24hrSCS2072

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.87	6.00	1.56	12.00	16.38	18.00	1.55
0.10	0.87	6.10	1.58	12.10	14.41	18.10	1.52
0.20	0.89	6.20	1.60	12.20	12.44	18.20	1.50
0.30	0.89	6.30	1.62	12.30	10.47	18.30	1.48
0.40	0.91	6.40	1.63	12.40	8.50	18.40	1.46
0.50	0.91	6.50	1.65	12.50	7.29	18.50	1.43
0.60	0.92	6.60	1.67	12.60	6.84	18.60	1.42
0.70	0.92	6.70	1.68	12.70	6.39	18.70	1.39
0.80	0.94	6.80	1.70	12.80	5.94	18.80	1.37
0.90	0.94	6.90	1.72	12.90	5.50	18.90	1.35
1.00	0.96	7.00	1.74	13.00	5.15	19.00	1.33
1.10	0.96	7.10	1.75	13.10	4.91	19.10	1.30
1.20	0.98	7.20	1.77	13.20	4.67	19.20	1.29
1.30	0.98	7.30	1.79	13.30	4.42	19.30	1.26
1.40	0.99	7.40	1.81	13.40	4.18	19.40	1.24
1.50	0.99	7.50	1.82	13.50	3.97	19.50	1.22
1.60	1.01	7.60	1.84	13.60	3.80	19.60	1.20
1.70	1.01	7.70	1.86	13.70	3.63	19.70	1.18
1.80	1.03	7.80	1.87	13.80	3.46	19.80	1.16
1.90	1.03	7.90	1.89	13.90	3.28	19.90	1.13
2.00	1.05	8.00	1.94	14.00	3.17	20.00	1.12
2.10	1.05	8.10	2.03	14.10	3.10	20.10	1.11
2.20	1.06	8.20	2.12	14.20	3.05	20.20	1.11
2.30	1.06	8.30	2.20	14.30	2.98	20.30	1.11
2.40	1.08	8.40	2.29	14.40	2.93	20.40	1.11
2.50	1.08	8.50	2.38	14.50	2.86	20.50	1.10
2.60	1.10	8.60	2.46	14.60	2.81	20.60	1.10
2.70	1.10	8.70	2.55	14.70	2.74	20.70	1.09
2.80	1.11	8.80	2.64	14.80	2.69	20.80	1.09
2.90	1.11	8.90	2.72	14.90	2.62	20.90	1.08
3.00	1.13	9.00	2.76	15.00	2.57	21.00	1.08
3.10	1.13	9.10	2.76	15.10	2.50	21.10	1.07
3.20	1.15	9.20	2.76	15.20	2.45	21.20	1.07
3.30	1.15	9.30	2.76	15.30	2.38	21.30	1.06
3.40	1.17	9.40	2.76	15.40	2.32	21.40	1.06
3.50	1.17	9.50	2.83	15.50	2.26	21.50	1.05
3.60	1.18	9.60	2.97	15.60	2.20	21.60	1.05
3.70	1.18	9.70	3.11	15.70	2.13	21.70	1.05
3.80	1.20	9.80	3.25	15.80	2.08	21.80	1.05
3.90	1.20	9.90	3.39	15.90	2.01	21.90	1.04
4.00	1.22	10.00	3.56	16.00	1.98	22.00	1.04

4.10	1.24	10.10	3.77	16.10	1.95	22.10	1.03
4.20	1.25	10.20	3.97	16.20	1.94	22.20	1.03
4.30	1.27	10.30	4.18	16.30	1.91	22.30	1.02
4.40	1.29	10.40	4.39	16.40	1.89	22.40	1.02
4.50	1.30	10.50	4.67	16.50	1.87	22.50	1.01
4.60	1.32	10.60	5.01	16.60	1.85	22.60	1.01
4.70	1.34	10.70	5.36	16.70	1.82	22.70	1.00
4.80	1.36	10.80	5.70	16.80	1.81	22.80	1.00
4.90	1.37	10.90	6.05	16.90	1.78	22.90	0.99
5.00	1.39	11.00	6.64	17.00	1.76	23.00	0.99
5.10	1.41	11.10	7.46	17.10	1.74	23.10	0.98
5.20	1.43	11.20	8.29	17.20	1.72	23.20	0.98
5.30	1.44	11.30	9.12	17.30	1.69	23.30	0.98
5.40	1.46	11.40	9.95	17.40	1.68	23.40	0.98
5.50	1.48	11.50	20.60	17.50	1.65	23.50	0.97
5.60	1.49	11.60	41.06	17.60	1.63	23.60	0.97
5.70	1.51	11.70	66.04	17.70	1.61	23.70	0.96
5.80	1.53	11.80	118.43	17.80	1.59	23.80	0.96
5.90	1.55	11.90	82.20	17.90	1.56	23.90	0.95

CALIB STANDHYD (0002) ID= 1 DT= 6.0 min	Area (ha)= 7.35 Total Imp(%)= 44.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.23	4.12	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	221.36	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		118.43	21.23	
over (min)		6.00	18.00	
Storage Coeff. (min)=		3.85 (ii)	16.96 (ii)	
Unit Hyd. Tpeak (min)=		6.00	18.00	
Unit Hyd. peak (cms)=		0.22	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.95	0.15	1.026 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	85.40	19.16	48.31
TOTAL RAINFALL	(mm)=	86.40	86.40	86.40
RUNOFF COEFFICIENT	=	0.99	0.22	0.56

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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 (  0009)|   Area    (ha)=   3.95
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.91         0.04
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     162.28        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.43        25.66
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       3.19 (ii)    4.24 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.24         0.21
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.19         0.00          1.195 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      85.40        19.16          84.74
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.99         0.22           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0022)|
| Inlet Cap.= 1.076|
| #of Inlets=     1|
| Total(cms)=   1.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   3.95      1.19     11.90   84.74
     ================================================
     MAJOR SYS.(ID= 2):   0.05      0.12     11.90   84.74
     MINOR SYS.(ID= 3):   3.90      1.08     11.90   84.74

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

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--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0880      0.1914
                          0.0320     0.1737   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0022)      3.899      1.076     11.90      84.74
   OUTFLOW: ID= 1 (  0018)      3.715      0.088     12.10      85.38
   OVERFLOW:ID= 3 (  0003)      0.185      0.255     12.10      85.38

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

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                    TIME SHIFT OF PEAK FLOW         (min)= 12.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1914

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     0.18   0.255    12.10    85.38
      + ID2= 2 (  0002):     7.35   1.026    11.90    48.31
        ================================================
        ID = 3 (  0013):     7.53   1.026    11.90    49.22

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

--------------------
| ADD HYD  (  0013)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0013):     7.53   1.026    11.90    49.22
      + ID2= 2 (  0022):     0.05   0.119    11.90    84.74
        ================================================
        ID = 1 (  0013):     7.59   1.145    11.90    49.45

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

```
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  6.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4070      0.3116
                          0.0600     0.1442   |   0.4700      0.3829
                          0.1680     0.1966   |   0.5790      0.4158
                          0.2480     0.2802   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0013)      7.585      1.145     11.90      49.45
   OUTFLOW: ID= 1 (  0004)      7.585      0.168     12.50      49.45

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.67
                  TIME SHIFT OF PEAK FLOW         (min)= 36.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1966

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.38
|ID= 1 DT= 6.0 min |   Total Imp(%)=  79.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.08
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.43        25.66
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       1.58 (ii)    5.46 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.28         0.19
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.01          0.103 (iii)
     TIME TO PEAK    (hrs)=      11.90        12.00          11.90
     RUNOFF VOLUME    (mm)=      85.40        19.16          71.48
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.99         0.22           0.83

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.96
|ID= 1 DT= 6.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      80.00        40.00
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.43        25.66
               over (min)        6.00         6.00
     Storage Coeff.  (min)=       2.09 (ii)    3.14 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=       0.27         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.30         0.00          0.305 (iii)
     TIME TO PEAK    (hrs)=      11.90        11.90          11.90
     RUNOFF VOLUME    (mm)=      85.40        19.16          84.74
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.99         0.22           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0014)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     0.96   0.305    11.90    84.74
      + ID2= 2 (  0003):     0.38   0.103    11.90    71.48
        ================================================
        ID = 3 (  0014):     1.34   0.408    11.90    80.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
```

DT= 6.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0910	0.0802
	0.0140	0.0524	0.0920	0.0880
	0.0470	0.0621	0.1090	0.0963
	0.0560	0.0719	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0014)	1.340	0.408	11.90	80.98
OUTFLOW: ID= 1 (0005)	1.340	0.047	12.30	80.27

PEAK FLOW REDUCTION [Qout/Qin](%)= 11.52
TIME SHIFT OF PEAK FLOW (min)= 24.00
MAXIMUM STORAGE USED (ha.m.)= 0.0621

CALIB	
STANDHYD (0007)	Area (ha)= 1.92
ID= 1 DT= 6.0 min	Total Imp(%)= 31.00 Dir. Conn.(%)= 31.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.60	1.32	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	113.14	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	118.43	21.23	
over	(min)	6.00	18.00	
Storage Coeff.	(min)=	2.57 (ii)	15.69 (ii)	
Unit Hyd. Tpeak	(min)=	6.00	18.00	
Unit Hyd. peak	(cms)=	0.26	0.07	
				TOTALS
PEAK FLOW	(cms)=	0.19	0.05	0.211 (iii)
TIME TO PEAK	(hrs)=	11.90	12.10	11.90
RUNOFF VOLUME	(mm)=	85.40	19.16	39.69
TOTAL RAINFALL	(mm)=	86.40	86.40	86.40
RUNOFF COEFFICIENT	=	0.99	0.22	0.46

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0018):     3.71   0.088    12.10    85.38
      + ID2= 2 (  0004):     7.59   0.168    12.50    49.45
        ================================================
        ID = 3 (  0008):    11.30   0.256    12.50    61.26

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

--------------------
| ADD HYD  (  0008)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0008):    11.30   0.256    12.50    61.26
      + ID2= 2 (  0005):     1.34   0.047    12.30    80.27
        ================================================
        ID = 1 (  0008):    12.64   0.301    12.50    63.28

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0008):    12.64   0.301    12.50    63.28
      + ID2= 2 (  0007):     1.92   0.211    11.90    39.69
        ================================================
        ID = 3 (  0008):    14.56   0.353    12.30    60.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  13.86   Curve Number   (CN)= 49.0
|ID= 1 DT= 6.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   1.649

     PEAK FLOW       (cms)=   0.466 (i)
     TIME TO PEAK    (hrs)=  12.200
     RUNOFF VOLUME    (mm)=  19.151
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.222
```

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

URBANTECH®

Water Quality Treatment Train Calculation

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684

Prepared by: KR
Last Revised: 12-May-22

New Jersey Stormwater Best Management Practices Manual
Removal Rates for WQ Treatment in Series

Equation: R = A + B – [(A X B) / 100]

Where: R = Total Removal Rate
A = Removal Rate of the First BMP
B = Removal Rate of the Second BMP

WQ Treatment Measure	Removal Rate	Total TSS Removal Rate
OGS	50	80
Filtration	60	

WATER QUALITY SIZING FILTRATION FACILITY - SWM NORTH

Project Name: 5525 8th Line (Empire, Erin) Prepared by: KR
Municipality: Town of Erin
Project No.: 21-684 Submission: 1
Date: 05/12/2022

Basic Level - 60% TSS Removal

Dry Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Infiltration m^3/ha
35%	90	0	90
55%	150	0	150
70%	200	0	200
85%	240	0	240

Interpolated Storage Requirement

44%	118	0	**118**

	Area [ha]	IMP%
Total Contributing Area	7.35	44%
Quantity Control Only	7.35	44%
Quality Control Only	7.35	44%

Total WQ Vol Required =	865	m^3
Total Ext Det Vol Required =	0	m^3
Total Dry Pond Vol Required =	**865**	m^3

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WATER QUALITY SIZING INFILTRATION FACILITY - SWM EAST

Project Name: 5525 8th Line (Empire, Erin)
Municipality: Town of Erin
Project No.: 21-684
Date: 05/12/2022

Prepared by: KR
Submission: 1

Enhanced Level - 80% TSS Removal
Iniltration *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Infiltration m^3/ha
35%	25	0	25
55%	30	0	30
70%	35	0	35
85%	40	0	40

Interpolated Storage Requirement

79%	38	0	**38**

	Area [ha]	IMP%
Total Contributing Area	0.38	79%
Quantity Control Only	0.38	79%
Quality Control Only	0.38	79%

Total WQ Vol Required =	14	m^3
Total Ext Det Vol Required =	0	m^3
Total Perm Pool Vol Required =	14	m^3
Total Filtration Media Volume =	36	m^3
Total Filtration Media Footprint =	693	m^2
Total Filtration Media Min. Depth =	0.05	m

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SANITARY SEWER DESIGN SHEET

5525 EIGHTH LINE

TOWN OF ERIN

PROJECT DETAILS

Project No: 21-684
Date: 10-Feb-22
Designed by: SL
Checked by: DZ

DESIGN CRITERIA

Min Diameter =	200	mm	Avg. Domestic Flow =	290.0	l/c/d
Mannings 'n'=	0.013		Infiltration =	0.286	l/s/ha
Min. Velocity =	0.6	m/s	Max. Peaking Factor =	4.00	
Max. Velocity =	3.0	m/s	Min. Peaking Factor=	2.00	
Factor of Safety =	20	%			

NOMINAL PIPE SIZE USED

			RESIDENTIAL							COMMERCIAL/INDUSTRIAL/INSTITUTIONAL						FLOW CALCULATIONS							PIPE DATA					
STREET	FROM MH	TO MH	AREA (ha)	ACC. AREA (ha)	UNITS (#)	DENSITY (P/ha)	DENSITY (P/unit)	POP	ACCUM. RES. POP.	AREA (ha)	ACC. AREA (ha)	EQUIV. POP. (p/ha)	FLOW RATE (l/s/ha)	EQUIV. POP.	ACCUM. EQUIV. POP.	INFILTRATION (l/s)	TOTAL ACCUM. POP.	PEAKING FACTOR	RES. FLOW (l/s)	COMM. FLOW (l/s)	ACCUM. COMM. FLOW (l/s)	TOTAL FLOW (l/s)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	ACTUAL VELOCITY (m/s)	PERCENT FULL (%)
STREET A	201A	202A	2.16	2.16	42		2.8	118	118							0.6	118	4.00	1.6			2.2	1.00	200	32.8	1.0	0.6	7%
STREET A	202A	203A		2.16					118							0.6	118	4.00	1.6			2.2	1.00	200	32.8	1.0	0.6	7%
STREET A	203A	204A		2.16					118							0.6	118	4.00	1.6			2.2	1.00	200	32.8	1.0	0.6	7%
EXISTING RESIDENTIAL	204A	205A	20.60	22.76	100		2.8	280	398							6.5	398	4.00	5.3			11.9	3.00	200	56.8	1.8	1.4	21%
STREET A	205A	206A		22.76					398							6.5	398	4.00	5.3			11.9	3.00	200	56.8	1.8	1.4	21%
STREET A	206A	208A		22.76					398							6.5	398	4.00	5.3			11.9	2.00	200	46.4	1.5	1.2	26%
STREET E	207A	208A	0.41	0.41	8		2.8	23	23							0.1	23	4.00	0.3			0.4	2.00	200	46.4	1.5	0.4	1%
STREET A	208A	209A	2.46	25.63	39		2.8	110	531							7.3	531	3.96	7.1			14.4	0.50	200	23.2	0.7	0.8	62%
STREET A	209A	210A		25.63					531							7.3	531	3.96	7.1			14.4	0.50	200	23.2	0.7	0.8	62%
STREET A	210A	211A		25.63					531							7.3	531	3.96	7.1			14.4	0.50	200	23.2	0.7	0.8	62%
STREET A	211A	214A		25.63					531							7.3	531	3.96	7.1			14.4	0.50	200	23.2	0.7	0.8	62%
STREET E	207A	212A	0.96	0.96	21		2.8	59	59							0.3	59	4.00	0.8			1.1	2.00	200	46.4	1.5	0.6	2%
STREET E	212A	213A		0.96					59							0.3	59	4.00	0.8			1.1	2.00	200	46.4	1.5	0.6	2%
STREET E	213A	214A		0.96					59							0.3	59	4.00	0.8			1.1	0.50	200	23.2	0.7	0.4	5%
STREET D	215A	216A	1.62	1.62	46		2.8	129	129							0.5	129	4.00	1.7			2.2	3.00	200	56.8	1.8	0.9	4%
STREET D	216A	217A		1.62					129							0.5	129	4.00	1.7			2.2	2.50	200	51.9	1.7	0.8	4%
STREET D	217A	218A		1.62					129							0.5	129	4.00	1.7			2.2	0.50	200	23.2	0.7	0.5	9%
STREET C	219A	220A	1.93	1.93	63		2.8	177	177							0.6	177	4.00	2.4			2.9	3.00	200	56.8	1.8	0.9	5%
STREET C	220A	221A		1.93					177							0.6	177	4.00	2.4			2.9	0.50	200	23.2	0.7	0.5	13%
STREET A	201A	223A	2.03	2.03	69		2.8	194	194							0.6	194	4.00	2.6			3.2	3.00	200	56.8	1.8	1.0	6%
STREET A	223A	224A		2.03					194							0.6	194	4.00	2.6			3.2	3.00	200	56.8	1.8	1.0	6%
STREET A	224A	225A		2.03					194							0.6	194	4.00	2.6			3.2	0.50	200	23.2	0.7	0.5	14%
STREET A	214A	218A		26.59					590							7.6	590	3.94	7.8			15.4	0.50	200	23.2	0.7	0.8	66%
STREET A	218A	221A		28.21					719							8.1	719	3.89	9.4			17.5	0.50	200	23.2	0.7	0.8	75%
STREET A	221A	222A		30.14					896							8.6	896	3.83	11.5			20.1	0.50	250	42.0	0.9	0.8	48%
STREET A	222A	225A		30.14					896							8.6	896	3.83	11.5			20.1	0.50	250	42.0	0.9	0.8	48%
STREET A	225A	226A		32.17					1090							9.2	1090	3.78	13.8			23.0	0.50	250	42.0	0.9	0.9	55%

Urbantech Consulting, A Division of Leighton-Zec Ltd.
3760 14th Avenue, Suite 301 Markham, Ontario L3R 3T7
TEL: 905.946.9461 FAX: 905.946.9595
www.urbantech.com

APPENDIX C

BACKGROUND STUDIES

- Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis – Erin Fairways Subdivision, 5525 Eighth Line (Terra-Dynamics Consulting Inc., May 2022)

Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

May 18, 2022

Mr. Jeffrey Swartz
Vice-President, Land Development
EC (Erin) GP Inc.
125 Villarboit Crescent
Vaughan, ON L4K 4K2

Re: Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis, Erin Fairways Subdivision, 5525 Eighth Line, Town of Erin, ON

Dear Mr. Swartz,

EXECUTIVE SUMMARY

The Erin Fairways Subdivision is proposed for development at the Erin Heights Golf Course. A water level monitoring network using groundwater monitoring wells, as well as downgradient monitors of wetlands, surface water and shallow groundwater have been in operation since mid-2021 to document pre-development conditions. Site design can accommodate water balance maintenance for the downgradient provincially significant wetlands and protection of the nearby municipal supply well.

1.0 Introduction and Background Information

Terra-Dynamics Consulting Inc. (Terra-Dynamics) respectfully submits this study of the proposed Erin Fairways Subdivision (the Site, Figure 1). This study includes (i) a Hydrogeological Assessment, (ii) a Water Balance Assessment and (iii) a Source Protection Analysis. The Site is part of a golf course and is approximately 13.9 hectares in size. The Erin Fairways Subdivision will be a municipally serviced residential development (Armstrong, 2021).

2.0 Scope of Work

A background review of available information was completed that included, but was not limited to:

1. West Credit Subwatershed Study, Characterization Report (CVC, 1998);

2. Integrated Water Budget Report – Tier 2, Credit Valley Source Protection Area (AquaResource Inc., 2009);

3. WHPA Delineation and Vulnerability Assessment (Blackport Hydrogeology Inc. and Golder Associates Ltd., 2010);

4. Highly Vulnerable Aquifer Delineation, Groundwater Quality Vulnerability Analysis (CTC Source Protection Region, 2010);

5. Existing Conditions Report, Phase 1 – Environmental Component, Erin Servicing and Settlement Master Plan (CVC et al, 2011);

6. Ontario Geological Survey (OGS) surficial geology (OGS, 2003) and OGS 3-D modelling of surficial deposits (Burt and Dodge, 2016); and

7. Stormwater Management Criteria, Credit Valley Conservation (2012).

In addition, on-site investigations have been reviewed including geotechnical (DS Consultants Inc., 2021) geomorphic (GEO Morphix, 2020) and ecological (WSP, 2022).

2.1 Hydrogeological Assessment

A hydrogeological assessment was completed following the Conservation Authority Guidelines for Hydrogeological Assessments (Conservation Ontario, 2013) as required by the CVC (Vandermeulen, 2021).

The hydrogeological assessment includes (i) a description of existing conditions, (ii) an impact assessment and (iii) recommended mitigation measures. A private well survey and groundwater quality analyses can be completed after review of our initial report by the Town of Erin and Credit Valley Conservation (CVC) for comment on the scope of these items.

Downgradient features discussed in detail include:

(i) Two Provincially significant swamp wetland areas (MNRF, 1995); and

(ii) Two watercourses associated with Subwatershed 15 of the Erin Branch of the West Credit River (AquaResource Inc., 2009) with the main tributary classified as a cold-water fishery (CVC et al, 2011).

As requested by CVC (Salsberg, 2021), Subwatershed 15 West Credit River study recommendations (1998) were also considered.

2.2 Water Balance Assessment

A water balance assessment was completed as required for development of the Site (Salsburg, 2021).

Credit Valley Conservation (CVC) have specified that a "*Site-specific and features-based water balance will be required… Low Impact Development (LID) features be incorporated in the design to achieve a neutral water balance given the site is located within …* (a) *Significant Groundwater Recharge Area* (SGRA)". Also, given the Site is almost entirely mapped as an SGRA, a "*Site specific water balance* (is) *required to identify pre-development groundwater recharge rates and distribution as well as hydrologic and ecologic functions*" (CVC, 2012).

Our water balance assessment used existing long-term modelling results of the Site completed for CVC (AquaResource Inc., 2009) with some adjustments reflecting soil conditions documented during the geotechnical investigation (DS Consultants, 2021), i.e. providing a "*more detailed hydrogeological characterization*" (CVC, 2012).

A Wetland Risk Evaluation (TRCA, 2017) was also completed.

2.3 Source Water Protection Analysis – Municipal Groundwater Supply

Development of the Site includes consideration of source water protection policies given the Town of Erin's Municipal Well E8 is located northwest of the Site, and the associated municipal wellhead protection areas (WHPAs) extend into the Site. The source water protection policies concern water quality, not water quantity (Salsburg, 2021). WHPA water quality considerations include:

A. A Section 59 Notice evaluation, i.e. the Site being in a municipal WHPA requires review by the source water protection risk management officer/investigator;

B. Significant threat management discussion, specifically meeting the Town of Erin/Source Water Protection requirements for:
    i. Higher construction and operational standards for sanitary sewers and related pipes near the municipal supply well; and
    ii. Stormwater management facilities and outlets located in such a way as to prevent negative impacts to the municipal supply well;

C. Consideration of road salt and snow storage management; and

D. Reporting on existing transport pathways and any transport pathways to be created.

3.0 Physical Setting Summary

The Site is located within the Guelph Drumlin Field within a glacial outwash plain spillway area, immediately north of an area that is mapped as till plain (Chapman and Putnam, 1984, and CVC, 1998).

The Site is located within Subwatershed 15 of the West Credit River watershed (AquaResource Inc., 2009). Site topography generally slopes to the north from an elevation of 424 metres above sea level (m ASL) to 397 m ASL, with the downgradient Erin Branch of the West Credit River tributary at/below 394 mASL (Figure 2).

3.1 Surface Water

No surface watercourses are mapped at the Site.

The Erin Branch of the West Credit River is located downgradient and about 50 m northwest of the Site. It has perennial flow and is classified as cold water (Credit Valley et al, 2011). It is noted that downstream of the golf course, the thermal regime is historically reported as cool water (Credit Valley at el, 2011). The river bed material in the area of the Site is reported as sand, and in some riffles, sand and gravel, with watercress noted as evidence of groundwater inputs. The reach is also noted as having a low gradient and an average bankfull depth of 1 m (GEO Morphix Ltd., 2020). Surface water levels were monitored at staff gauge station SW-2, which was responsive to precipitation events (Appendix A).

A tributary of the West Credit River is also located along the east side of the Site, paralleling the Site boundary at a distance of close to, but slightly greater than 30 m. This tributary may have been created between 1954 and 1980, and has a bankfull depth of 0.45 m (GEO Morphix Ltd., 2020). Surface water levels were being monitored at staff gauge station SW-1, however, the monitoring location was destroyed during the fall of 2021 as part of a washout of the tributary and the station was re-installed in spring of 2022. It is currently presumed that this tributary intersects the shallow groundwater table adjacent to the Site. The portion of the Site calculated to be draining to this tributary is shown on Figure 5. Site golf course operations have an irrigation pond that receives discharge from this tributary (Figure 2). This irrigation pond is subject to a Ministry of the Environment, Conservation and Parks (MECP) Permit To Take Water (7370-A8YL4P) which allows for a maximum daily taking of 909,000 Litres/day from the pond. During the August 25, 2021 site visit it was observed that the pond water level was lower than the outlet pipe to the Erin Branch of the West Credit River.

3.1.1 Baseflow

Baseflow analysis was completed for the Erin Branch of the West Credit River at the upgradient Water Survey of Canada (WSC) stream gauge station 02HB020 (Figure 1) as part of the Tier 2 Water Budget (AquaResource Inc., 2009). An average baseflow of 0.33 m^3/s was calculated, including a mean flow of 0.47 m^3/s and a high baseflow component of 71%. It was also noted that low flow issues are sometimes a problem later in summer:

> "*Monthly variations in streamflow are not very large, and summer baseflow remains sustained…the 90th percentile exceedance flow does tend to decrease over the summer months into September which suggests that low flow issues are sometimes a problem later in the summer.*" (AquaResource Inc., 2009)

Historic baseflow measurements of the West Credit River immediately downgradient of the Site indicate this reach can be both an area of groundwater discharge (1.68 L/sec/km^2, August 1992) as well as an area of groundwater recharge (-9.1 L/sec/km^2, November 1995) (CVC 2011 et al):

> "*The gaining and losing portions of the West Credit River through the Erin Village area is variable and recharge/discharge conditions are more complex than previously interpreted.*" (CVC et al, 2011)

Earlier CVC reports (1998) have also indicated "*Much of the baseflow lost in the lower reaches of the northern tributaries of the West Credit appears to be related to the change in surficial geology from till to sands and gravel".* We note that Municipal Well E8 began operation in 1993, between these two sets of baseflow measurements referenced above, and that the water level at Municipal Well E8 changes on average from flowing/above ground surface (0.7 m) to approximately 4.6 m below ground surface during operation (OCWA, 2021). However, it is acknowledged that reporting on the 1993 municipal well testing stated "*there was no direct connection or impact of groundwater discharge to the West Credit River or adjacent wetlands*" (Blackport et al, 2010).

Manual surface water flow measurements have been completed on (i) August 25, 2021, (ii) November 10, 2021 and (iii) April 5, 2022. The monitoring results are described below:

1. No measurable precipitation occurred for 8 days prior to the August measurements (Environment Canada Station 6142400, Shand Dam) meeting the 7-day criteria for baseflow measurements (MacViro, 2009). The approximate baseflow at the tributary (station SW-1) was approximately 0.75 L/s and a temperature measured of 17.6°C (maximum day temperature of 28°C at Shand Dam). The measured baseflow in the Erin Branch of the West Credit River increased from 214 to 225 L/s between stations SW-2 and SW-3, respectively.

2. Precipitation of 5.4 mm occurred the day before the November 10 measurements, with no measurable precipitation for the 8 days prior. The flow at the tributary (station SW-1) was approximately 1.2 L/s. The measured flow in the Erin Branch of the West Credit River increased from 278 to 433 L/s between stations SW-2 and SW-3, respectively.

3. Precipitation of 7.2 mm (partly snow) occurred during the week prior to the April 5, 2022 measurements. The flow at the tributary (station SW-1) was approximately 14 L/s. The measured flow in the Erin Branch of the West Credit River decreased from 729 to 562 L/s between stations SW-2 and SW-3, respectively.

3.2 Soils

The Site soils are mapped as Hillsburgh Fine Sandy Loam (OMAFRA, 2021). These permeable soils were developed on fine to medium outwash sands (Hoffman, Matthews and Wicklund, 1963). Infiltration rates were calculated as per CVC's methodology (2012, CVC Figure B11) from the shallowest grain-size analysis (DS Consultants Ltd., 2021) based upon hydraulic conductivity calculations (Appendix C, Devlin, 2015) at each borehole.

All calculated potential infiltration rates were greater than 7.6 mm/hour as expected for hydrologic soil group A (USDA, 1986), and none were less than 15 mm/hour, i.e. all suitable for recharge measures, with the highest rates in the central portion of the Site at boreholes BH21-3, BH21-6, BH21-7 and BH21-8 (Table 1, Figure 2) which consists of silty sand fill, sand or sand and gravel at surface.

Table 1 - Calculated Infiltration Rates

Calculated Infiltration Rates	Borehole Locations
>50 mm/hour	BH21-3, BH21-6, BH21-7 and BH21-8
15 to 50 mm/hour	MW21-1, MW21-2, BH21-4, BH21-5, BH21-9 and MW21-10

3.3 Surficial Geology

The surficial geology for the Site is regionally mapped as "*gravel and gravelly sand, frequently overlain by several feet of sand or silt*" (OGS, 2003). The 2021 geotechnical investigation (DS Consultants Ltd., 2021), confirmed this classification in the central portion of the Site at boreholes 6, 7 and 8 (Figure 2), however lower permeability silty sand and silt were identified at-surface in most remaining boreholes (Appendix B, Section 3.4.1). Overall, the thickness of the surficial permeable soils, above the underlying silty sand till, had average and median thicknesses of 3.6 m and 2.8 m, respectively.

A local hydrogeologic cross-section summarizes the Site setting, with the overburden thickness above bedrock decreasing from 40 m to less than 10 m towards the northwest and the West Credit River

(Figure 3). This cross-section for the Site matches the general conceptual model in the area of (i) sand and gravel, underlain by (ii) sandy silt (*to silty sand*) till, underlain by (iii) the bedrock aquifer as shown below in Figure 4 (Credit Valley et al, 2011).

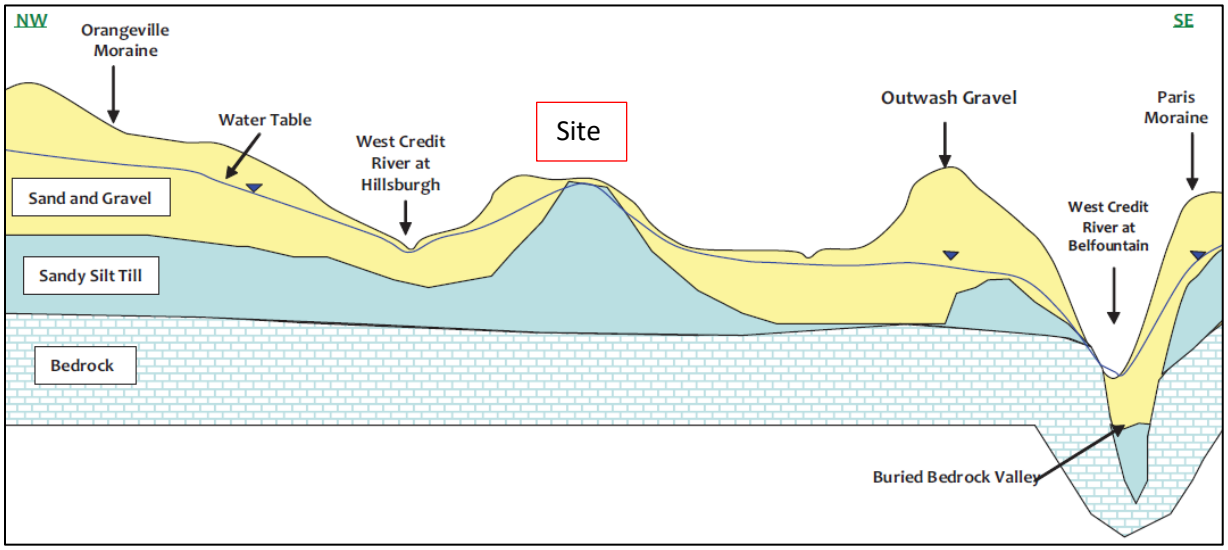


Figure 4 – Hillsburgh and Erin Schematic Cross-Section (Credit Valley et al, 2011)

3.4 Overburden Groundwater

3.4.1 Hydraulic Conductivities

Hydraulic conductivities were calculated from grain-size analyses (DS Consultants Ltd., 2021) according to the methodology of Devlin (2015). Shallow (0.3 to 1.1 mBGS) soil sample results, from highest hydraulic conductivity to lowest, are listed below grouped by material (Appendix C):

1. Sand and gravel (boreholes BH21-6, BH21-7): 10^{-4} m/s
2. Gravelly sand (borehole BH21-8): 10^{-5} m/s
3. Silty Sand Fill (borehole MW21-3): $7x10^{-6}$ m/s
4. Silty Sand and Silty Sand Fill (boreholes MW21-2, BH21-4 and BH21-5): 10^{-6} m/s
5. Silt and Sand (borehole MW21-1): $5x10^{-7}$ m/s
6. Silty Sand Fill (boreholes BH21-9 and MW21-10): $1x10^{-7}$ to $6x10^{-8}$ m/s

While the calculated hydraulic conductivity results appear low for some of the reported borehole log geology (MECP, 2006), the amount of 'fines' lowered the calculated hydraulic conductivities (Appendix C) for the at-surface samples at boreholes MW21-1, MW21-2, MW21-3, BH21-5, BH21-9 and MW21-10. For example, the grain-size classification of the 0.3 m sample from borehole BH21-9 is "poorly sorted sandy silt with fines". Lower hydraulic conductivities that are below the range used for the CVC Model uppermost glaciofluvial outwash layer of $5x10^{-4}$ to $5x10^{-6}$ m/s were identified for approximately 28% of the Site (AquaResource Inc., 2009), e.g. $1x10^{-7}$ m/s at BH21-9 is the same as reported by the MECP for sandy/silty diamicton (2006).

The calculated hydraulic conductivity for the sandy silt till at borehole BH21-1 was $5x10^{-7}$ m/s. This value is reasonable given previous reporting of a moderately low infiltration rate (Credit Valley et al, 2011) and reporting from MECP (2006).

3.4.2 Shallow Overburden Groundwater Flow

In April 2021, four monitoring wells were constructed (DS Consultants, 2021). Three monitoring wells were screened in the surficial silty sand and upper silty sand till (MW21-2, MW21-3 and MW21-10), from 4.6 to 7.6 m BGS, 4.6 to 7.6 m BGS and 1.3 to 4.3 m BGS, respectively (Appendix B). A fourth deeper monitoring well (MW21-1) was also constructed in only the silty sand till from 7.6 to 10.6 m BGS. DS Consultants have completed manual and datalogger monitoring at these locations in 2021 and are continuing measurements in 2022 (Appendix A).

Shallow overburden groundwater flow mimics the topography (Figure 5) with flow generally towards the north-northwest (Figure 5), as previously identified by CVC, *"…gravelly soils….allow water to percolate…and make its way slowly to the river…..*" (CVC, 1998). Overburden water levels are within the silty sand till in the higher portions of the Site and become shallower to the north, sometimes being within the overlying silty sand. The depth to the shallow groundwater table during the spring (April 2021) was generally greater than 1 metre.

With respect to shallow groundwater flow it has been previously reported that:

> "*…an extensive low permeability till unit underlying the sand and gravel … much of the groundwater will not move to depth and likely discharge as baseflow to a local surface water feature…*" (CVC et al 2011).

This is reasonable for the Site given the top of the silty sand till parallels that of the ground surface dipping to the northwest, north and northeast.

As shown in Appendix A, relatively similar water level trends were noted at the shallow monitors (2, 3 and 10) from April to August 2021, with the deeper silty sand till showing some water level recovery during the summer. An upwards vertical gradient was noted between the groundwater levels in the deeper silty sand till (MW21-1) and those in the adjacent shallow silty sand (MW21-10). The only shallow monitor to show a fluctuating water level was MW21-2, which is only 65 metres away from Municipal Well E8, and may reflect the pumping cycle of the municipal well.

An existing shallow monitoring well (2.5 m BGS) was identified between the Site and the Erin Branch of the West Credit River (MW-6-00, Figure 2), and has been incorporated into the monitoring program since November 2021. Groundwater levels were responsive to precipitation (Appendix A).

In August 2021, shallow drive-point piezometers were installed to monitor (a) shallow groundwater at the two wetland polygons (GW-1 and GW-2), (b) surface watercourses (SW-1 and SW-2), (c) at ground surface at the wetlands (WET-1 and WET-2) and (d) shallow groundwater adjacent surface watercourses (GW-3 and GW-4) (Figure 2). The shallow groundwater monitors (GW-1, GW-2, GW-3 and GW-4) were installed approximately 1 m deep, the wetland and surface water monitors (SW-1, SW-2, WET-1, and

WET-2) were installed between 0.2 and 0.4 m deep, and datalogging pressure transducers were installed in each. The hydrographs for these are shown in Appendix A and described below:

1. Water levels in the poplar swamp (WET-1/GW-1) were (a) generally below ground surface, (b) groundwater levels showed some seasonal recovery after the summer period, (c) were responsive to precipitation events, and (d) the vertical gradient was generally downwards.

2. Water levels in the cedar swamp (WET-2/GW-2) were (a) below ground surface, (b) fairly consistent over time, (c) groundwater levels showed some seasonal recovery after the summer period, (d) there was limited responsiveness to precipitation events and (e) the vertical gradient was generally downwards.

3. Shallow groundwater levels adjacent the west tributary (GW-3) were fairly consistent during the monitoring period.

4. Shallow groundwater levels adjacent to the Erin Branch of the West Credit River (GW-4) were (a) responsive to precipitation events, and (b) had a fairly consistent upwards vertical gradient.

3.5 Bedrock Aquifer

The bedrock aquifer underlying the Site is the Amabel Formation, "*…a highly transmissive bedrock aquifer*" (AquaResource Inc., 2009). As shown on the Site cross-section (Figure 3), the confined aquifer bedrock groundwater levels (Section 3.4.1) are above ground surface under static conditions at the Erin Branch of the West Credit River. Regional groundwater flow in the bedrock aquifer is towards the east in the area of the Site (CVC et al, 2011).

3.5.1 Municipal Well E8

Municipal Well E8 is located at 5555 Eighth Line, northwest of the Site (Figure 2). Further details regarding the bedrock supply well include:

> *"Municipal well E8, was constructed to a depth of 46 metres in 1991, and has been in production since 1993. Bedrock was encountered at 6.6 metres below ground surface (m BGS) but the upper bedrock zones were sealed to 16.8 m BGS by pressure-grouting to minimize potential connection to surface water. The well is artesian with a static level about 6.4 m above ground surface.* (Credit Valley et al, 2011)

Water levels provided by the Ontario Clean Water Agency (2021) indicated that daily maximum water levels at Municipal Well E8 continue to be generally above ground surface.

3.5.2 Well Head Protection Area (WHPA) Mapping

Well Head Protection Areas (WHPAs) were mapped for Municipal Well E8 as part the 2006 County of Wellington Groundwater Protection Study (Golder Associates Ltd., 2006). Bedrock aquifer vulnerability scoring of the modelled WHPAs was completed in 2010 (Blackport Hydrogeology Inc. and Golder Associated Ltd.). Underlying the Site, the intrinsic susceptibility index (ISI) of the bedrock aquifer

vulnerability was modelled as 'medium' closer to Municipal Well E8 and 'low' further upgradient (Appendix D).

The WHPAs at the Site include (Appendix D):

a) Well Head Protection Area (WHPA)-A: a 100-metre circle around the Municipal Well E8, with a vulnerability score of 10, and covers 0.64 hectares or 5% of the Site.
b) WHPA-B: the 2-year time of travel to Municipal Well E8, with vulnerability scores of 8 and 6 (because of lower natural vulnerability mapped to the southeast), and covers 4.15 hectares or 29% of the Site.
c) WHPA-C: the 5-year time of travel to municipal well E8, with a vulnerability score of 4, and covers 1.3 hectares or 9% of the Site.

Due to the age of the WHPAs, they may be remodelled in the future, which may change their size and location. However, it is our understanding that funding for WHPA updates has not been confirmed, and it would likely take on the order of 3 years to complete the modelling and update the source protection assessment report and plan policies.

3.6 Highly Vulnerable Aquifer Mapping

The delineation of Highly Vulnerable Aquifers (HVAs) was completed as part of a modelling effort (CTC Source Protection Region, 2010) separate from the earlier WHPA modeling (Section 3.5.2). During the HVA modelling project, Municipal Well E8 was still classified as being in a 'medium' vulnerability physical setting whereby the bedrock aquifer is "*overlain by aquitard material*".

However, most of the Site (10.9 hectares or 78%) was regionally classified as an HVA (Appendix D) because of (i) surficial geology mapping of sand and gravel and (ii) off-site water well records suggesting that the on-site sand and gravel thickness is greater than 2 metres on-site. The HVA in this case is the at-surface surficial sediments, not the underlying municipal bedrock aquifer. Based upon the CTC Source Protection Region (2010) criteria using the on-site investigations, the entire Site could be mapped as an HVA; however, this unit is not a potable water supply aquifer on-site, nor immediately downgradient. HVAs are assigned a vulnerable score of 6 based upon source water protection technical rules.

3.7 Wetlands

Downgradient of the Site are three swamp polygons of Provincially Significant Wetland (PSW) associated with the West Credit River Wetland Complex (Figure 2, MNRF, 1995, Appendix D). Ecological Land Classifications (ELC) of these swamps are (WSP, 2022): (i) cedar hardwood organic mixed swamp SWM4-1 or (ii) poplar conifer mineral mixed swamp SWM3-2 (Figure 2). These wetlands occur at ground elevations that are approximately below or lower than the 400 m ASL contour line, similar to the Tributary that is mapped east of the Site (Figure 2).

Soil hand-augering completed for installation of wetland water level monitoring stations noted (i) 0.65 metres of clay and silt at the cedar swamp over sand (WET-2, SWM4-1, polygon 4a), and (ii) 0.75 m clay and silt over silty sand at the poplar swamp (WET-1, SWM3-2, polygon 5a). This is not unexpected as

OMAFRA has mapped "muck", or hydrologic soil group D, for much of the poplar swamp (Appendix D) and the OGS has mapped a portion of the poplar swamp as bog deposits. These lower permeability soils correlate with the expected higher soil water holding capacity at swamps than is expected at the Site, i.e. 350 mm versus 50-100 mm (AquaResource Inc. and NPCA, 2009).

Topographic contours through the wetlands indicate gentle slopes of between 3% (cedar swamp) and 4% (poplar swamp) towards the West Credit River. However, most of the poplar swamp is within the West Credit River floodplain while the cedar swamp is upgradient of the floodplain (Figure 5).

These wetlands are classified as groundwater slope wetlands, defined by Mitsch and Gosselink (2007) as follows (Figure 6):

> "*Wetlands often develop on slopes or hillsides where groundwater discharges to the surface as springs and seeps. Groundwater flow into these wetlands can be continuous or seasonal, depending on the local geohydrology and on the evapotranspiration rates of the wetland and adjacent uplands*."

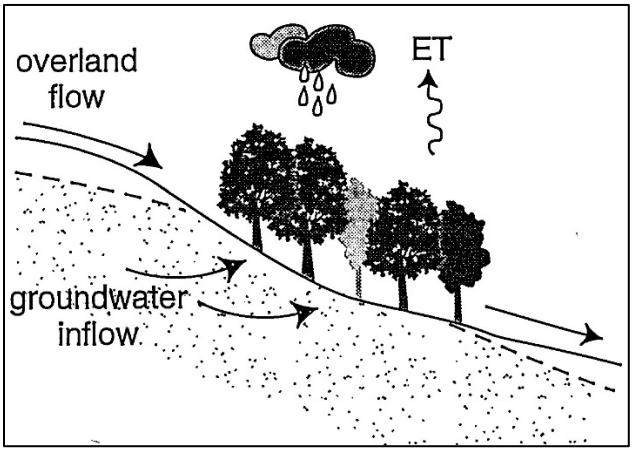


Figure 6 – Groundwater slope wetland (Mitsch and Gosselink, 2007)

The upgradient catchment areas for each wetland were calculated using topographic contours as 2.16 and 7.56 hectares for the cedar (SWM4-1, 4a wetland polygon) and poplar (SWM3-2, 5a wetland polygon) wetlands, respectively (Figure 5). The wetlands are 1.2 and 1.0 hectares approximately, respectively. The upgradient drainage area of each wetland catchment within the Site is 1.38 and 6.05, hectares, respectively (Figure 5). However, it should be noted that 0.78 and 1.51 hectares, respectively can remain unchanged between the Site and the wetlands to both (i) receive direct precipitation recharge and (ii) transmit subsurface recharge.

It is worth noting that previous reporting by CVC (1998) appears to comment on this reach of the West Credit River in the area of the Site, with respect to the effect of wetlands on upgradient infiltrated groundwater, "…*because of the wetland vegetation, most this cool groundwater is used up and transpired by the vegetation before reaching the stream or warms up as it passes through the wetland soils*…" which is reflected in the change from cold to cool of the West Credit River (Section 3.1).

It is also noted that there is an existing irrigation pond adjacent/downgradient of the cedar hardwood organic mixed swamp SWM4-1 (Figure 2). This pond is unlikely to be in operation following residential development of the Site. Consequently, this should benefit wetland hydrology, as the irrigation pond would not be drawn down for irrigation during the growing season.

As introduced in Section 3.4.2, continuous hydrologic monitoring is on-going at the two wetlands since late August 2021 and includes a measure of the vertical gradient. Based upon the water level monitoring completed up to March 2022 (Appendix A):

a) the cedar swamp (WET-2/GW-2) was generally under recharge conditions with groundwater levels during the fall and winter within 0.5 m of surface; and
b) the poplar swamp (WET-1/GW-1) showed more seasonal water level variability with water levels during the fall and winter close to surface.

Overall, precipitation conditions during this fall 2021 and winter 2022 monitoring period were generally at or above historic average conditions at the Shand Dam (Environment Canada Station 6142400).

There is also small polygon (5d, Figure 2) of poplar swamp located north of the Site (WSP, 2022). This has not been investigated for impacts as there is already substantial municipal infrastructure for Municipal Well E8 between the Site and this wetland.

4.0 Water Balances and Groundwater Recharge

4.1 West Credit Subwatershed Study (CVC, 1998)

It has been noted by CVC for Subwatershed 15 of the West Credit River that:

> "*Not all the recharge to the subwatershed discharges to the West Credit River. The average annual precipitation within the subwatershed is 850 mm per year, and average infiltration within the subwatershed is estimated to be 338 mm per year. The average infiltration contributing to baseflow is estimated to be 294 mm per year* (35% of precipitation)*. The difference is approximately 13%, meaning that this water would discharge outside the West Credit Subwatershed to the main Credit River, within Subwatershed 18."*

4.2 Tier 2 Source Water Protection Water Budget (AquaResource Inc., 2009)

Water Survey of Canada (WSC) surface water flow gauge 02HB020 (Figure 1), is located on the Erin Branch of the West Credit River upstream of 8th Line and the Site. Surface water balance analyses of the 1961-2004 dataset provided the following water balance results in mm: (i) Precipitation 894, (ii) Evapotranspiration 437 (49%), (iii) Runoff 139 (16%) and (iv) Recharge 319 (36%). Of the precipitation noted at the Shand Dam weather station (Environment Canada Station 6142400), 15% of precipitation is snowfall, or 125 mm, and this station is considered representative of climatic conditions west of the Niagara Escarpment.

AquaResource Inc. modelling of groundwater recharge was completed for average conditions for 1960-2005. The results for the Site in mm per hectare were: (i) Precipitation 897, (ii) Evapotranspiration 402-

408, (iii) Runoff 114-122 and (iv) Recharge 368-381. An average area-weighted value for the Site of 340 mm/year recharge (38% of precipitation) was calculated after (a) incorporating values for the lower permeability soils identified for 28% of the Site (Section 3.4.1) which were assigned a recharge rate of 302 mm/year pro-rated from AquaResource Inc. modelling for similar soils west of the Site, and (b) including a limited existing impervious area of 4%. This equates to an annual recharge volume of 47,368 m^3. However, it should be noted that these modelled results remain significantly in excess of typical MECP groundwater recharge rates (Table 2).

Table 2 - Typical Groundwater Recharge Rates (MECP, 1995)

Soil Texture	Groundwater Recharge Rate (mm/year)
Coarse sand and gravel	>250
Fine to medium sand	200-250
Silty sand to sandy silt	150-200
Silt	125-150
Clayey silt	100-125
Clay	<100

4.3 Significant Groundwater Recharge Areas

The CTC Source Protection Committee/Region choose to delineate Significant Groundwater Recharge Areas (SGRAs) as those areas modelled as having 115% greater than the overall average watershed recharge rate of 230 mm/year, for a criterion of 265 mm/year. This value of 265 mm/year is within the expected range for coarse sand and gravel (Table 2, MECP, 1995). Consequently, given a CVC modelled recharge rate of 374 mm/year for the Site (Section 3.6.2) it is mapped almost entirely as an SGRA (95%).

4.4 Maintenance of the Site Water Balance

A daily precipitation analysis was completed for Environment Canada Shand Dam Station 6142400 for the period 2013-2021 and summarized in Table 3. The analysis was completed to determine a precipitation infiltration threshold to maintain pre-development levels of groundwater recharge. This threshold can then be a criterion for design of future stormwater management low impact development (LID) infiltration facilities.

The analysis indicated that annual daily 10 mm or less precipitation events ranged between 386 to 488 mm/year (Table 3). These values exceed the modelled Site pre-development recharge rate of 340 mm/year, with a median '10 mm or greater precipitation' value of 422 mm/year exceeding the modelled recharge by over 24%. However, a larger amount of precipitation abstraction is required. This is because driveway and road runoff cannot be included because of potential water quality concerns (e.g. road salt) to features such as wetlands (CVC, 2012).

The pre-development Site recharge rate will be maintained to 80% or greater, if (a) 15 mm, or less, precipitation events are infiltrated from "clean" impervious surface roof runoff and (b) fill is of loam quality or higher infiltration rate (Table 4). If a higher recharge rate is required more permeable soils than loam could be specified for fill areas. Table 4 is further explained below:

(a) Infiltration of 'clean' runoff from 4.91 hectares of impervious areas (i.e. multiplied by 605 mm/year) via a 3rd pipe system to infiltration areas at the stormwater management facilities resulting in an estimated annual recharge volume of 29,706 m^3; and

(b) 5.21 hectares of continuing recharge for the permeable areas of lots, the park and the stormwater management areas.

    a. 4.81 hectares multiplied by 138 mm/year (representing an average rate for loam soils to be placed at the Site) for an annual recharge volume of 6,633 m^3.
    b. 0.40 hectares multiplied by 302 mm/year (representing areas where native soils will be at-surface not fill) for an annual recharge volume of 1,218 m^3.

The eastern infiltration area will provide groundwater recharge to, and discharge to, the eastern tributary.

It is also noted that the annual precipitation amounts are generally above the 1980-2010 climate normal of 946 mm/year. This analysis was of precipitation (both snow and rainfall), and it is noted that climate change modelling by the Grand River Conservation Authority has indicated future winters are expected to have less snow and greater precipitation (Shifflett, 2014).

Table 3 - Daily Precipitation Summary*

Year	Annual Precipitation (mm/% of average)	Days with 1-10 mm	Depth Sum of 1-10 mm Days (mm)	Days with 1-15 mm	Depth Sum of 1-15 mm Days (mm)	Days with 1-20 mm	Depth Sum of 1-20 mm Days (mm)
2013	1199 (127%)	152 (42%)	395	175 (48%)	686	184 (50%)	840
2014	1102 (116%)	152 (42%)	407	174 (48%)	677	177 (48%)	731
2015	866 (92%)	138 (38%)	386	149 (41%)	523	156 (43%)	643
2016 (Leap)	1032 (109%)	138 (38%)	420	151 (41%)	588	160 (44%)	740
2017	1110 (117%)	160 (44%)	488	175 (48%)	678	185 (51%)	853
2018	953 (101%)	146 (40%)	456	155 (42%)	564	166 (45%)	753
2019	Shand Dam and nearby meteorological stations had too many data gaps						
2020 (Leap)	1017 (108%)	123 (34%)	423	139 (38%)	622	147 (40%)	765
2021	878 (93%)	144 (39%)	428	150 (41%)	498	151 (41%)	516
Average	1,020 (108%)	144 (40%)	425	159 (43%)	605	166 (45%)	730
Median	1,025 (109%)	145 (40%)	422	153 (42%)	605	163 (45%)	747

Note: * - Shand Dam (Station 6142400) 1981-2010 Average Precipitation of 946 mm/year, 20 km away

Table 4 – Annual Estimated Recharge Rates

	Area (hectares)	Recharge (mm/year)	Volume (m^3)
Pre-development	13.86	340	**47,081**
Post-development	4.91 (clean impervious roof areas via 3rd pipe to infiltration systems)	605	29,706
	4.81 (pervious areas fill)	138	6,633
	0.40 (pervious areas native)	302	1,218
		SUM	**37,557**

4.5 Wetland Water Balance Analysis

Credit Valley Conservation (CVC) (AquaResource Inc., 2009), through the source water protection water budgeting exercise, have calculated average water balance results per CVC climatic zone, soil type and land use type. The wetlands downgradient of the Site are in climatic zone 1, with a #3 slope category (i.e. slope 3.01 degrees or greater), and hydrologic soil group "organic" based upon the site investigations (Section 3.7). The CVC reported annual results in mm were: (i) Precipitation 897, (ii) Evapotranspiration 578, (iii) Recharge 152 and (iv) Runoff 167. These results reflect the lower permeability of the uppermost soils of the wetlands as observed during installation of wetland monitoring locations.

A monthly water balance for the swamps was completed using the U.S. Geological Survey (USGS) Monthly Water Balance Model (McCabe and Markstrom, 2007), which considers direct precipitation only, not runoff to the wetland. For temperature and precipitation climate normal inputs, Environment Canada weather station, Shand Dam Station, ID 6142400 (Environment Canada, 2022) was used. The calculated annual surplus (Precipitation minus Evapotranspiration) of 401 mm was higher than that modelled by CVC, and may be a result of the more detailed CVC 1-hour model time steps. The monthly modelling wetland results (Table 5) are summarized below.

1. Potential evapotranspiration exceeded precipitation for June and July, i.e. soil water utilization occurred;
2. Swamp soil water holding capacities were less than saturated for the summer months, i.e. June through September; and
3. Soil water recharge occurred in September.

Table 5 – Monthly Wetland Water Balance (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	68	56	60	74	87	84	89	97	93	77	93	69
Potential (mm) Evapotranspiration	8	10	18	36	67	98	113	91	54	29	15	9
Soil Moisture (mm)	350	350	350	350	350	**332**	**305**	**306**	**340**	350	350	350
Soil Water Depletion (mm)						18	45	44	10			

4.6 Maintenance of the Wetland Water Balance

The water balances for the wetlands can be maintained post-development (Table 6). The Table 6 details are explained below:

1. Direct precipitation will continue to the wetlands.

2. Pre-development groundwater recharge rates will be maintained immediately upgradient of the wetlands because development is set-back from the wetlands, i.e. 0.78 ha for Wetland 4a (SWM4-1) and 1.51 ha for Wetland 5a (SWM3-2).

3. Discontinued use of the irrigation pond downgradient of Wetland 4a, as it is possible the pond lowered groundwater levels below the wetland during summer months.

4. Stormwater management infiltration of clean roof runoff will occur at the two proposed infiltration facilities upgradient of the wetlands providing infiltration of events up to 15 mm.

5. Lot-level infiltration will occur in pervious areas upgradient on-site.

Table 6 – Annual Estimated Upgradient Wetland Recharge

Wetland 4a Catchment	**Area – on and off-site (hectares)**	**Recharge (mm/year)**	**Volume (m^3)**
Pre-development	2.16	374	**8,078**
Post-development	0.96 (clean roof runoff infiltrated at SWM LID)	605	5,808
	0.78 (preserved off-site upgradient buffer area)	374	2,917
	0.39 (pervious drainage upgradient on-site)	138	538
		SUM	**9,263**
Wetland 5a Catchment	**Area – on and off-site (hectares)**	**Recharge (mm/year)**	**Volume (m^3)**
Pre-development	7.56	359	**27,140**
Post-development	3.95 (clean roof runoff infiltrated at SWM LID)	605	23,898
	1.51 (preserved off-site upgradient buffer area)	374	5,647
	1.86 (pervious drainage upgradient on-site)	138	2,567
		SUM	**32,112**

4.7 Wetland Risk Evaluation

4.7.1 Magnitude of Hydrological Change

TRCA's wetland risk evaluation decision tree (Figure 6) includes four key hydrological change criteria (2017):

1. Change in catchment size;
2. Impact to recharge areas;
3. Impervious cover in catchment; and

4. Dewatering.

"*The highest magnitude category with one or more criteria satisfied determines the potential magnitude of change*" (TRCA, 2017).

(1)(2) The upgradient groundwater catchments for the downgradient PSW wetlands will be reduced, as well as their associated recharge areas as there will be "*replacement of existing soils with significantly less permeable materials*". The Wetland 4a catchment will be reduced from 2.16 ha to 0.78 ha (64% reduction) and the Wetland 5a catchment will be reduced from 7.56 ha to 1.51 ha (80% reduction). These changes meet the criteria for high magnitude of hydrological change as they are greater than 25%. However, this is without consideration of SWM LID mitigation measures, or consideration of on-site recharge (Section 4.6).

(3) Impervious cover in the upgradient catchments on-site are 72 and 69%, which equate to 46 and 55% of the total wetland catchments for Wetland 4a and Wetland 5a, respectively. These changes meet the criteria for high magnitude of hydrological change as they are greater than 25%. However, this is without consideration of SWM LID mitigation measures.

(4) Dewatering activities may occur during installation of on-site services and construction of basements. However, dewatering needs are expected to be limited to the south and some southwest portions of the Site, given most of the site is planned to receive fill for development (Urbantech, 2022). Given these details remain to be further refined, and the hydrologic risk evaluation is already classified as high based upon the factors (1)(2) and (3) it is suggested this portion of the risk analysis can be completed in future and utilize the existing monitoring network if impacts are a potential concern.

4.7.2 Sensitivity of the Wetlands

The risk assignment (Figure 6) is also to consider the type of wetland and their hydrological sensitivity (TRCA, 2017), downgradient of the Site:

(i) Wetland 4a is mapped as cedar hardwood organic mixed swamp (SWM4-1) which has a High Hydrological Sensitivity; and
(ii) Wetland 5a is mapped as poplar conifer mineral mixed swamp (SWM3-2) which has a Medium Hydrological Sensitivity.

4.7.3 Risk Assignment

The cedar hardwood organic mixed swamp (SWM4-1) receives a High-Risk assignment, having a high hydrological sensitivity and a high magnitude of hydrological change (Figure 6). However, the poplar conifer mineral mixed swamp SWM3-2 receives a Medium Risk assignment because of having a medium hydrological sensitivity although having a high magnitude of hydrological change (Figure 6).

The recommended study, modelling and mitigation requirements are similar for high and medium risks, i.e. similar levels of effort for considering Wetlands 4a and 5a:

(i) Pre-development monitoring is required as outlined in the Wetland Water Balance Monitoring Protocol (TRCA, 2016).
- This monitoring of both wetlands began in August 2021 and is continuing.

(ii) Continuous hydrological modelling is required at daily aggregated to weekly resolution.
- Existing annual HSP-F modelling (completed at 1-hour time steps) completed for CVC was utilized for this report (AquaResource Inc., 2009). This existing work could be re-visited to extract the weekly results, however it is unclear the direct benefit of doing so at this time.

(iii) Design of a mitigation plan to maintain the wetland water balance, in some cases an interim mitigation plan may also be required.
- This has already been prepared as briefly outlined herein and presented in detail in Urbantech (2022).

(iv) Additional emphasis placed on characterization of groundwater interaction [High Risk only, i.e. Wetland 4a]
- Monitoring is on-going with respect to this concern.

(v) Integrated hydrological model may be required where groundwater interaction is high [High Risk only, i.e. Wetland 4a]
- The existing CVC FEFlow model (AquaResource Inc., 2009) can be used if required, however it is unclear of the direct benefit of doing so at this time given the conceptual model appears well understood.

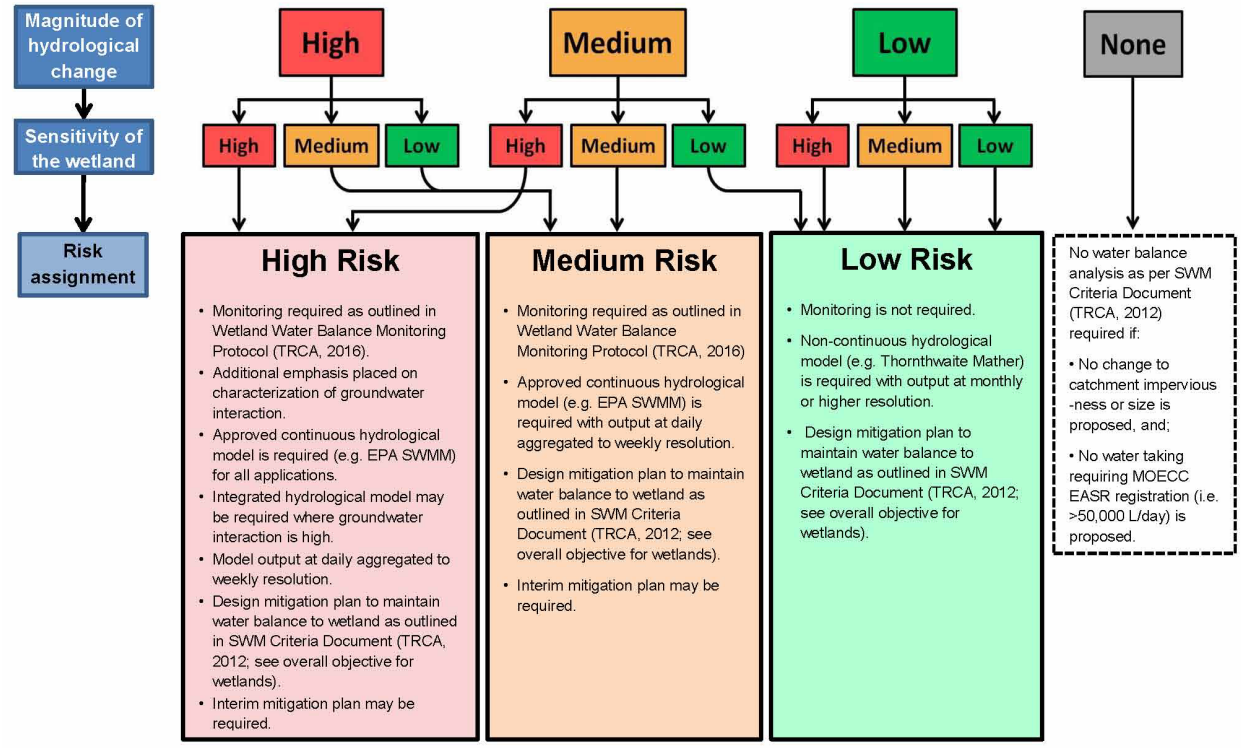


Figure 6 - Wetland Risk Evaluation Decision Tree

5.0 Source Water Protection Policy Implementation

5.1 Section 59 Notice Evaluation

Site development will include a Section 59 notice evaluation by Wellington County source water protection risk management staff. The '*Section 59 process*' is a review process to ensure that the Site design complies with the required source water protection policies. The policies requiring compliance concern the prevention of significant water quality threats to Municipal Well E8 serving the Town of Erin.

5.2 Significant Threat Management

Source water protection policies SWG-13/SWG-14: If sanitary sewer pipes are proposed within the WHPA-A they will require higher than normal construction and operational standards in order to not be a significant municipal drinking water threat. However, the specifics of these higher standards are not yet available from the municipal staff involved. Source water protection policies SWG-13 and SWG-14 do not require these standards outside the WHPA-A, however such standards may be requested outside the WHPA-A. Parklands are currently proposed for the portion of WHPA-A within the Site. However, it is expected that the sanitary main will be located along 8th Line right-of-way and therefore pass through the WHPA-A and require additional standards for implementation.

Source water protection policies SWG-11(1)/SWG-12(1): Stormwater management facilities, including outlets and infiltration are prohibited within the WHPA-A. One of the water quality concerns for the municipal well is road salt contamination of the municipal water supply. Source water protection policies SWG-11(1) and SWG-12(1) do not require these standards outside the WHPA-A. It is noted CVC (2012) has stated that "*infiltration from "clean" water sources such as roof runoff….will be encouraged in these areas*".

5.3 Road Salt and Snow Storage Management

Road salting, road salt storage, and snow storage are drinking water threats that are associated with urban/developed areas. However, the water quality threat level classification (significant, moderate or low) of these activities is based upon the vulnerability zone (and associated vulnerability score) and activity details as will be explained below.

Road salting and road salt storage are calculated as low water quality threats for the Site, given the area of the WHPA-A is planned to be a park (Armstrong, 2021) without roadways or road salt storage. Snow storage would also be a low threat within WHPA-B for snow storage areas between 0.01 and 0.5 hectares in size; however, snow would not be expected to be stored at the park as it would have to be moved across the stormwater management facility.

Source water protection policy SAL-10: this policy concerns application of road salt and is a '*have-regard-to*" policy not an enforcement policy. This policy advocates development of a salt management plan for the development of the Site including "*directing stormwater discharge outside of vulnerable areas where possible*". Wellington Source Water Protection have recommended the stormwater management facility "*have an impervious liner to avoid recharge of water containing contaminants,*

particularly sodium and chloride, back to the aquifer" (2021) which could be considered unnecessary as downgradient surface water discharge would be expected to infiltrate into the shallow sand unit.

Section 5.4 Existing transport pathways and creation of transport pathways

Transport pathways are created features that could promote 'transport' of contaminants to a water supply aquifer, e.g. unused water supply or monitoring wells.

There is an existing water supply well at the Site, MECP water well record 6700766 (Figure 2) which is listed on the PTTW as the Club House Well. This well will be decommissioned by an Ontario-licensed water well driller once no longer required for golf course operations.

There are monitoring wells located on the Site which will be decommissioned by an Ontario-licensed water well driller once they are no longer required for monitoring purposes.

Section 5.5 Water Quantity

As stated by Wellington County source water protection risk management staff (Vandermeulen, 2021), "*There are currently no Clean Water Act requirements related to the management of the water quantity*…". However, recharge at the Site will be maintained to at least 80%, and maintained to pre-development rates to the downgradient wetlands.

6.0 Conclusions and Recommendations

The following conclusions are provided:

1. There are no watercourses at the Site.

2. Downgradient of the Site is the Erin Branch of the West Credit River, which has perennial flow and a cold-water regime. Analyses of West Credit River flows, upstream of the Site and municipal well E8, indicated a baseflow/groundwater discharge component of 71%. However, baseflow measurements downgradient of the Site have indicated both groundwater discharge and groundwater recharge conditions.

3. Calculated on-site soil infiltration rates were greater than 15 mm/hour, including areas of >50 mm/hour.

4. Surficial geology ranged from gravel and gravelly sand, to silty sand and silt, with a thickness of approximately 3 metres above the underlying silty sand to sandy silt till aquitard.

5. Shallow groundwater flow follows the site topography with flow to the north-northwest. The April 2021 spring water table was generally 1 m below ground surface where mapped.

6. Bedrock groundwater levels at the Erin Branch of the West Credit River are above ground surface when municipal well E8 is not operating.

7. The natural vulnerability of the bedrock aquifer supplying municipal well E8 is medium to low beneath the Site because of overlying aquitard material.

8. Municipal well E8 wellhead protection areas (WHPAs) extend beneath the Site. Policies requiring compliance at the Site concern the WHPA-A, which covers 0.64 hectares of the northwest corner of the Site. This area is proposed to be a park in order to protect the water quality of the municipal well.

9. Highly Vulnerable Aquifer mapping of the Site is related to the overlying sand and gravel, which is not a potable water supply on-site, nor immediately downgradient.

10. CVC annual water balance modelling results for the Site were precipitation (897 mm), evapotranspiration (402-408 mm/year), runoff (114-122 mm/year) and recharge (368-381 mm/year). Considering soil conditions at the Site and existing impervious areas, the pre-development recharge rate for the Site is 340 mm/year.

11. Annual precipitation on average totals (i) 422 mm/year for precipitation events of 10 mm or less, (ii) 605 mm/year for precipitation events of 15 mm or less and (iii) 747 mm/year for events of 20 mm or less.

12. The pre-development recharge rate can be maintained to 80% with a combination of (a) infiltration of 'clean' runoff from precipitation events of 15 mm or less, and (b) permeable area recharge.

13. Provincially significant wetlands, located downgradient of the Site, are identified as mixed swamp cedar hardwood organic (4a SWM4-1), and poplar conifer mineral (5a SWM3-2). These are classified as groundwater slope wetlands with high and medium hydrological sensitivity, respectively.

14. Monitoring of water levels at the wetlands since August 2021 have showed the:

    a. Cedar swamp as generally under recharge conditions with groundwater levels within 0.5 m of surface in fall and winter after some recovery from the summer period; and
    b. Poplar swamp showing seasonal water level variability with water levels during the fall and winter close to surface.

15. CVC wetland annual water balance modelling rates for the types of wetlands identified at the Site were precipitation (897 mm/year), evapotranspiration (578 mm/year), runoff (167 mm/year) and recharge (152 mm/year).

16. A monthly water balance for the wetlands indicated that soil water holding capacities are expected to be less than saturated during the summer months of June to September.

17. Groundwater recharge rates upgradient of the wetlands can be maintained from infiltration of (a) clean roof runoff at LID facilities, (b) preserved buffer areas and (c) pervious areas.

18. The developed wetland risk assignment is high for Wetland 4a, and medium for Wetland 5a. According to the Wetland Risk Evaluation this requires: (i) pre-development monitoring, which is already occurring, (ii) continuous hydrological modelling, which already exists and has been used in this report, and (iii) design of a mitigation plan which has been completed. For the Wetland 4a, given the high-risk assignment, (i) additional groundwater characterization is required which is on-going and (ii) potential use of an integrated hydrology model, which is available as already prepared for CVC, the FEflow model.

19. If sanitary infrastructure is required within the municipal well E8 WHPA-A, higher than standard construction/monitoring requirements must be implemented. These requirements have not been specified as yet by municipal staff. However, it is expected that the sanitary main will be located along 8th Line right-of-way, not on-site, and therefore pass through the WHPA-A and require the additional standards for implementation.

20. Stormwater management facilities are prohibited within the municipal well E8 WHPA-A; however, CVC's stormwater management criteria (2012) state that "*infiltration from "clean" water sources such as roof runoff...will be encouraged in these areas*".

The following recommendations are provided:

1. Continue the surface water and groundwater monitoring program to further define background conditions as recommended as part of the outcome of the Wetland Risk Evaluation;

2. Submit our report to CVC and the Town of Erin and receive clarification regarding (a) if a private water well survey is required and (b) groundwater quality parameters required for analyses;

3. Fill texture to be classified as loam or a material with a higher infiltration rate than silt.

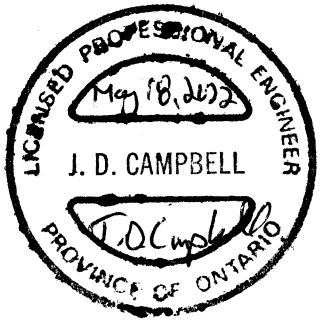
We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.

Jayme D. Campbell, P. Eng.
Senior Water Resources Engineer

Annie Michaud, M.Eng., P. Eng.
Senior Water Resources Engineer



cc.
Carleigh Oude-Reimerink, Senior Planning, Project Manager, Armstrong Planning & Project Management
Dragan Zec and Kate Rothwell, Urbantech Consulting
Steven Leslie, WSP

Attachments
Figure 1 – Location of Subject Lands
Figure 2 – Site Details
Figure 3 – Geological Cross-Section A-A'
Figure 5 – Surface water/Groundwater Flow
Appendix A - Hydrographs
Appendix B – Borehole logs
Appendix C – Grain-size Hydraulic Conductivity Analyses
Appendix D – Provincial Maps

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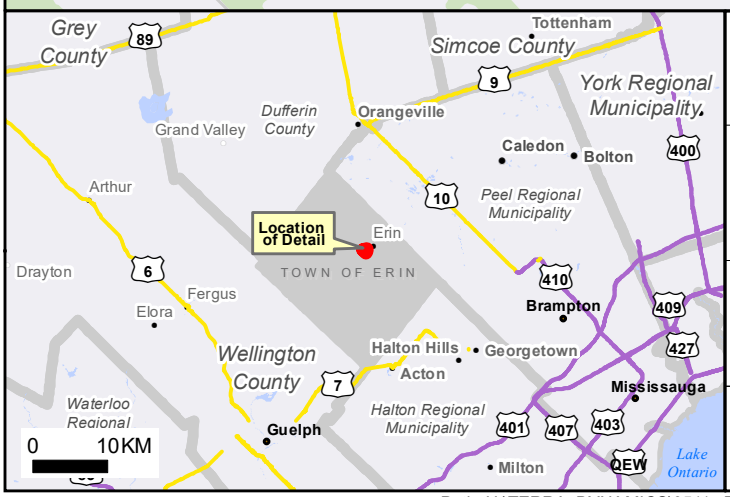


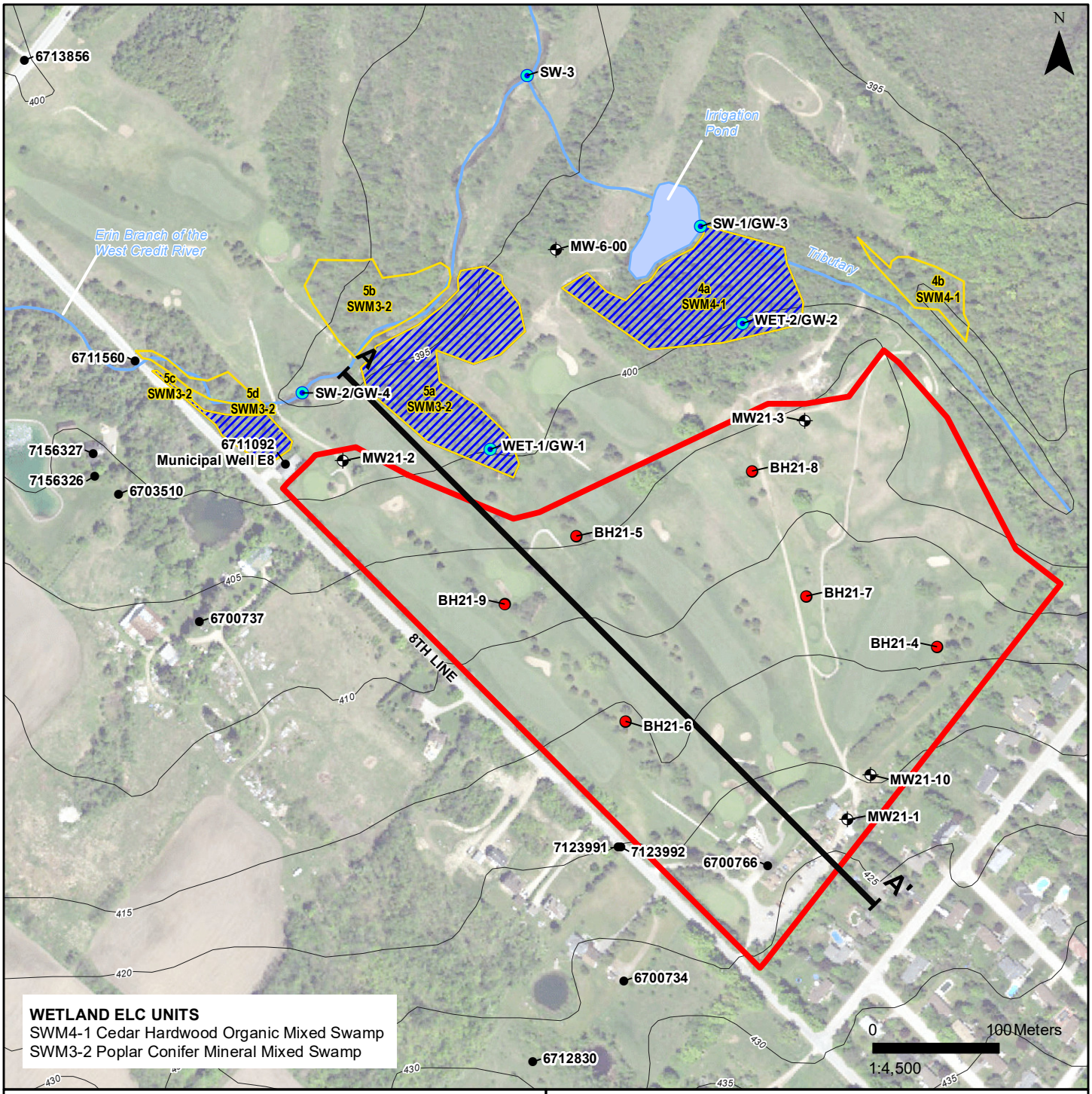
Site Location

Erin Fairways Subdivision
5525 8th Line, Town of Erin, ON
EC (Erin) GP Inc.

TDC Terra-Dynamics Consulting Inc.

Figure 1

Path: H:\TERRA_DYNAMICS\9511 - TD Empire Erin\gis\mxd\Figure 1 Location of Subject Lands.mxd Revised: January 21, 2022



- Subject Lands
- Wetlands
- Irrigation Pond
- Ecological Land Classification
- Geologic Cross-section Location
- Ground Surface Contour (5m)
- Watercourse
- Geotechnical Borehole
- Monitoring Well
- Water Well Record (MECP)
- Drive-point Piezometers and Staff Gauges

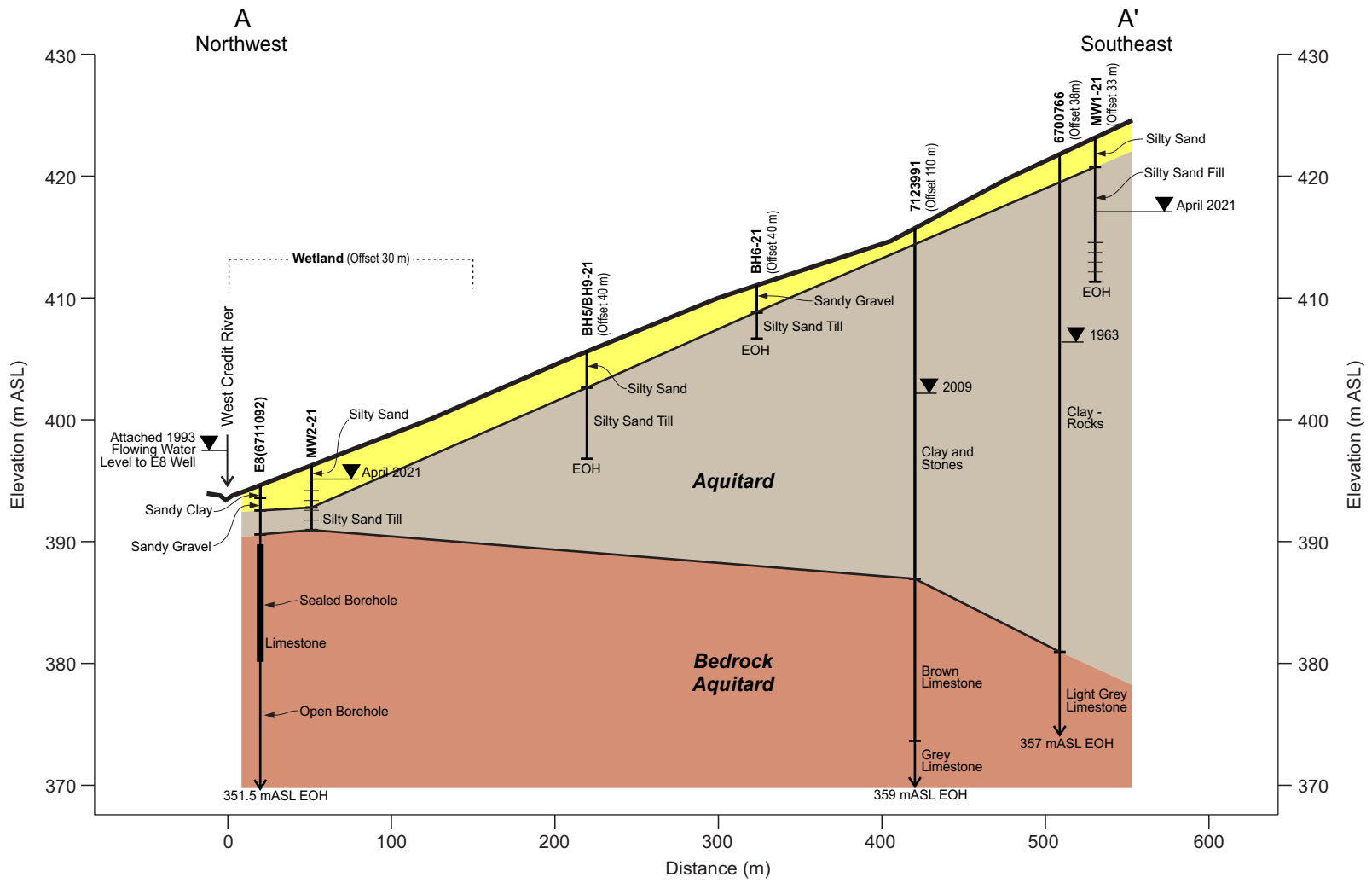
Site Details

Erin Fairways Subdivision
5525 8th Line, Town of Erin, ON
EC (Erin) GP Inc.

TDC Terra-Dynamics Consulting Inc.

Figure 2

Path: H:\TERRA_DYNAMICS\9511 - TD Empire Erin\gis\mxd\Figure 2 Site Details.mxd Revised: January 21, 2022



Borehole
Well Screen
EOH End of Hole
Waterlevel

Sand/Gravel
Silty Sand Till
Bedrock

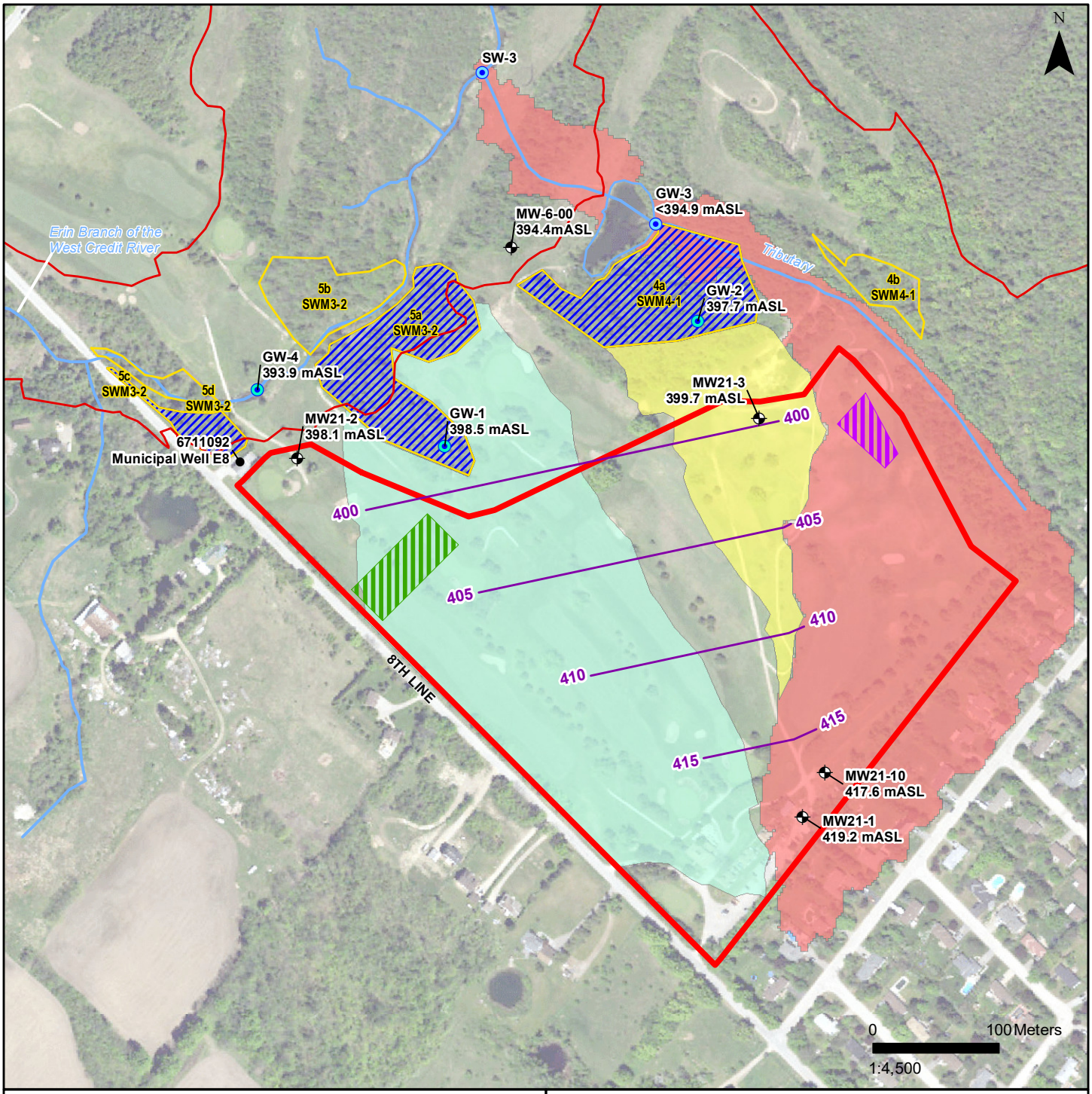
Geologic Cross-section A-A'

Erin Fairways Subdivision
5525 8th Line, Town of Erin, ON
EC (Erin) GP Inc.

Terra-Dynamics Consulting Inc.

Figure 3

H:\TERRA_DYNAMICS\9511 - TD Empire Erin\corel\Figure 3 Geologic Cross-section A-A'.cdr Revised: April 8, 2022



Subject Lands
Wetlands
Ecological Land Classification
Area for Infiltration of Clean Water
Surface Infiltration Gallery
Watercourse
Monitoring Well
Water Well Record (MECP)
Drive-point piezometers – groundwater levels November 10, 2021
Shallow Groundwater Flow Contour (December 14, 2021)
Floodplain (Credit Valley Conservation 2008)

Catchment Areas
Wetland 4a
Wetland 5a
Tributary

Surface water / Groundwater Flow

Erin Fairways Subdivision
5525 8th Line, Town of Erin, ON
EC (Erin) GP Inc.

TDC Terra-Dynamics Consulting Inc.

Figure 5

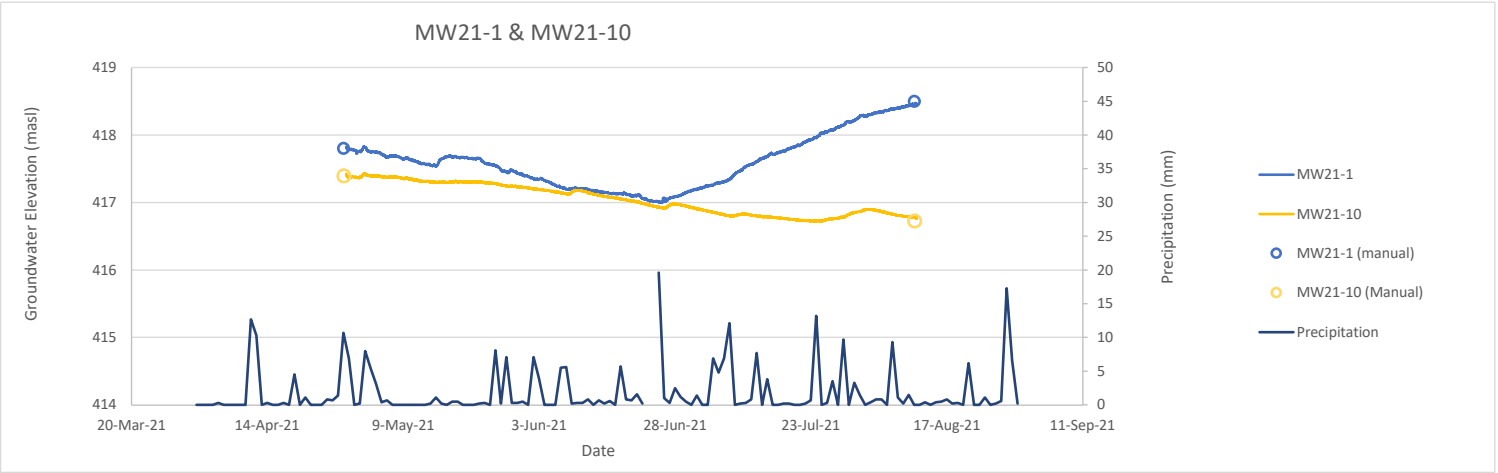
Path: H:\TERRA_DYNAMICS\9511 - TD Empire Erin\gis\mxd\Figure 5 Surfacewater Groundwater flow.mxd Revised: April 8, 2022

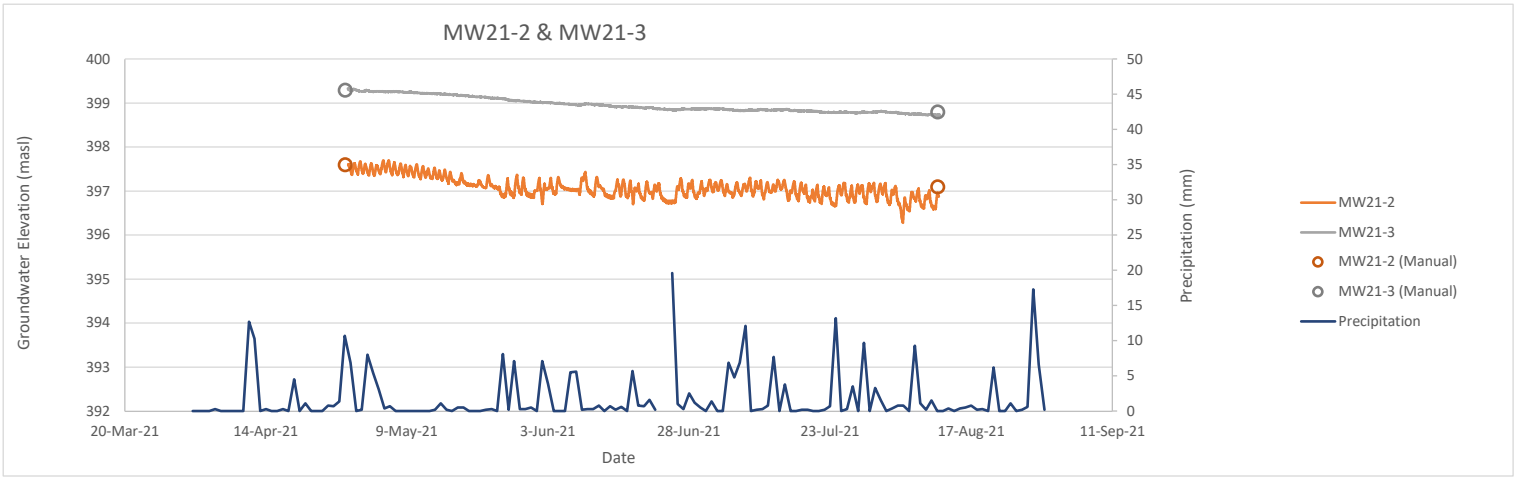
Appendix A

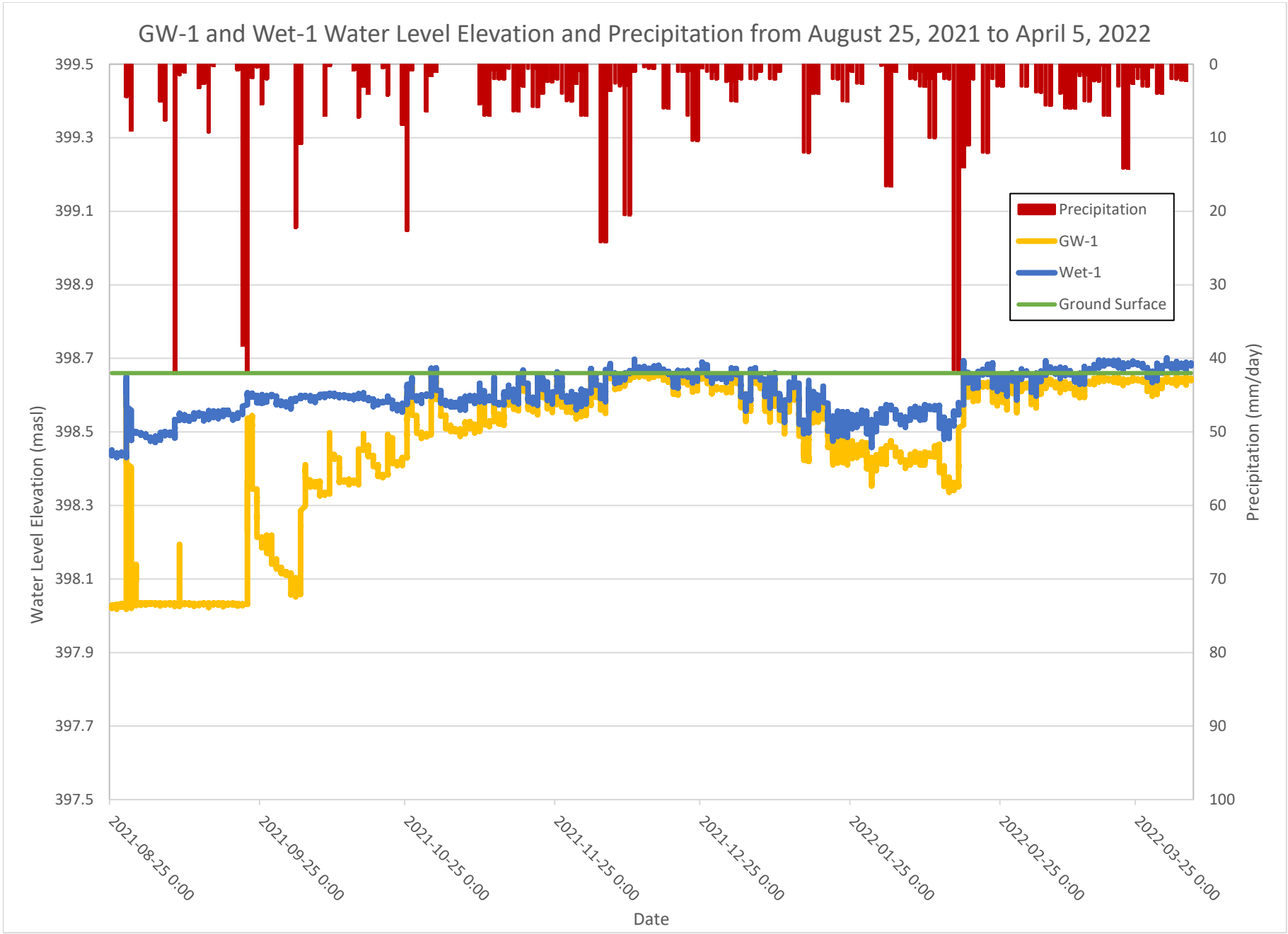
Hydrographs

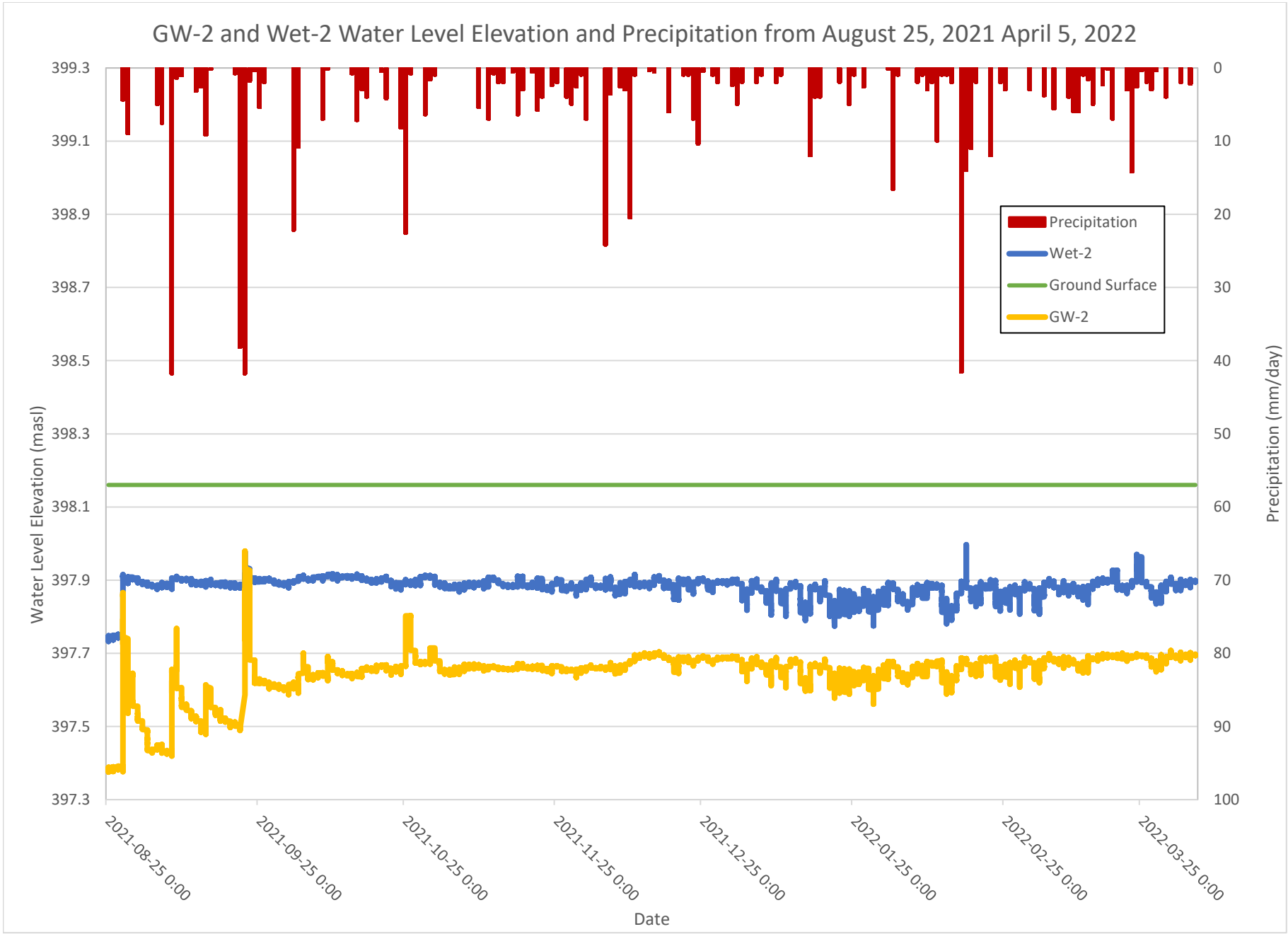
Erin Heights Golf Course Hydrographs

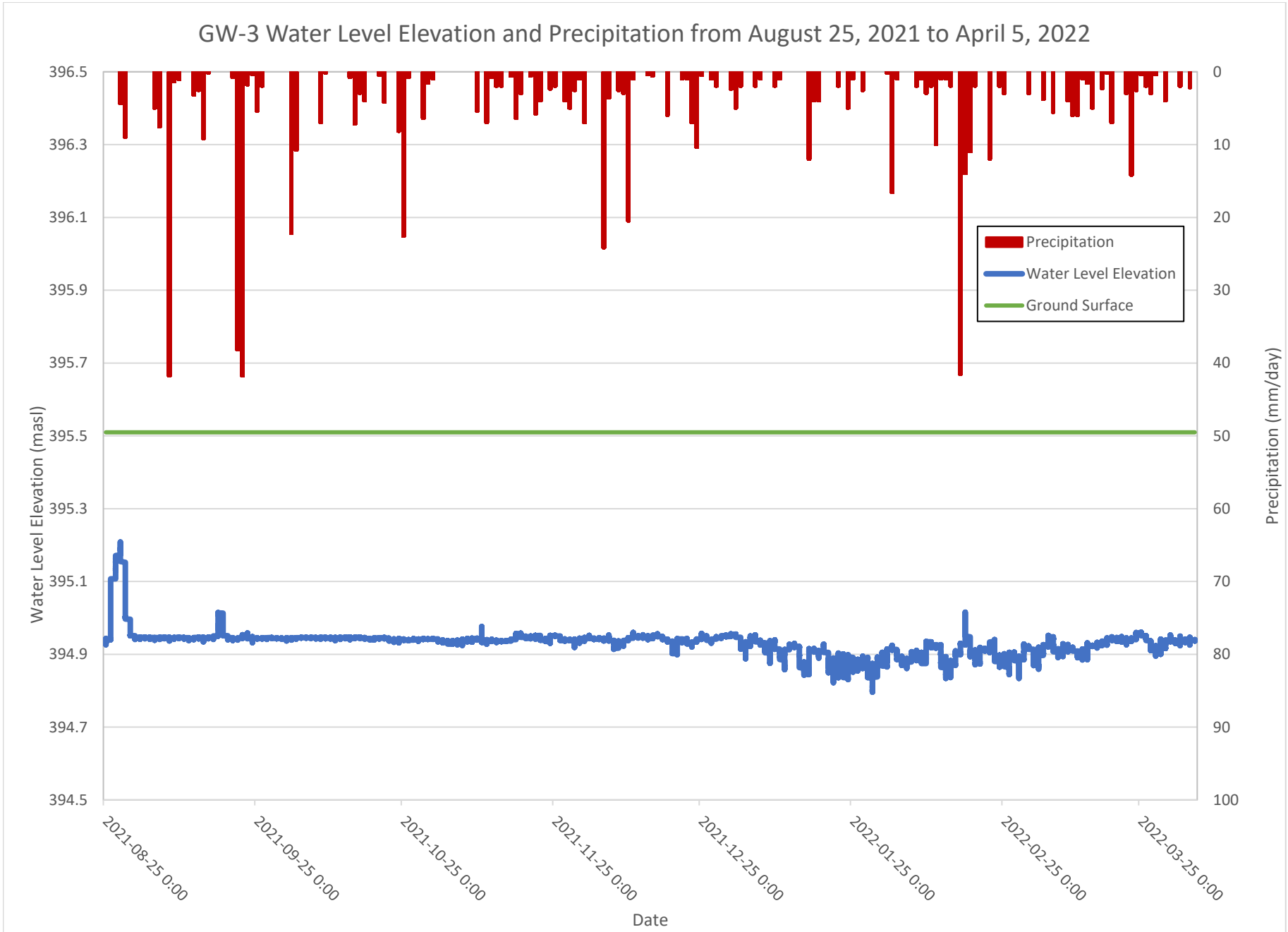
	Ground Surface (masl)	28-Apr-21		11-Aug-21	
		WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)
BH21-1	422.8	5.0	417.8	3.3	419.5
BH21-2	398.8	1.2	397.6	1.7	397.1
BH21-3	405.7	6.3	399.3	6.9	398.8
BH21-10	419.1	1.7	417.4	2.4	416.7

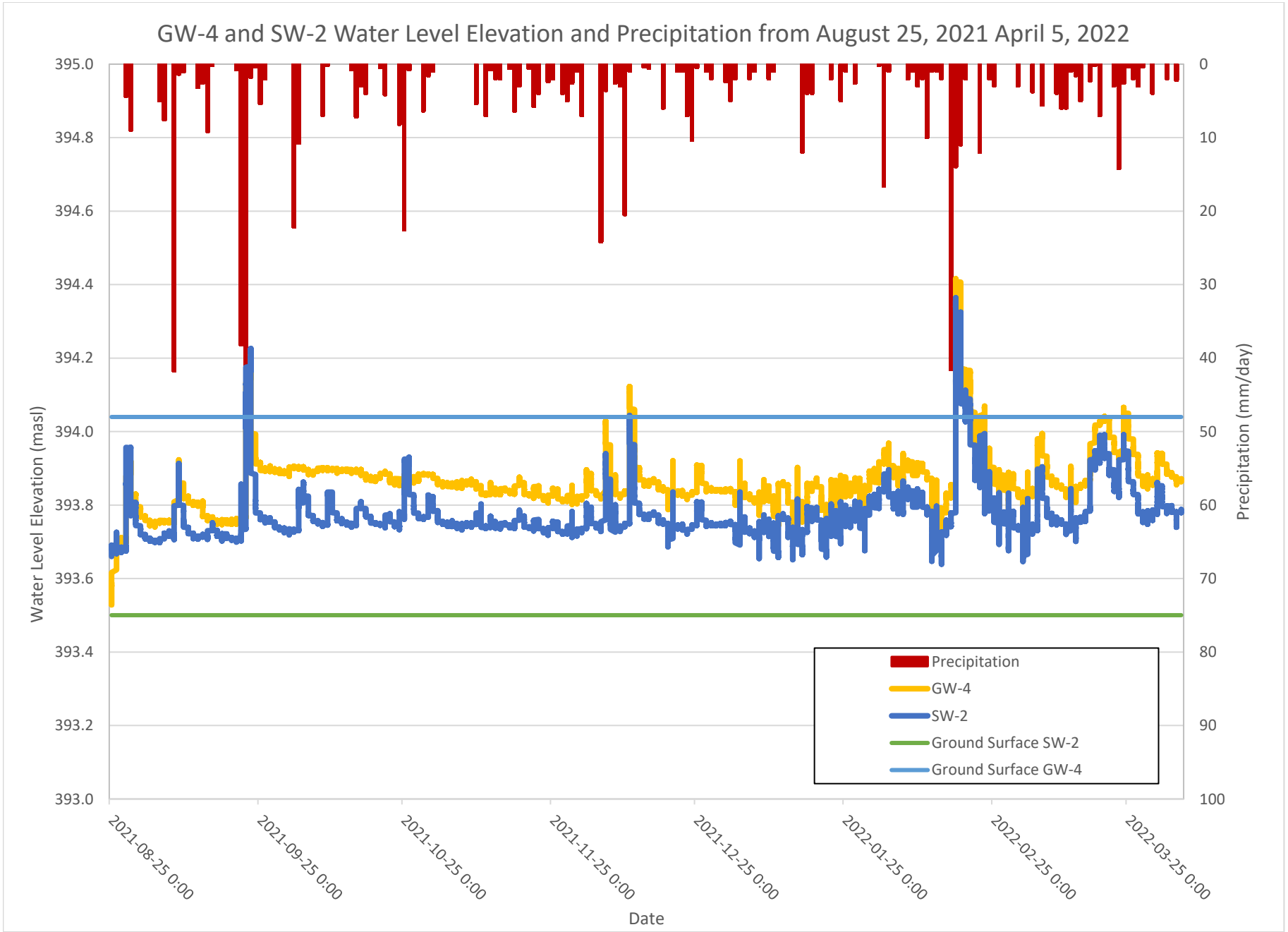


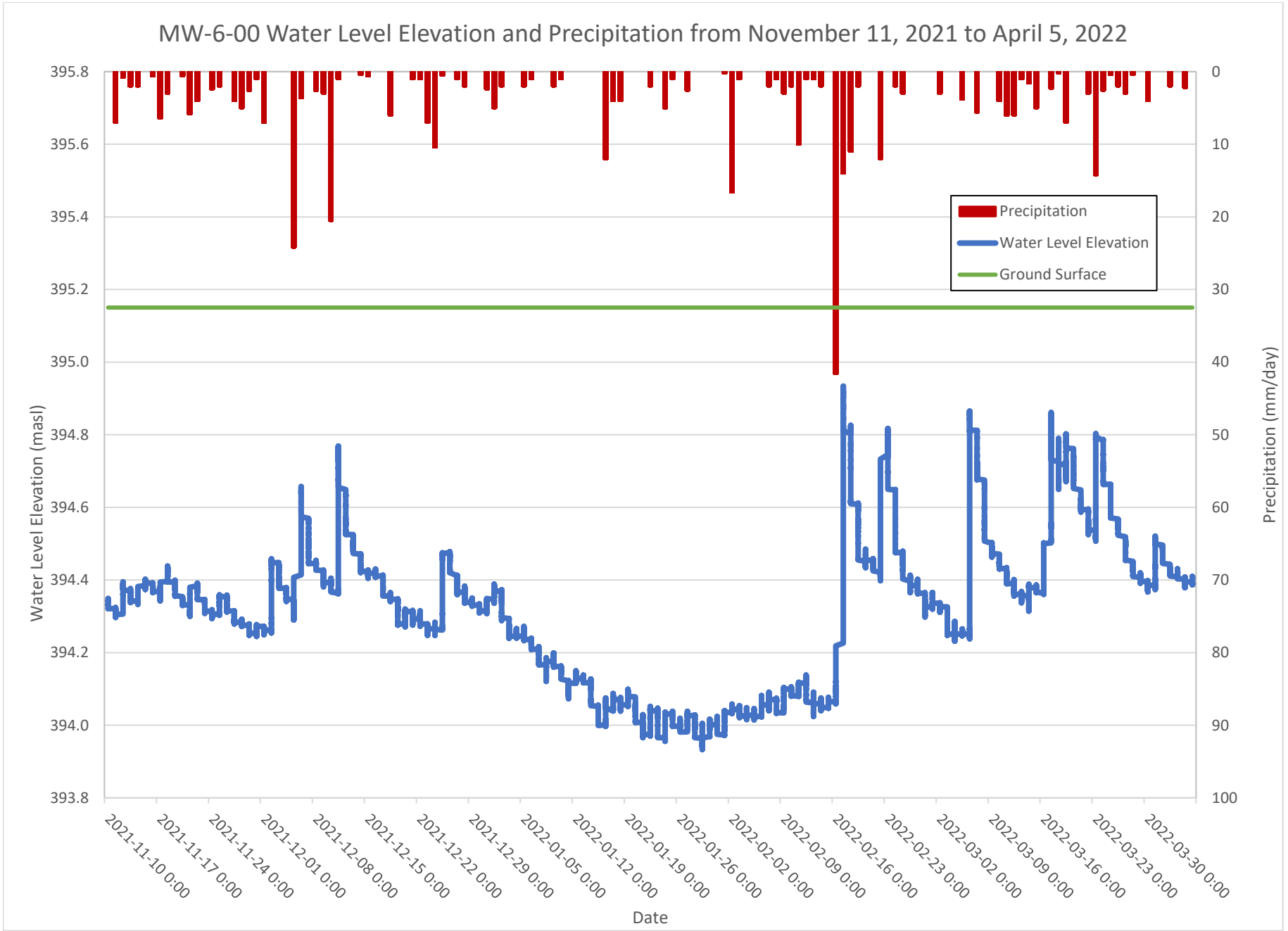



GW-1 and Wet-1 Water Level Elevation and Precipitation from August 25, 2021 to April 5, 2022
Water Level Elevation (masl)
399.5
399.3
399.1
398.9
398.7
398.5
398.3
398.1
397.9
397.7
397.5
Precipitation (mm/day)
0
10
20
30
40
50
60
70
80
90
100
Precipitation
GW-1
Wet-1
Ground Surface
2021-08-25 0:00
2021-09-25 0:00
2021-10-25 0:00
2021-11-25 0:00
2021-12-25 0:00
2022-01-25 0:00
2022-02-25 0:00
2022-03-25 0:00
Date


GW-2 and Wet-2 Water Level Elevation and Precipitation from August 25, 2021 April 5, 2022
Water Level Elevation (masl)
399.3
399.1
398.9
398.7
398.5
398.3
398.1
397.9
397.7
397.5
397.3
Precipitation (mm/day)
0
10
20
30
40
50
60
70
80
90
100
Precipitation
Wet-2
Ground Surface
GW-2
2021-08-25 0:00
2021-09-25 0:00
2021-10-25 0:00
2021-11-25 0:00
2021-12-25 0:00
2022-01-25 0:00
2022-02-25 0:00
2022-03-25 0:00
Date


GW-3 Water Level Elevation and Precipitation from August 25, 2021 to April 5, 2022
Water Level Elevation (masl)
396.5
396.3
396.1
395.9
395.7
395.5
395.3
395.1
394.9
394.7
394.5
Precipitation (mm/day)
0
10
20
30
40
50
60
70
80
90
100
Precipitation
Water Level Elevation
Ground Surface
2021-08-25 0:00
2021-09-25 0:00
2021-10-25 0:00
2021-11-25 0:00
2021-12-25 0:00
2022-01-25 0:00
2022-02-25 0:00
2022-03-25 0:00
Date


GW-4 and SW-2 Water Level Elevation and Precipitation from August 25, 2021 April 5, 2022
Water Level Elevation (masl)
Precipitation (mm/day)
Date
395.0
394.8
394.6
394.4
394.2
394.0
393.8
393.6
393.4
393.2
393.0
0
10
20
30
40
50
60
70
80
90
100
2021-08-25 0:00
2021-09-25 0:00
2021-10-25 0:00
2021-11-25 0:00
2021-12-25 0:00
2022-01-25 0:00
2022-02-25 0:00
2022-03-25 0:00
Precipitation
GW-4
SW-2
Ground Surface SW-2
Ground Surface GW-4


MW-6-00 Water Level Elevation and Precipitation from November 11, 2021 to April 5, 2022
Water Level Elevation (masl)
Precipitation (mm/day)
Date
Precipitation
Water Level Elevation
Ground Surface
395.8
395.6
395.4
395.2
395.0
394.8
394.6
394.4
394.2
394.0
393.8
0
10
20
30
40
50
60
70
80
90
100
2021-11-10 0:00
2021-11-17 0:00
2021-11-24 0:00
2021-12-01 0:00
2021-12-08 0:00
2021-12-15 0:00
2021-12-22 0:00
2021-12-29 0:00
2022-01-05 0:00
2022-01-12 0:00
2022-01-19 0:00
2022-01-26 0:00
2022-02-02 0:00
2022-02-09 0:00
2022-02-16 0:00
2022-02-23 0:00
2022-03-02 0:00
2022-03-09 0:00
2022-03-16 0:00
2022-03-23 0:00
2022-03-30 0:00

Appendix B

Borehole Logs

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE MW21-1

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846537.081 E 573786.33

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-15-2021

REF. NO.: 21-129-300
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
422.8					
422.7 / 0.1	**GRANULAR FILL:** 50mm				
	SILT AND SAND: trace gravel, trace clay, brown, moist, loose to compact	1	SS	9	
		2	SS	15	422
		3	SS	22	421
420.7 / 2.1	**SILTY SAND TILL:** some gravel, some clay, cobble/boulder sizes, brown, moist, very dense	4	SS	76	420
		5	SS	50/ 25mm	
					Bentonite 419
		6	SS	50/ 50mm	418
					W. L. 417.8 m Apr 28, 2021
					417
		7	SS	50/ 50mm	
					416
	wet below 7.6m	8	SS	87	415
					Filter Pack
		9	SS	50/ 25mm	Slotted Pipe
					413
411.8 / 11.0	**END OF BOREHOLE:**	10	SS	50/ 75mm	412

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
April 28, 2021	5.0

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
1	9	46	37	8
8	11	45	31	13

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE MW21-2

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846813.344 E 573411.482

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-19-2021

REF. NO.: 21-129-300
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
398.8												
0.0 / 398.4	**TOPSOIL:** 350mm		1	SS	10							1 58 35 6
0.4	**SILTY SAND:** trace to some gravel, trace clay, brown, moist, loose to compact		2	SS	13		398					
	wet below 1.5m		3	SS	8		W. L. 397.6 m Apr 28, 2021 / 397 Bentonite					
			4	SS	12		396					
			5	SS	17		395					
			6	SS	31		394 Filter Pack / Slotted Pipe					10 69 (22)
392.7 / 6.1	**SILTY SAND TILL:** some clay, cobble/boulder sizes, brown, moist, very dense		7	SS	62		392					
390.9			8	SS	50/ 25mm		391					
7.9	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): April 28, 2021 1.18											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE MW21-3

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846862.76 E 573771.456

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-16-2021

REF. NO.: 21-129-300
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
405.7					
0.0 / 405.4	**TOPSOIL:** 250mm	1	SS	4	
0.3	**FILL**: sand, some silt to silty, some gravel, trace clay, trace organics, brown, moist, loose to compact	2	SS	6	405
		3	SS	8	404
		4	SS	22	403
402.7					
3.0	**SILTY SAND:** trace gravel, trace clay, brown, moist to wet, compact to dense	5	SS	15	402
	wet below 4.6m	6	SS	31	401
399.6					400
6.1	**SILTY SAND TILL:** gravelly, brown, wet, compact	7	SS	12	
	layer of sand, medium to coarse	8	SS	12	398
397.5					
8.2	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
April 28, 2021	6.33

Bentonite
Filter Pack
Slotted Pipe
W. L. 399.3 m
Apr 28, 2021

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
1	14	67	15	4
5	4	59	32	5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-4

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846678.156 E 573864.767

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-15-2021

REF. NO.: 21-129-300
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
414.1							414
0.0 / 413.8	**TOPSOIL:** 250mm		1	SS	2		
0.3	**FILL**: silty sand, some gravel, trace clay, brown, moist, loose		2	SS	6		413
1			3	SS	9		
2 / 411.8							412
2.3	**SILTY SAND TILL:** cobble/boulder sizes, brown, moist to wet, very dense		4	SS	50/ 25mm		
3			5	SS	50/ 50mm		411
4	wet below 4.6m		6	SS	50		410
5							409
6			7	SS	50/ 75mm		408
7 / 406.4							407
7.7	**END OF BOREHOLE:**		8	SS	50/ 50mm		

Notes:

1) Water level in open borehole:

Date:	Water Level (mbgl):
on completion	4.6

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
16	44	32	8

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-5

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846760.737 E 573587.463

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-16-2021

REF. NO.: 21-129-300
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
404.9												
404.7	**TOPSOIL:** 200mm											
0.2	**FILL**: silty sand, gravelly, trace clay, brown, wet, loose		1	SS	4							
1			2	SS	4		404					24 41 29 6
403.4												
1.5	**SILTY SAND**: trace gravel, brown, moist to wet, compact		3	SS	11		403					
2	wet below 2.3m		4	SS	15							
3			5	SS	25		402					
400.3												
4.6	**SILTY SAND TILL:** cobble/boulder sizes, brown to grey, moist, very dense		6	SS	50		401					
5							400					
6			7	SS	50/ 50mm		399					
7							398					
396.9			8	SS	50/ 100mm		397					
8.0	**END OF BOREHOLE:**											

Notes:

1) Water level in open borehole:

Date:	Water Level (mbgl):
on completion	2.3

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-6

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846610.242 E 573617.42

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-16-2021

REF. NO.: 21-129-300
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
415.3												
415.0 0.0	**TOPSOIL:** 200mm											
0.2	**SANDY GRAVEL**: some silt, brown, moist, compact to dense		1	SS	17		415					
1			2	SS	48							54 32 (14)
413.8							414					
1.5	**SILTY SAND TILL:** cobble/boulder sizes, brown to grey, moist, compact to very dense		3	SS	19							
2			4	SS	27		413					
3			5	SS	44		412					
4			6	SS	29		411					
5							410					
6			7	SS	71		409					
7							408					
8			8	SS	81							
407.1												
8.2	**END OF BOREHOLE:** Notes: 1) Borehole open and dry upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-7

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846717.062 E 573766.909

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-15-2021

REF. NO.: 21-129-300
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
412.0							
412.0 / 0.1	**TOPSOIL:** 100mm						
	SAND AND GRAVEL: some silt, brown, moist, loose to very dense		1	SS	4		
			2	SS	65		411
			3	SS	50/ 100mm		
409.7							410
2.3	**SILTY SAND TILL:** cobble/boulder sizes, brown to grey, moist to wet, compact to very dense		4	SS	28		
	wet below 3m depth		5	SS	18		409
			6	SS	50/ 25mm		408
			7	SS	50/ 25mm		407
404.3							406
7.7	**END OF BOREHOLE:**		8	SS	50/ 25mm		405

Notes:

1) Water level in open borehole:

Date:	Water Level (mbgl):
on completion	3.0

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
36	47		(17)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-8

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846819.483 E 573729.609

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-16-2021

REF. NO.: 21-129-300
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
407.7							
407.6 0.0	**TOPSOIL:** 150mm						
0.2	**GRAVELLY SAND**: some silt, brown, moist, loose to compact		1	SS	3		407
			2	SS	19		
			3	SS	30		406
			4	SS	24		405
403.1			5	SS	23		404
4.6	**SILTY SAND**: some gravel, brown, moist to wet, dense to loose		6	SS	35		403
	wet at 6.1m depth disturbed at 6.1m		7	DIST	(disturbed)		402
400.1							401
7.6	**SILTY SAND TILL:** brown, moist, dense		8	SS	39		400
399.5							
8.2	**END OF BOREHOLE:** Notes: 1) Water level in open borehole: Date: Water Level (mbgl): on completion 6.1						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

34 53 (13)

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH21-9

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846702.204 E 573529.376

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-19-2021

REF. NO.: 21-129-300
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
408.2							
408.0 0.1	**TOPSOIL:** 100mm						408
	FILL: sand and silt, trace clay, mixed with organics/topsoil, very loose to compact		1	SS	3		
1			2	SS	2		407
2			3	SS	10		
405.9 2.3	**SILTY SAND TILL:** brown, moist to wet, compact to very dense		4	SS	31		406
3	wet at 3m depth		5	SS	13		405
4							404
5	layer of medium to coarse sand		6	SS	33		403
6							
7			7	SS	54		402
8							401
400.0 8.2	**END OF BOREHOLE:**		8	SS	47		400

Notes:

1) Water level in open borehole:

Date: Water Level (mbgl):
on completion 3.0

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
	41	51	8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE MW21-10

PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course
CLIENT: Empire Communities
PROJECT LOCATION: 5525 8 Line, Erin, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4846573.281 E 573806.122

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Apr-19-2021

REF. NO.: 21-129-300
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
419.1							419
0.0 / 418.8	**GRANULAR FILL:** 250mm		1	SS	10	Bentonite	
0.3	**FILL**: silty sand, some gravel, trace clay, brown, moist, loose to compact		2	SS	4		418
			3	SS	23	W. L. 417.4 m Apr 28, 2021	417
416.8						Filter Pack	
2.3	**SILTY SAND:** trace gravel, trace clay, brown, wet, loose		4	SS	8	Slotted Pipe	
416.0							416
3.1	**SILTY SAND TILL:** gravelly, brown to grey, moist, dense to very dense		5	SS	44		
			6	SS	58		415
			7	SS	80		414
			8	SS	72		413
410.9							412
8.2	**END OF BOREHOLE:**						411

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
April 28, 2021	1.69

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

NUMBER	GR	SA	SI	CL
2	11	54	26	9
4	8	57	26	9

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

Appendix C

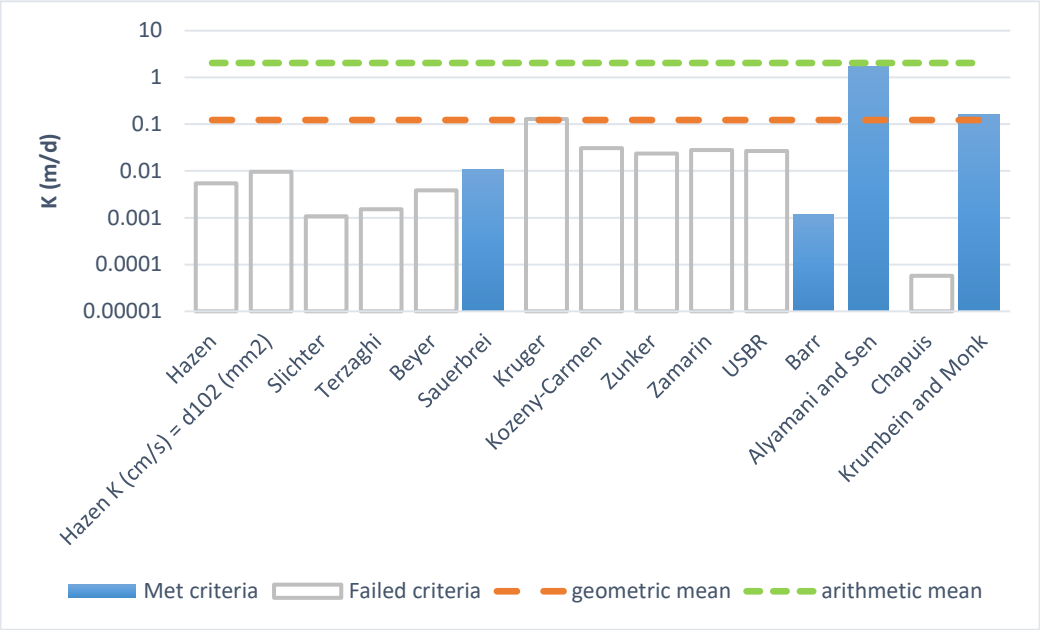
Grain Size Analyses

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-1, SS1, 0.3 mBGS, Silt and Sand

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand with fines



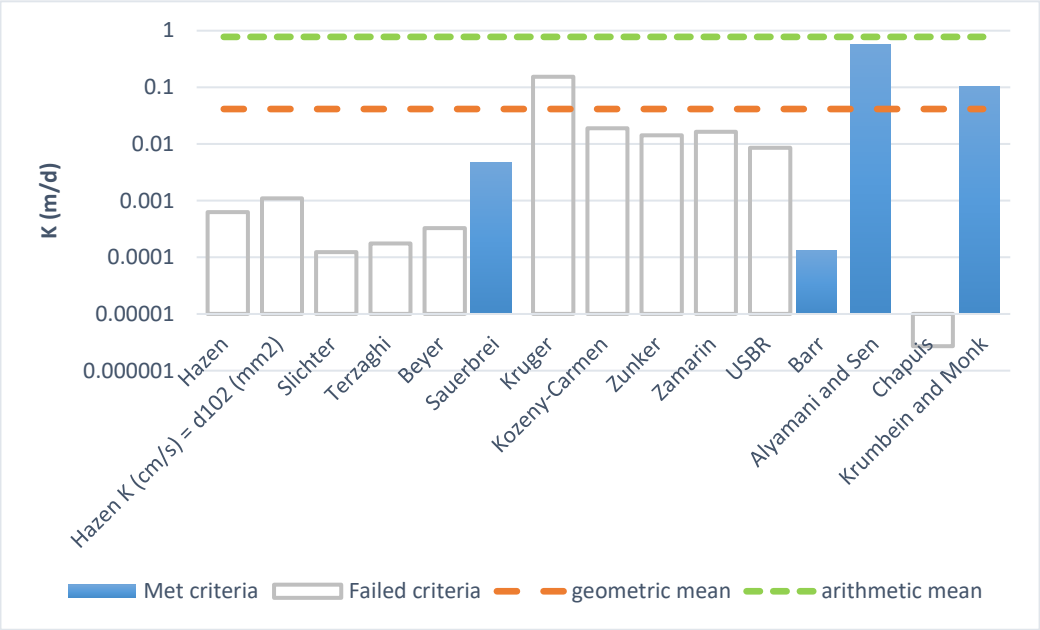
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.631E-05	.631E-07	0.01	
Hazen K (cm/s) = d_{10} (mm)	.111E-04	.111E-06	0.01	
Slichter	.124E-05	.124E-07	0.00	
Terzaghi	.177E-05	.177E-07	0.00	
Beyer	.444E-05	.444E-07	0.00	
Sauerbrei	.123E-04	.123E-06	0.01	
Kruger	.150E-03	.150E-05	0.13	
Kozeny-Carmen	.356E-04	.356E-06	0.03	
Zunker	.273E-04	.273E-06	0.02	
Zamarin	.324E-04	.324E-06	0.03	
USBR	.311E-04	.311E-06	0.03	
Barr	.133E-05	.133E-07	0.00	
Alyamani and Sen	.196E-02	.196E-04	1.70	
Chapuis	.661E-07	.661E-09	0.00	
Krumbein and Monk	.187E-03	.187E-05	0.16	
Shepherd	.965E-02	.965E-04	8.33	
geometric mean meeting criteria	5.E-05	5.E-07	4.E-02	
arithmetic mean meeting criteria	5.E-04	5.E-06	5.E-01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-1, SS8, 7.9 mBGS, Silty Sand Till

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



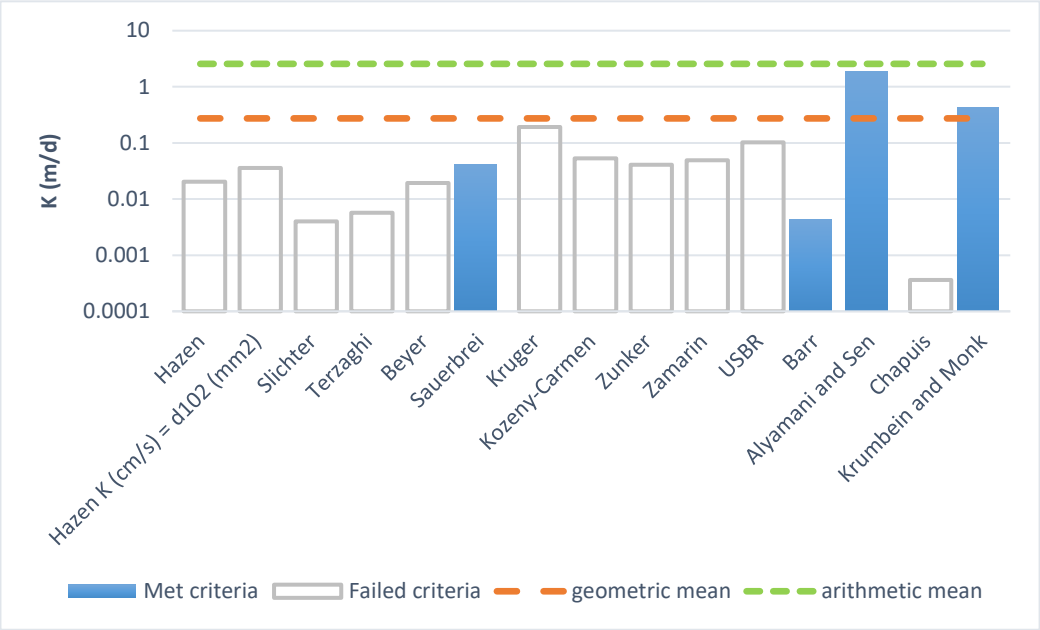
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.723E-06	.723E-08	0.00	
Hazen K (cm/s) = d_{10} (mm)	.128E-05	.128E-07	0.00	
Slichter	.142E-06	.142E-08	0.00	
Terzaghi	.203E-06	.203E-08	0.00	
Beyer	.378E-06	.378E-08	0.00	
Sauerbrei	.551E-05	.551E-07	0.00	
Kruger	.179E-03	.179E-05	0.15	
Kozeny-Carmen	.218E-04	.218E-06	0.02	
Zunker	.164E-04	.164E-06	0.01	
Zamarin	.191E-04	.191E-06	0.02	
USBR	.995E-05	.995E-07	0.01	
Barr	.152E-06	.152E-08	0.00	
Alyamani and Sen	.670E-03	.670E-05	0.58	
Chapuis	.313E-08	.313E-10	0.00	
Krumbein and Monk	.122E-03	.122E-05	0.11	
Shepherd	.370E-02	.370E-04	3.19	
geometric mean meeting criteria	2.E-05	2.E-07	1.E-02	
arithmetic mean meeting criteria	2.E-04	2.E-06	2.E-01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-2, SS1, 0.4 mBGS, Silty Sand

Mass Sample (g): 100 T (oC) 20

Poorly sorted sand with fines



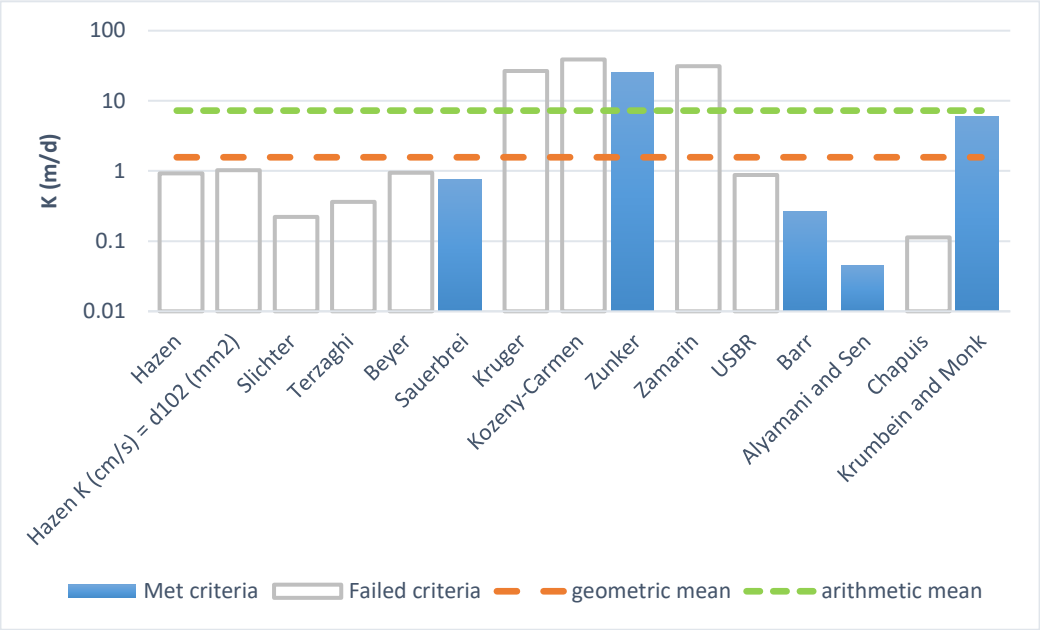
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.234E-04	.234E-06	0.02	
Hazen K (cm/s) = d_{10} (mm)	.414E-04	.414E-06	0.04	
Slichter	.461E-05	.461E-07	0.00	
Terzaghi	.657E-05	.657E-07	0.01	
Beyer	.225E-04	.225E-06	0.02	
Sauerbrei	.484E-04	.484E-06	0.04	
Kruger	.221E-03	.221E-05	0.19	
Kozeny-Carmen	.616E-04	.616E-06	0.05	
Zunker	.474E-04	.474E-06	0.04	
Zamarin	.566E-04	.566E-06	0.05	
USBR	.118E-03	.118E-05	0.10	
Barr	.494E-05	.494E-07	0.00	
Alyamani and Sen	.220E-02	.220E-04	1.90	
Chapuis	.420E-06	.420E-08	0.00	
Krumbein and Monk	.505E-03	.505E-05	0.44	
Shepherd	.121E-01	.121E-03	10.43	
geometric mean meeting criteria	1.E-04	1.E-06	1.E-01	
arithmetic mean meeting criteria	7.E-04	7.E-06	6.E-01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-2, SS6, 4.9 mBGS, Silty Sand

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



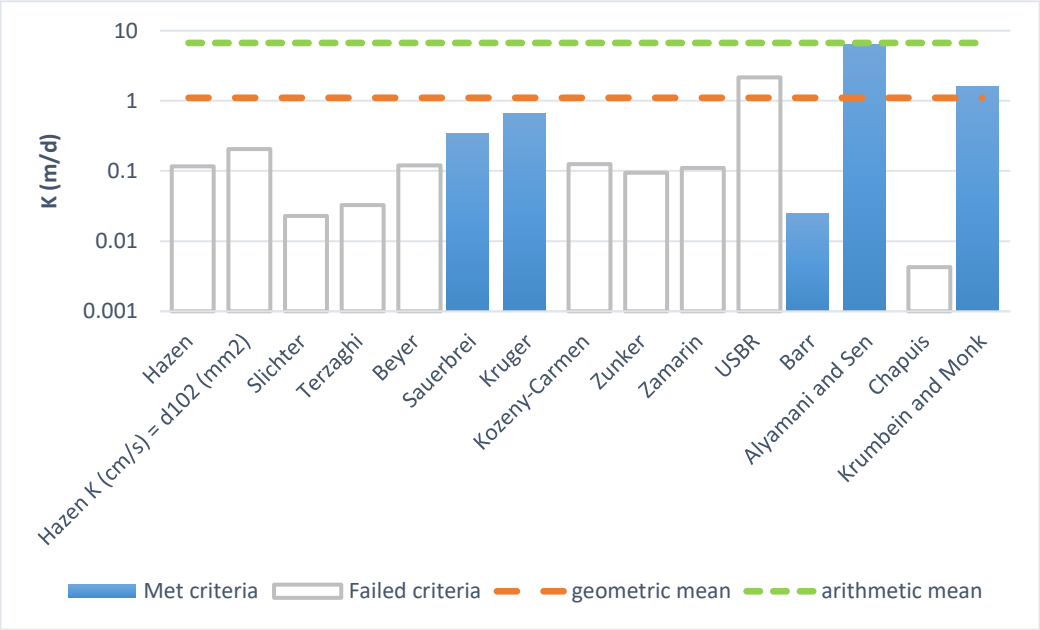
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.107E-02	.107E-04	0.93	
Hazen K (cm/s) = d_{10} (mm)	.118E-02	.118E-04	1.02	
Slichter	.256E-03	.256E-05	0.22	
Terzaghi	.420E-03	.420E-05	0.36	
Beyer	.110E-02	.110E-04	0.95	
Sauerbrei	.862E-03	.862E-05	0.75	
Kruger	.308E-01	.308E-03	26.58	
Kozeny-Carmen	.452E-01	.452E-03	39.06	
Zunker	.292E-01	.292E-03	25.26	
Zamarin	.359E-01	.359E-03	31.01	
USBR	.101E-02	.101E-04	0.87	
Barr	.304E-03	.304E-05	0.26	
Alyamani and Sen	.518E-04	.518E-06	0.04	
Chapuis	.131E-03	.131E-05	0.11	
Krumbein and Monk	.701E-02	.701E-04	6.06	
Shepherd	.129E-01	.129E-03	11.17	
geometric mean meeting criteria	1.E-03	1.E-05	1.E+00	
arithmetic mean meeting criteria	7.E-03	7.E-05	6.E+00	

K from Grain Size Analysis Report Date: 19-May-21

Sample Name: MW21-3, SS2, 1.1 mBGS, Fill

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



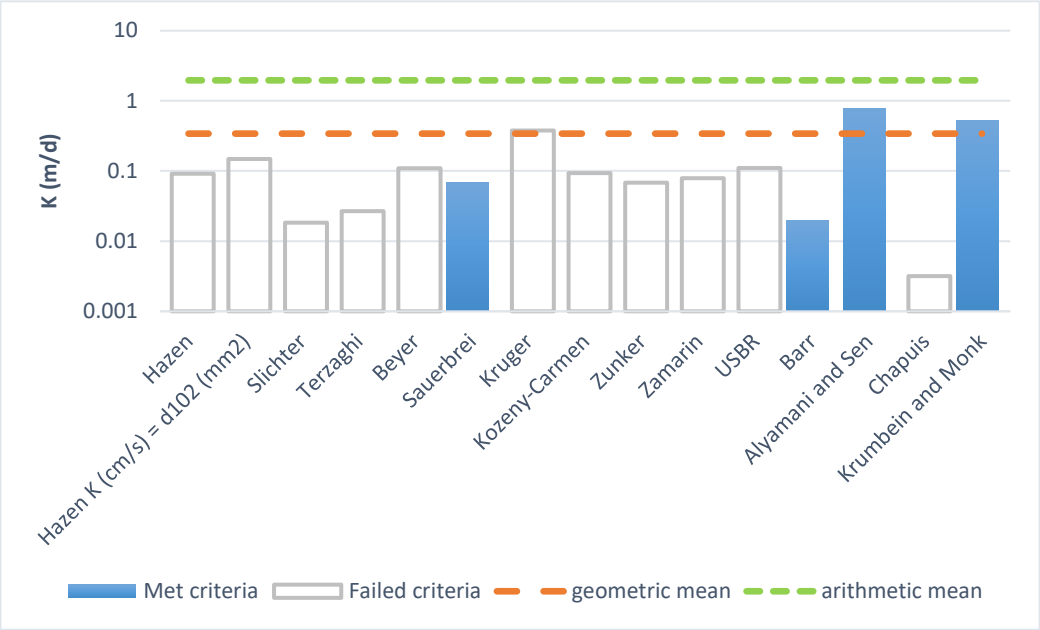
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.135E-03	.135E-05	0.12	
Hazen K (cm/s) = d_{10} (mm)	.237E-03	.237E-05	0.20	
Slichter	.265E-04	.265E-06	0.02	
Terzaghi	.378E-04	.378E-06	0.03	
Beyer	.139E-03	.139E-05	0.12	
Sauerbrei	.394E-03	.394E-05	0.34	
Kruger	.775E-03	.775E-05	0.67	
Kozeny-Carmen	.145E-03	.145E-05	0.13	
Zunker	.109E-03	.109E-05	0.09	
Zamarin	.128E-03	.128E-05	0.11	
USBR	.251E-02	.251E-04	2.17	
Barr	.284E-04	.284E-06	0.02	
Alyamani and Sen	.745E-02	.745E-04	6.43	
Chapuis	.494E-05	.494E-07	0.00	
Krumbein and Monk	.187E-02	.187E-04	1.62	
Shepherd	.359E-01	.359E-03	31.03	
geometric mean meeting criteria	7.E-04	7.E-06	6.E-01	
arithmetic mean meeting criteria	2.E-03	2.E-05	2.E+00	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-3, SS6, 4.9 mBGS, Silty Sand Till

Mass Sample (g): 100 T (oC) 20

Poorly sorted sand low in fines



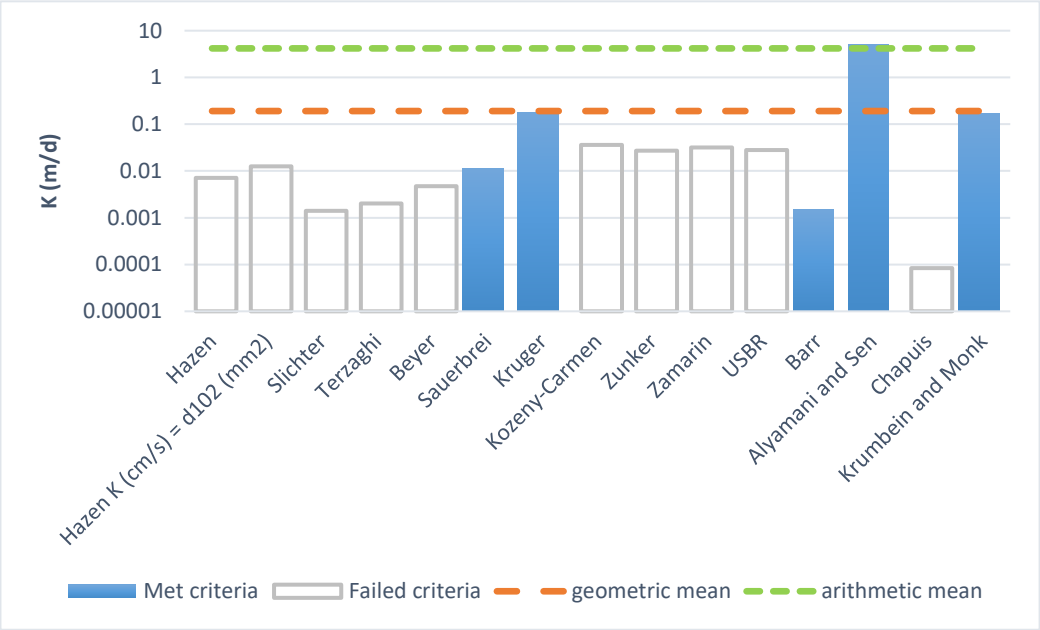
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.105E-03	.105E-05	0.09	
Hazen K (cm/s) = d_{10} (mm)	.171E-03	.171E-05	0.15	
Slichter	.212E-04	.212E-06	0.02	
Terzaghi	.311E-04	.311E-06	0.03	
Beyer	.127E-03	.127E-05	0.11	
Sauerbrei	.795E-04	.795E-06	0.07	
Kruger	.439E-03	.439E-05	0.38	
Kozeny-Carmen	.108E-03	.108E-05	0.09	
Zunker	.786E-04	.786E-06	0.07	
Zamarin	.915E-04	.915E-06	0.08	
USBR	.128E-03	.128E-05	0.11	
Barr	.230E-04	.230E-06	0.02	
Alyamani and Sen	.897E-03	.897E-05	0.78	
Chapuis	.368E-05	.368E-07	0.00	
Krumbein and Monk	.599E-03	.599E-05	0.52	
Shepherd	.974E-02	.974E-04	8.42	
geometric mean meeting criteria	2.E-04	2.E-06	2.E-01	
arithmetic mean meeting criteria	4.E-04	4.E-06	3.E-01	

K from Grain Size Analysis Report Date: 19-May-21

Sample Name: MW21-4, SS2, 1.1 mBGS, Fill

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand with fines



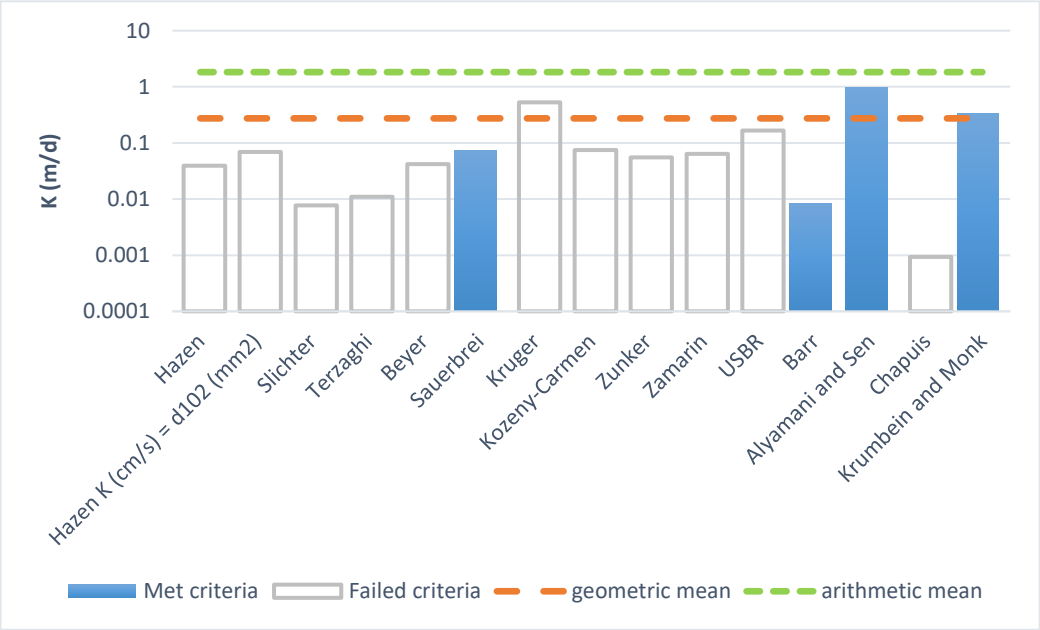
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.829E-05	.829E-07	0.01	
Hazen K (cm/s) = d_{10} (mm)	.146E-04	.146E-06	0.01	
Slichter	.163E-05	.163E-07	0.00	
Terzaghi	.232E-05	.232E-07	0.00	
Beyer	.543E-05	.543E-07	0.00	
Sauerbrei	.128E-04	.128E-06	0.01	
Kruger	.203E-03	.203E-05	0.18	
Kozeny-Carmen	.415E-04	.415E-06	0.04	
Zunker	.315E-04	.315E-06	0.03	
Zamarin	.369E-04	.369E-06	0.03	
USBR	.325E-04	.325E-06	0.03	
Barr	.175E-05	.175E-07	0.00	
Alyamani and Sen	.595E-02	.595E-04	5.14	
Chapuis	.972E-07	.972E-09	0.00	
Krumbein and Monk	.192E-03	.192E-05	0.17	
Shepherd	.227E-01	.227E-03	19.62	
geometric mean meeting criteria	9.E-05	9.E-07	8.E-02	
arithmetic mean meeting criteria	1.E-03	1.E-05	1.E+00	

K from Grain Size Analysis Report Date: 19-May-21

Sample Name: MW21-5, AS2, 1.1 mBGS, Fill

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



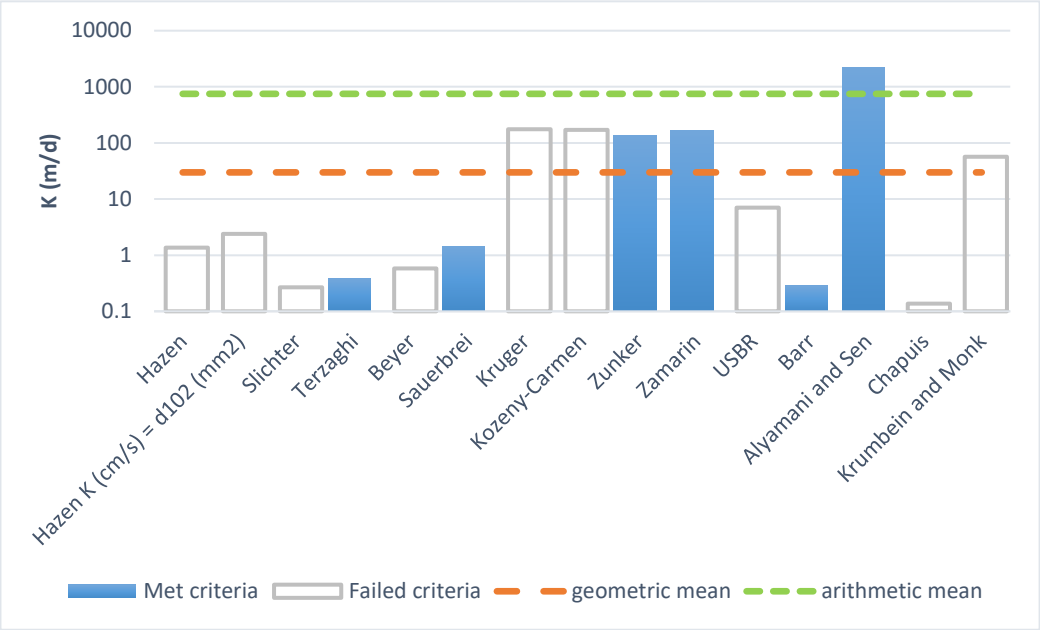
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.454E-04	.454E-06	0.04	
Hazen K (cm/s) = d_{10} (mm)	.798E-04	.798E-06	0.07	
Slichter	.894E-05	.894E-07	0.01	
Terzaghi	.128E-04	.128E-06	0.01	
Beyer	.483E-04	.483E-06	0.04	
Sauerbrei	.855E-04	.855E-06	0.07	
Kruger	.614E-03	.614E-05	0.53	
Kozeny-Carmen	.865E-04	.865E-06	0.07	
Zunker	.643E-04	.643E-06	0.06	
Zamarin	.742E-04	.742E-06	0.06	
USBR	.193E-03	.193E-05	0.17	
Barr	.959E-05	.959E-07	0.01	
Alyamani and Sen	.114E-02	.114E-04	0.98	
Chapuis	.107E-05	.107E-07	0.00	
Krumbein and Monk	.386E-03	.386E-05	0.33	
Shepherd	.895E-02	.895E-04	7.73	
geometric mean meeting criteria	1.E-04	1.E-06	1.E-01	
arithmetic mean meeting criteria	4.E-04	4.E-06	3.E-01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: BH21-6, SS2, 1.1 mBGS, Sandy Gravel

Mass Sample (g): 100 T (oC) 20

Poorly sorted sandy gravel low in fines



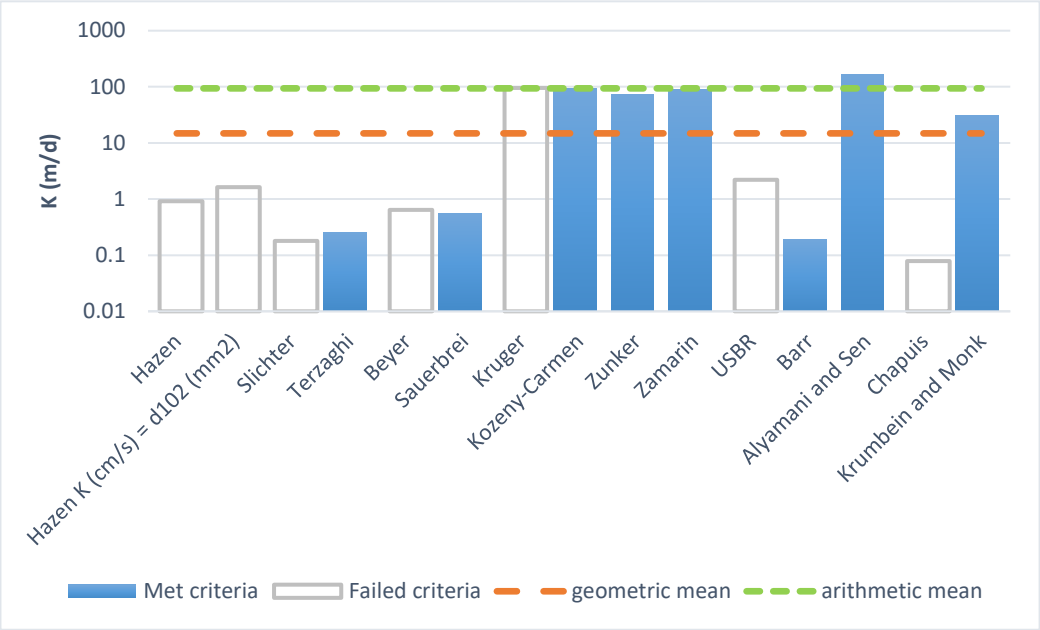
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.158E-02	.158E-04	1.36	
Hazen K (cm/s) = d_{10} (mm)	.279E-02	.279E-04	2.41	
Slichter	.310E-03	.310E-05	0.27	
Terzaghi	.443E-03	.443E-05	0.38	
Beyer	.668E-03	.668E-05	0.58	
Sauerbrei	.165E-02	.165E-04	1.43	
Kruger	.202E+00	.202E-02	174.39	
Kozeny-Carmen	.199E+00	.199E-02	171.65	
Zunker	.157E+00	.157E-02	135.72	
Zamarin	.193E+00	.193E-02	166.38	
USBR	.819E-02	.819E-04	7.08	
Barr	.333E-03	.333E-05	0.29	
Alyamani and Sen	.251E+01	.251E-01	2169.34	
Chapuis	.158E-03	.158E-05	0.14	
Krumbein and Monk	.652E-01	.652E-03	56.36	
Shepherd	.320E+01	.320E-01	2767.67	
geometric mean meeting criteria	2.E-02	2.E-04	1.E+01	
arithmetic mean meeting criteria	5.E-01	5.E-03	4.E+02	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: BH21-7, SS2, 1.1 mBGS, Sand and Gravel

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



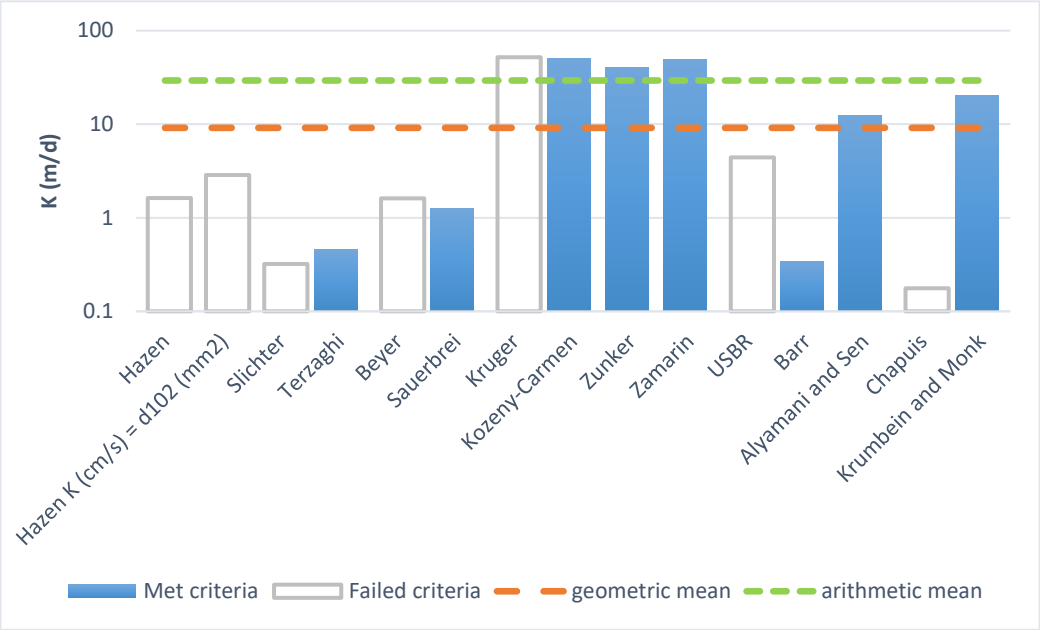
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.106E-02	.106E-04	0.92	
Hazen K (cm/s) = d_{10} (mm)	.188E-02	.188E-04	1.62	
Slichter	.209E-03	.209E-05	0.18	
Terzaghi	.298E-03	.298E-05	0.26	
Beyer	.741E-03	.741E-05	0.64	
Sauerbrei	.636E-03	.636E-05	0.55	
Kruger	.110E+00	.110E-02	94.88	
Kozeny-Carmen	.108E+00	.108E-02	93.23	
Zunker	.854E-01	.854E-03	73.75	
Zamarin	.105E+00	.105E-02	90.47	
USBR	.254E-02	.254E-04	2.20	
Barr	.224E-03	.224E-05	0.19	
Alyamani and Sen	.194E+00	.194E-02	167.43	
Chapuis	.908E-04	.908E-06	0.08	
Krumbein and Monk	.357E-01	.357E-03	30.82	
Shepherd	.448E+00	.448E-02	387.42	
geometric mean meeting criteria	1.E-02	1.E-04	1.E+01	
arithmetic mean meeting criteria	7.E-02	7.E-04	6.E+01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: BH21-8, SS2, 1.1 mBGS, Gravelly Sand

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines



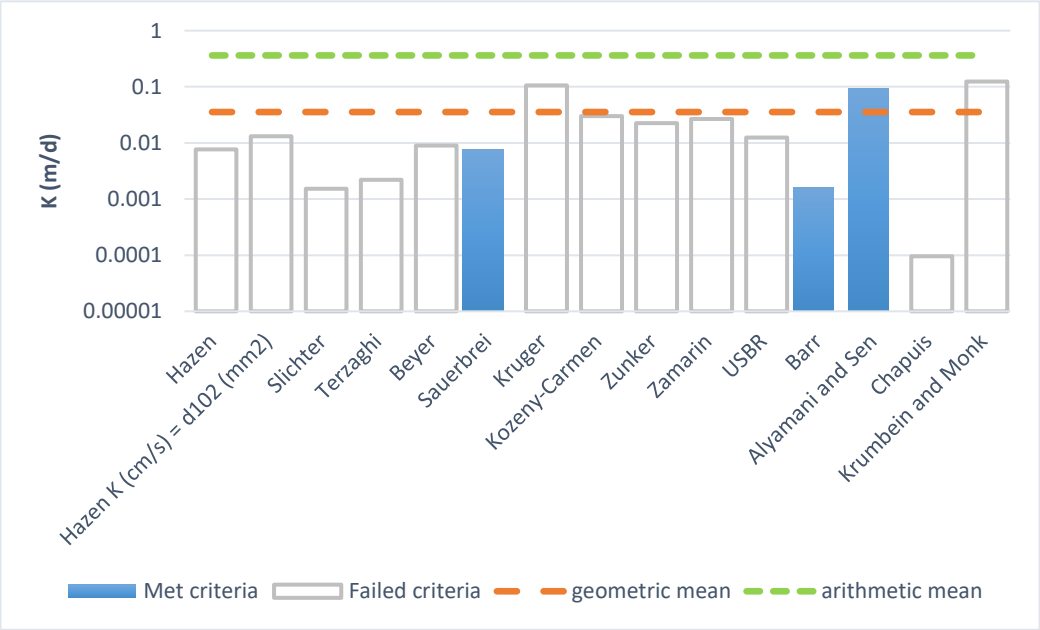
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.189E-02	.189E-04	1.63	
Hazen K (cm/s) = d_{10} (mm)	.333E-02	.333E-04	2.88	
Slichter	.371E-03	.371E-05	0.32	
Terzaghi	.529E-03	.529E-05	0.46	
Beyer	.187E-02	.187E-04	1.61	
Sauerbrei	.146E-02	.146E-04	1.26	
Kruger	.601E-01	.601E-03	51.90	
Kozeny-Carmen	.590E-01	.590E-03	51.01	
Zunker	.467E-01	.467E-03	40.34	
Zamarin	.573E-01	.573E-03	49.50	
USBR	.510E-02	.510E-04	4.40	
Barr	.398E-03	.398E-05	0.34	
Alyamani and Sen	.143E-01	.143E-03	12.35	
Chapuis	.204E-03	.204E-05	0.18	
Krumbein and Monk	.237E-01	.237E-03	20.44	
Shepherd	.102E+00	.102E-02	88.31	
geometric mean meeting criteria	8.E-03	8.E-05	7.E+00	
arithmetic mean meeting criteria	3.E-02	3.E-04	2.E+01	

K from Grain Size Analysis Report Date: 19-May-21

Sample Name: MW21-9, SS1, 0.3 mBGS, Fill

Mass Sample (g): 100 T (oC) 20

Poorly sorted sandy silt with fines



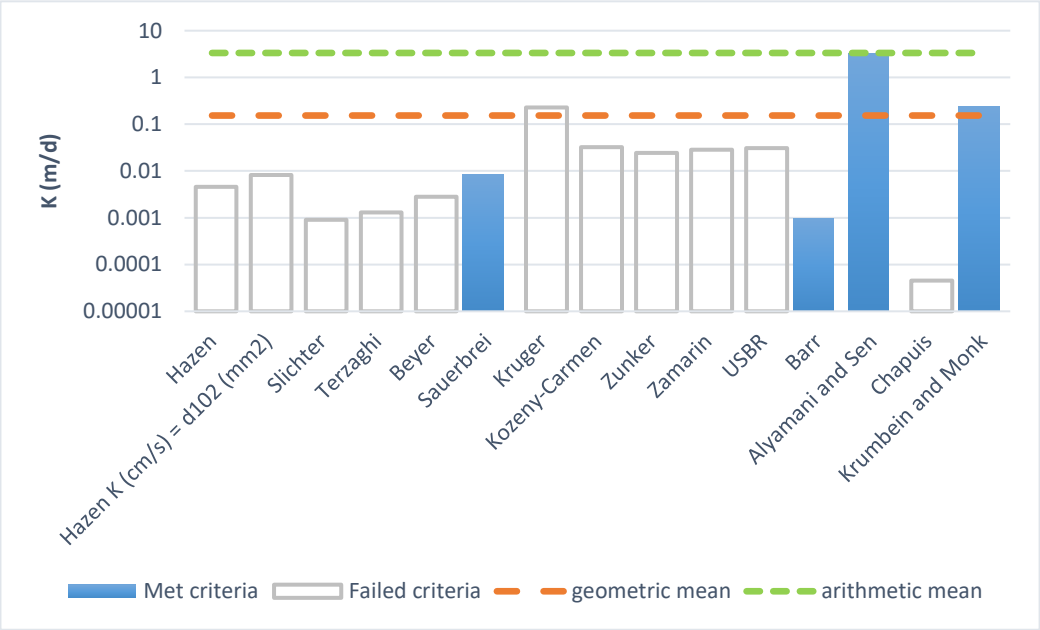
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.889E-05	.889E-07	0.01	
Hazen K (cm/s) = d_{10} (mm)	.152E-04	.152E-06	0.01	
Slichter	.176E-05	.176E-07	0.00	
Terzaghi	.254E-05	.254E-07	0.00	
Beyer	.104E-04	.104E-06	0.01	
Sauerbrei	.880E-05	.880E-07	0.01	
Kruger	.122E-03	.122E-05	0.11	
Kozeny-Carmen	.348E-04	.348E-06	0.03	
Zunker	.261E-04	.261E-06	0.02	
Zamarin	.308E-04	.308E-06	0.03	
USBR	.145E-04	.145E-06	0.01	
Barr	.190E-05	.190E-07	0.00	
Alyamani and Sen	.110E-03	.110E-05	0.09	
Chapuis	.111E-06	.111E-08	0.00	
Krumbein and Monk	.143E-03	.143E-05	0.12	
Shepherd	.156E-02	.156E-04	1.35	
geometric mean meeting criteria	1.E-05	1.E-07	1.E-02	
arithmetic mean meeting criteria	4.E-05	4.E-07	3.E-02	

K from Grain Size Analysis Report Date: 19-May-21

Sample Name: MW21-10, SS2, 1.1 mBGS, Fill

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand with fines



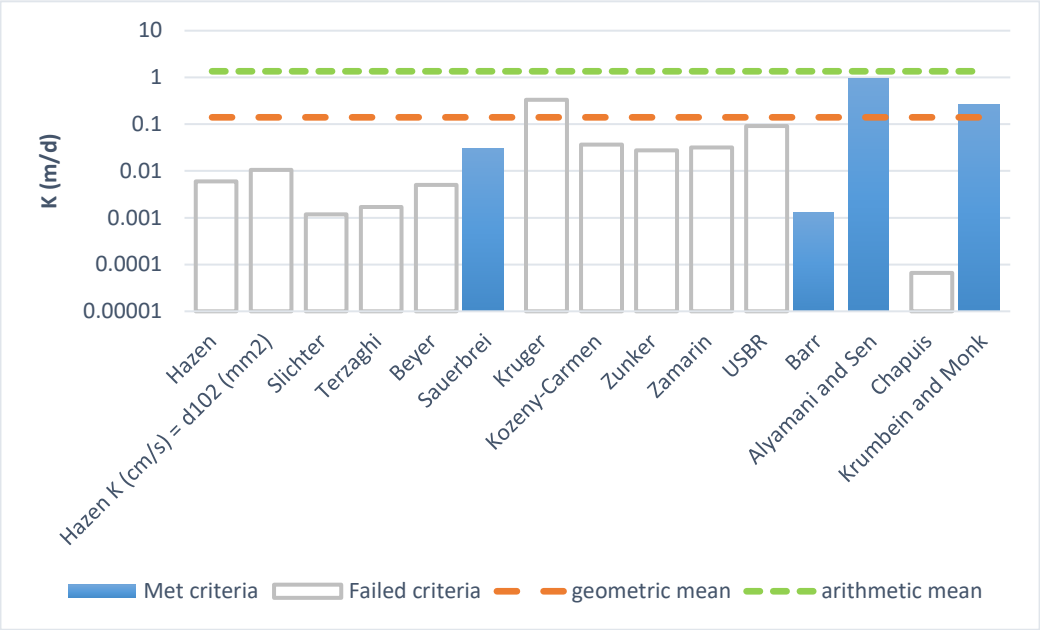
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.534E-05	.534E-07	0.00	
Hazen K (cm/s) = d_{10} (mm)	.944E-05	.944E-07	0.01	
Slichter	.105E-05	.105E-07	0.00	
Terzaghi	.150E-05	.150E-07	0.00	
Beyer	.327E-05	.327E-07	0.00	
Sauerbrei	.996E-05	.996E-07	0.01	
Kruger	.266E-03	.266E-05	0.23	
Kozeny-Carmen	.376E-04	.376E-06	0.03	
Zunker	.283E-04	.283E-06	0.02	
Zamarin	.330E-04	.330E-06	0.03	
USBR	.355E-04	.355E-06	0.03	
Barr	.113E-05	.113E-07	0.00	
Alyamani and Sen	.368E-02	.368E-04	3.18	
Chapuis	.524E-07	.524E-09	0.00	
Krumbein and Monk	.278E-03	.278E-05	0.24	
Shepherd	.153E-01	.153E-03	13.25	
geometric mean meeting criteria	6.E-05	6.E-07	5.E-02	
arithmetic mean meeting criteria	1.E-03	1.E-05	9.E-01	

K from Grain Size Analysis Report Date: 20-May-21

Sample Name: MW21-10, SS4, 2.6 mBGS, Silty Sand (above the till)

Mass Sample (g): 100 T (oC) 20

Poorly sorted gravelly sand low in fines

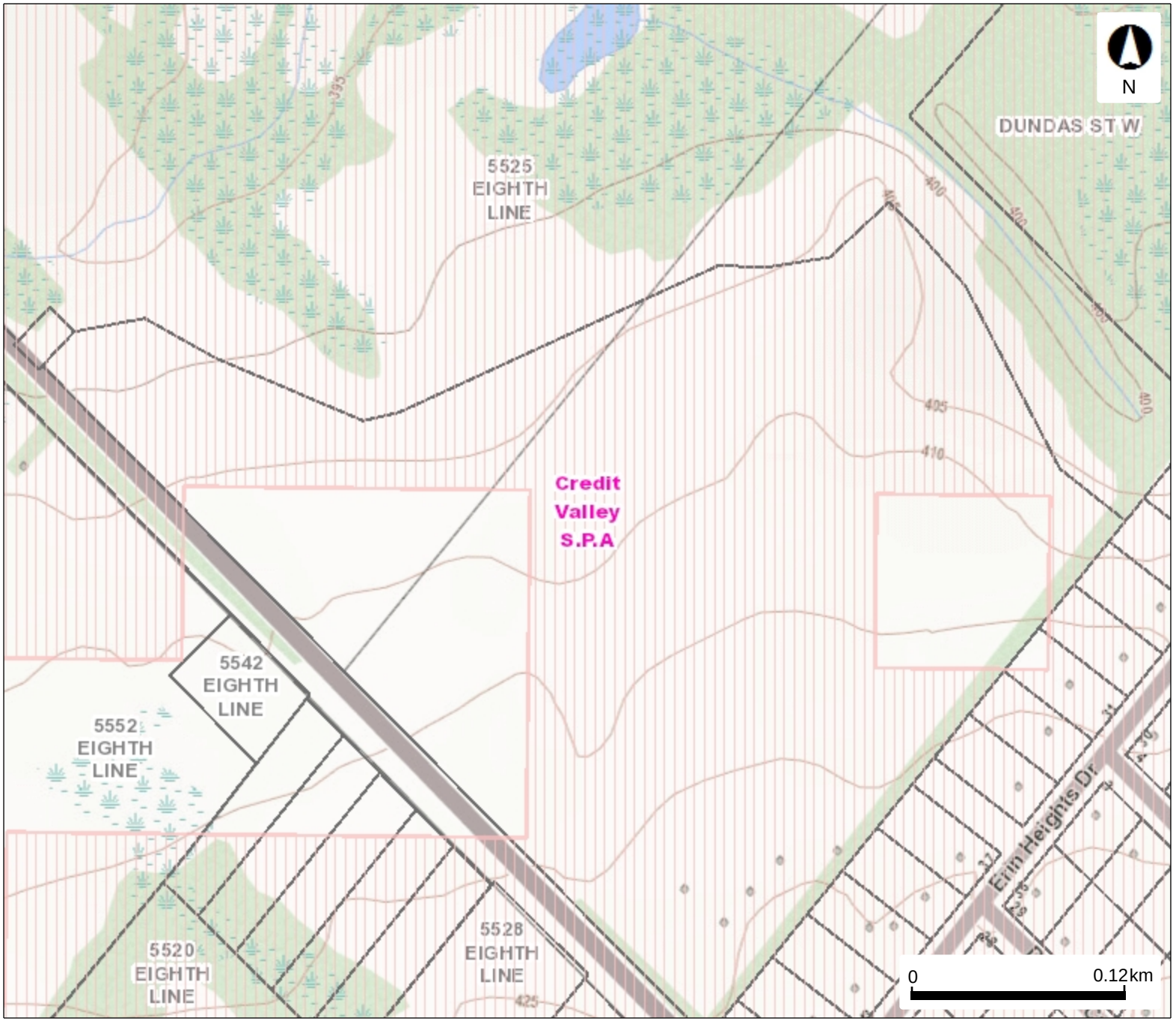


Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.697E-05	.697E-07	0.01	
Hazen K (cm/s) = d_{10} (mm)	.123E-04	.123E-06	0.01	
Slichter	.137E-05	.137E-07	0.00	
Terzaghi	.195E-05	.195E-07	0.00	
Beyer	.579E-05	.579E-07	0.00	
Sauerbrei	.359E-04	.359E-06	0.03	
Kruger	.385E-03	.385E-05	0.33	
Kozeny-Carmen	.423E-04	.423E-06	0.04	
Zunker	.317E-04	.317E-06	0.03	
Zamarin	.368E-04	.368E-06	0.03	
USBR	.106E-03	.106E-05	0.09	
Barr	.147E-05	.147E-07	0.00	
Alyamani and Sen	.110E-02	.110E-04	0.95	
Chapuis	.762E-07	.762E-09	0.00	
Krumbein and Monk	.306E-03	.306E-05	0.26	
Shepherd	.640E-02	.640E-04	5.53	
geometric mean meeting criteria	6.E-05	6.E-07	6.E-02	
arithmetic mean meeting criteria	4.E-04	4.E-06	3.E-01	

Appendix D

Provincial Maps

Highly Vulnerable Aquifer



Legend

- Source Protection Areas
- Highly Vulnerable Aquifers
- Assessment Parcel with Addre

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Ontario

Map Created: 1/18/2022
Map Center: 43.76998 N, -80.08494 W

570000
572500
575000
4850000
4847500
N
Binkham
Hillsburgh
Erin
E7
E8
GOUNTY-RD-24
GOUNTY-RD-23
GOUNTY-RD-22
MAIN-ST
TRAFALGAR-RD
WINSTON-CHURCHILL-BLVD

LEGEND

- Production Well

Wells Used in ISI Analysis

- Low Vulnerability
- Medium Vulnerability
- High Vulnerability
- Highway
- Major Road
- Local Road
- Railways
- Watercourse, Permanent
- Watercourse, Intermittent
- Waterbody
- Wetland

Wellhead Protection Area

- WHPA A (100 m)
- WHPA B (2 year)
- WHPA C (5 year)
- WHPA D (25 year)

ISI Vulnerability

- Low (>80)
- Medium (30 - 80)
- High (<30)

REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2006.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

0.5 0.25 0 0.5 1 1.5
SCALE 1:25,000 KILOMETERS

PROJECT
SOURCE WATER PROTECTION - TOWN OF ERIN

TITLE
ISI VULNERABILITY MAPPING - BEDROCK, ERIN MUNICIPAL WELLS

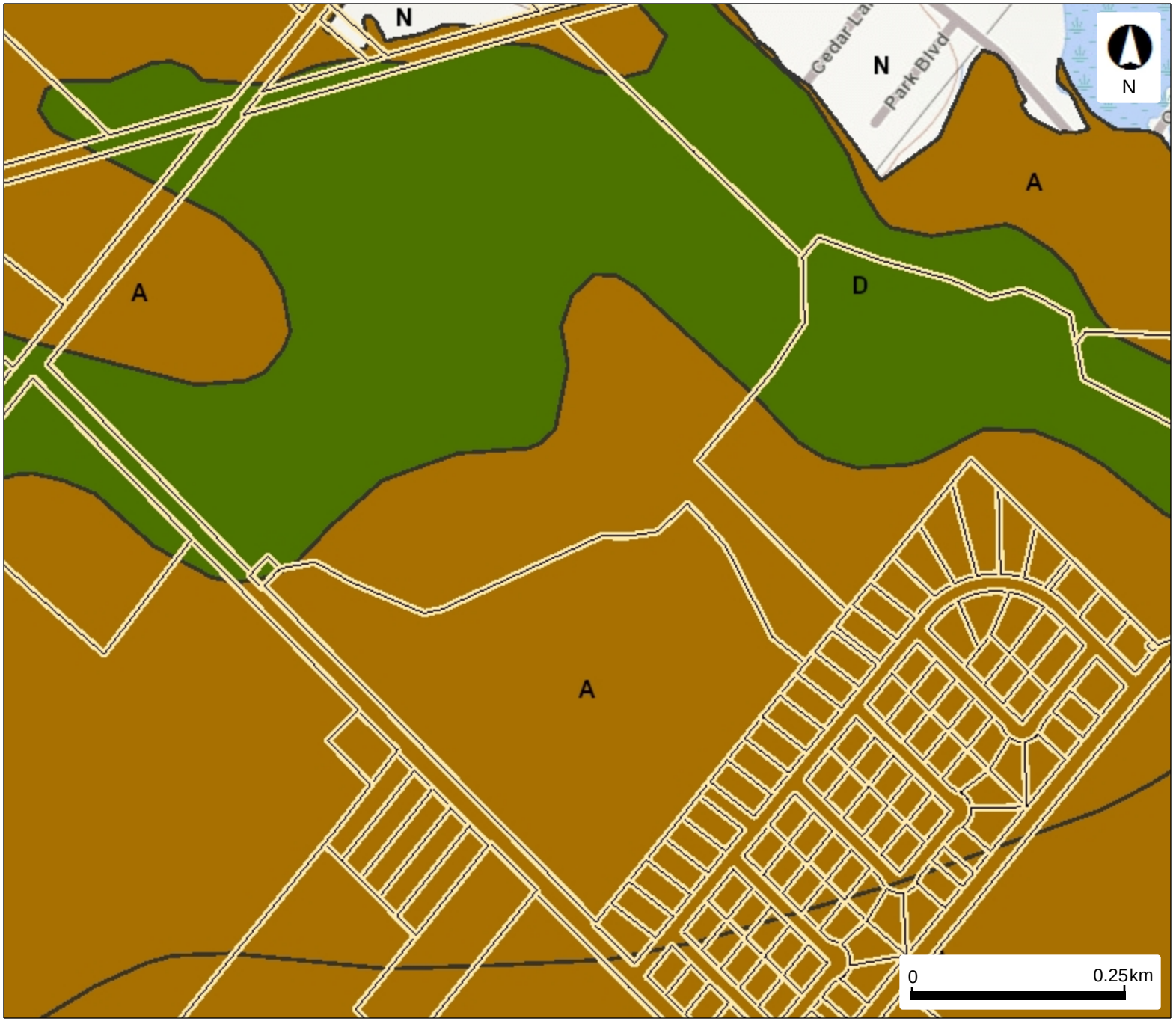
Golder Associates
Mississauga, Ontario

PROJECT NO. 09-1112-6139			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	1 Apr. 2010		
GIS	PRM	1 Apr. 2010		
CHECK	GP	1 Apr. 2010		
REVIEW	JP	1 Apr. 2010		

FIGURE: 5

G:\Projects\2009\09-1112-6139_Bel_Erin\GIS\MXDs\Draft\Blackport_Hydrogeology\ISI_Vulnerability_Erin_Bedrock.mxd

OMAFRA Hydrologic Soil Group



Legend

- Assessment Parcel
- Hydrologic Soil Group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

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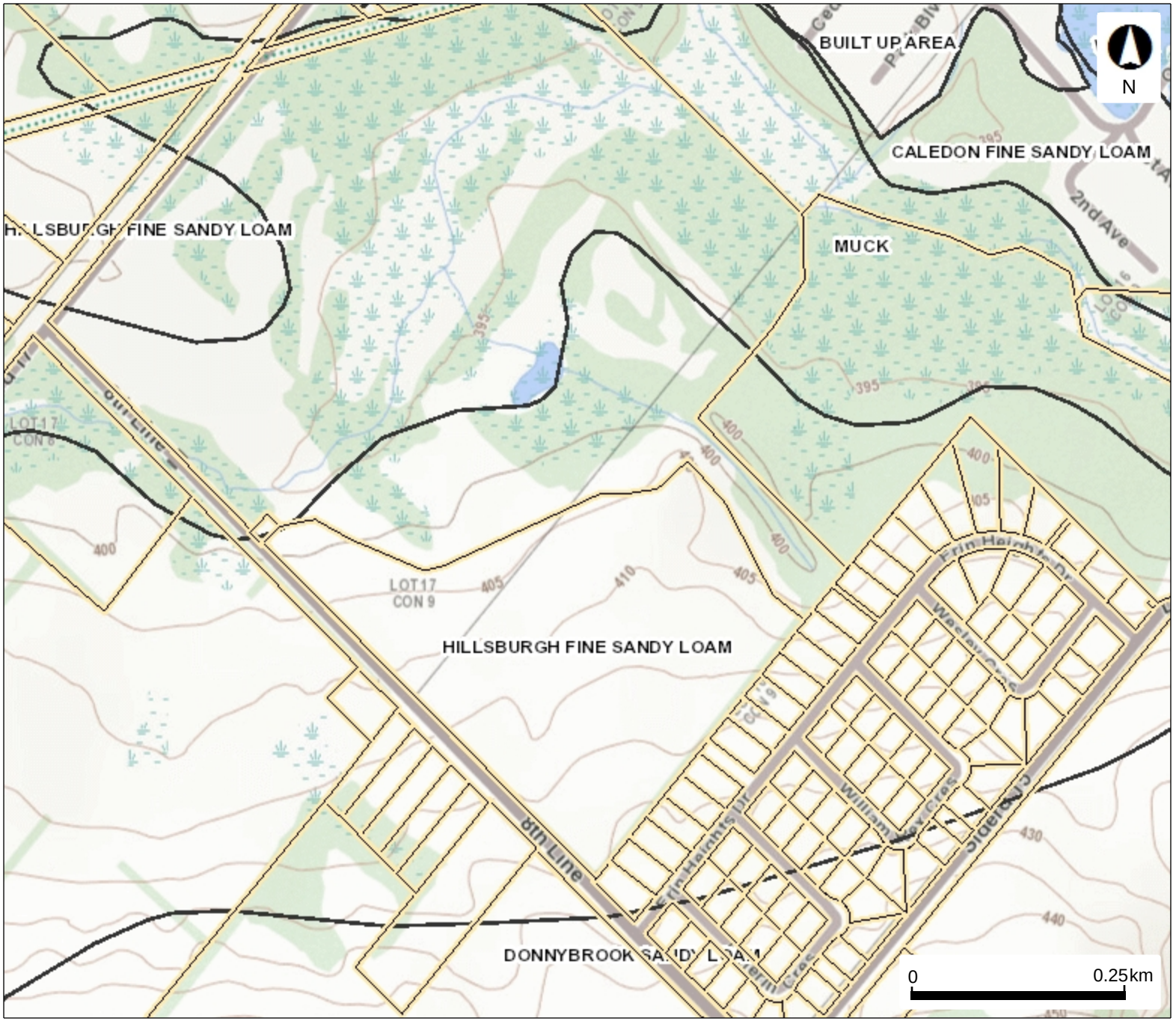
Map Created: 1/24/2022
Map Center: 43.77151 N, -80.08421 W

OMAFRA Soil Type



Legend

- Assessment Parcel
- Soil Name Label

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Map Created: 1/24/2022
Map Center: 43.77106 N, -80.08421 W

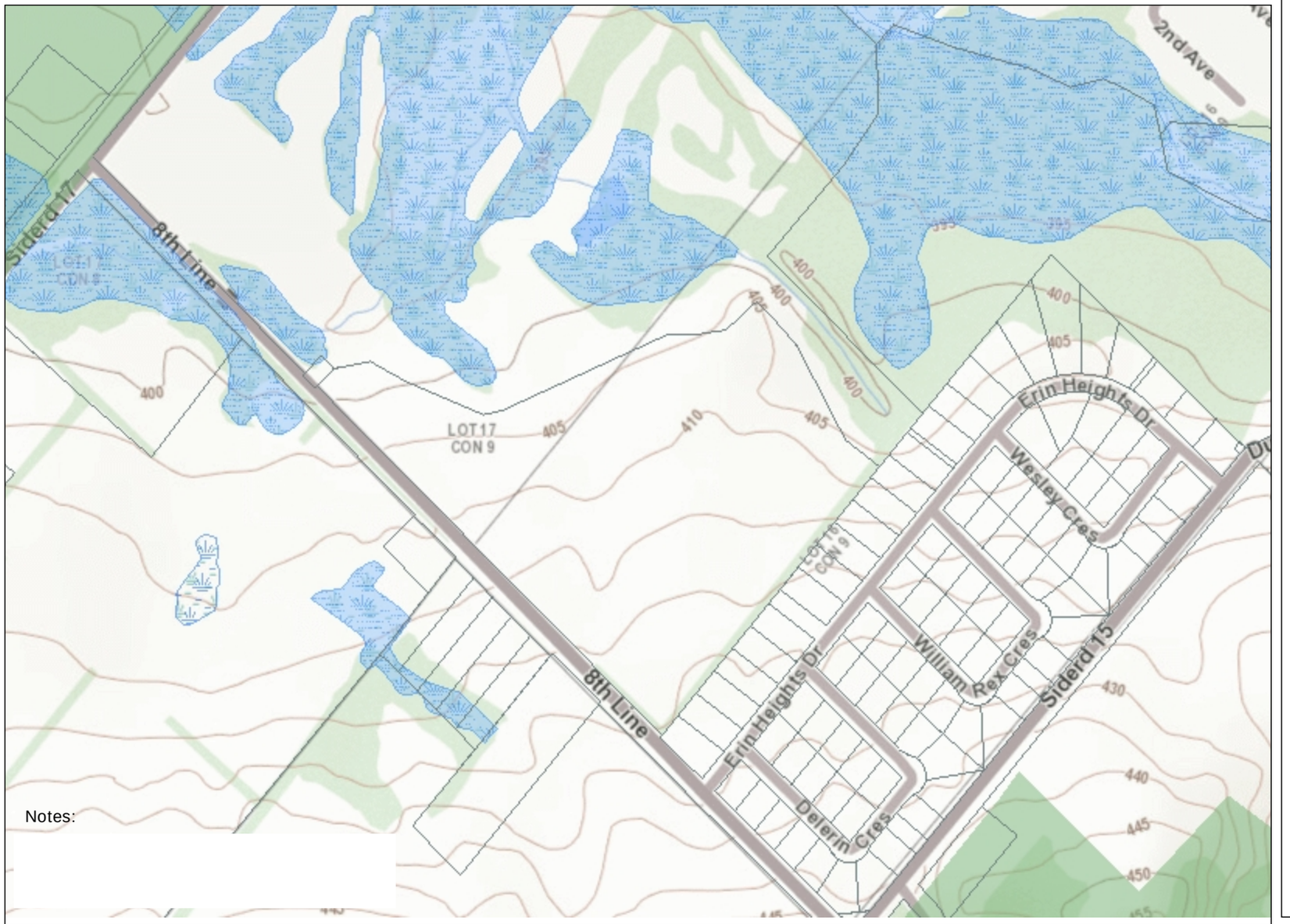
Ontario

Ministry of Natural Resources and Forestry

Make-a-Map: Natural Heritage Areas

West Credit River Wetland Complex

Map created:1/18/2022



Notes:

Legend

- Assessment Parcel
- ANSI
- Earth Science Provincially Significant/sciences de la terre d'importance provinciale
- Earth Science Regionally Significant/sciences de la terre d'importance régionale
- Life Science Provincially Significant/sciences de la vie d'importance provinciale
- Life Science Regionally Significant/sciences de la vie d'importance régionale
- Evaluated Wetland
- Provincially Significant/considérée d'importance provinciale
- Non-Provincially Significant/non considérée d'importance provinciale
- Unevaluated Wetland
- Conservation Reserve
- Provincial Park
- Natural Heritage System

0.3 0 0.17 0.3 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

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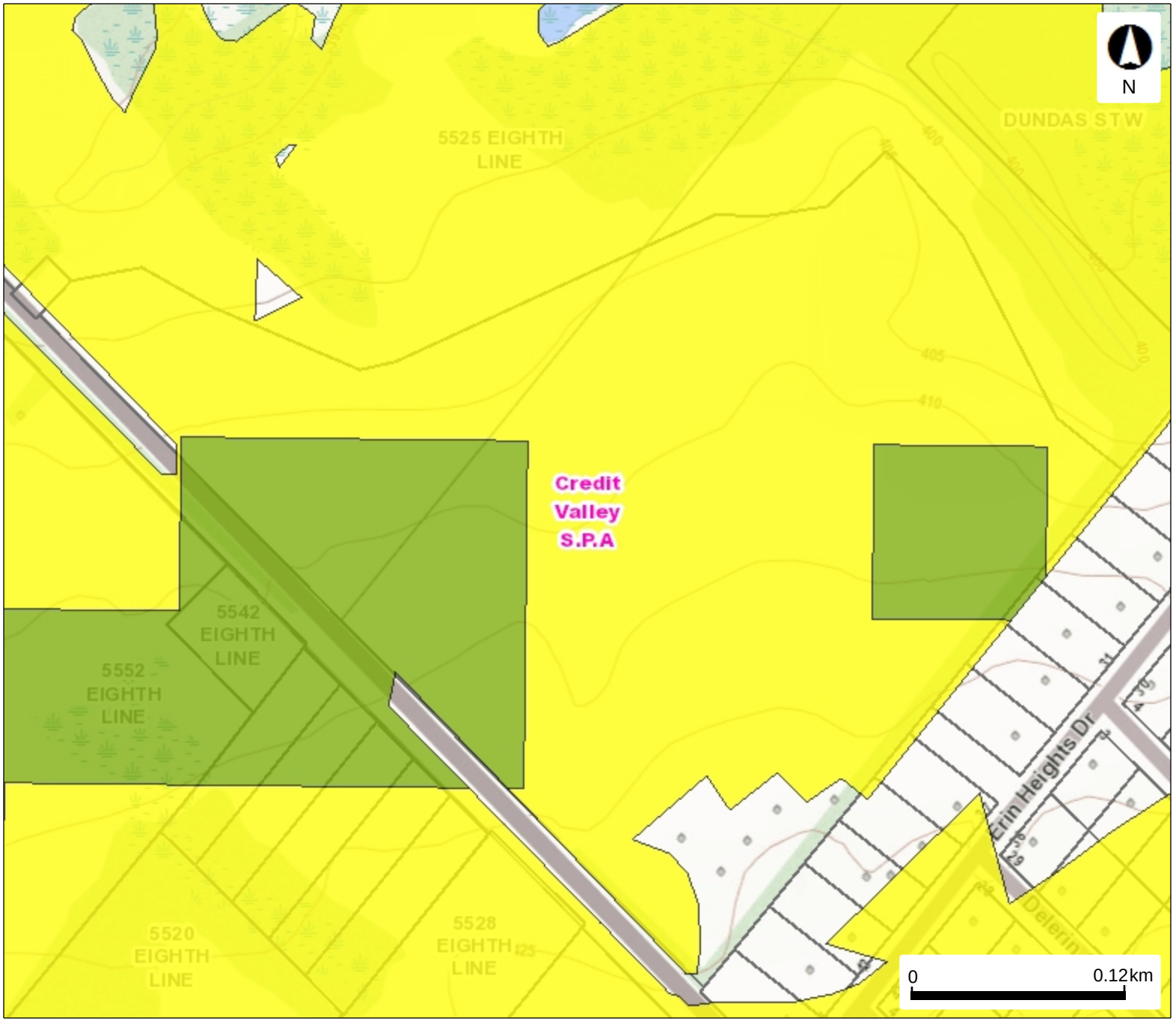
Significant Groundwater Recharge Areas



Legend

- Source Protection Areas
- Significant Groundwater Recharge Area
  - 0
  - 2
  - 4
  - 6
- Assessment Parcel with Addre

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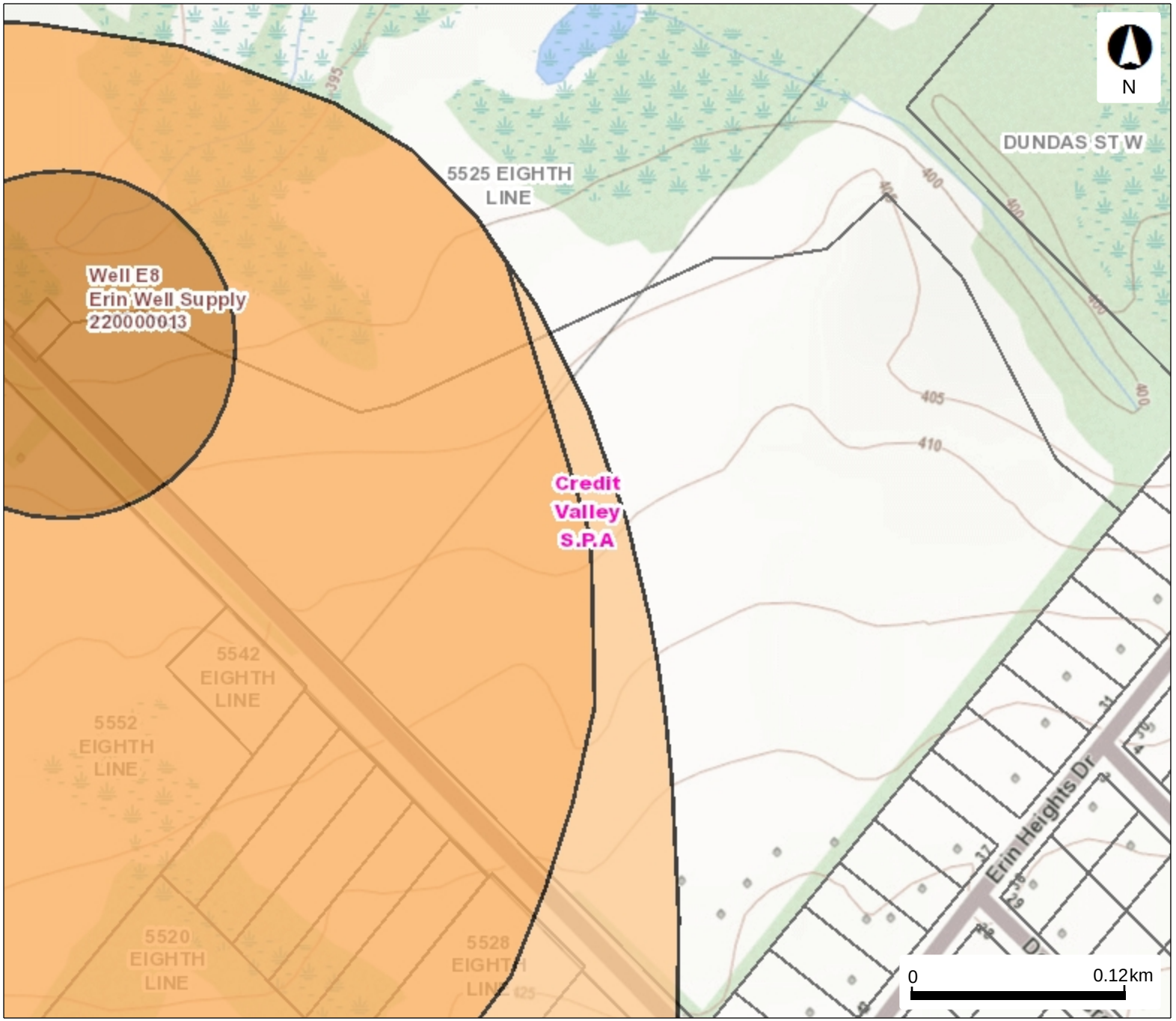
Ontario

Map Created: 1/18/2022
Map Center: 43.76972 N, -80.08491 W

Wellhead Protection Areas



Legend

- Source Protection Areas
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Assessment Parcel with Addre

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

Ontario

Map Created: 1/18/2022
Map Center: 43.76994 N, -80.08491 W