



**URBANTECH®**

**FUNCTIONAL SERVICING &  
STORMWATER MANAGEMENT REPORT**

**EMPIRE ERIN, 5525 8<sup>TH</sup> LINE**

**TOWN OF ERIN, COUNTY OF WELLINGTON**

**PREPARED FOR  
EC (ERIN) GP. INC.**

**Urbantech File No.: 21-684**

**2<sup>nd</sup> SUBMISSION – SEPTEMBER 2023**

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## 1 INTRODUCTION & BACKGROUND

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This report provides functional servicing and stormwater management information in support of the proposed Empire Erin Draft Plan of Subdivision located at 5525 8<sup>th</sup> Line in the Town of Erin, County of Wellington. This report includes conceptual details for the proposed grading, stormwater management (SWM), sanitary servicing and water distribution systems required to service the proposed development in sufficient detail to support Draft Plan Approval.

With reference to **Figure 1.0** in **Appendix A**, 5525 8<sup>th</sup> Line is located between Sideroad 17 and Dundas Street West and is bounded:

- To the east and north by an existing Natural Heritage System (NHS) associated with the West Credit River;
- To the south by the existing Erin Heights residential development; and
- To the west by 8<sup>th</sup> Line.

The subject site is comprised of Part of Lot 19, Plan 686 and lies within the limits of the West Credit River subwatershed, under 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:

- 68 Single Detached Residential lots;
- 25 Rear Access Single Detached Residential lots;
- 155 Street Townhouses;
- 58 Back-to-Back Townhouses;
- 0.77 ha Stormwater Management;
- 0.69 ha Park;
- 0.60 ha Open Space<sup>1</sup>; and
- 3.95 ha 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.

Two (2) street connections to 8<sup>th</sup> Line at Streets A and B are proposed as illustrated on **Drawing 2.2A** in **Appendix A**.

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

- Updated Report on Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Erin Height Golf Course, 5525 8<sup>th</sup> Line, prepared by DS Consultants Ltd. (September 11, 2023);
- Meander Belt Width and Erosion Hazard Assessment for the Credit River – Erin Branch, prepared by GEO Morphix Ltd. (January 16, 2020); and
- Updated Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis, Erin Fairways Subdivision, 5525 Eighth Line, prepared by Terra-Dynamics Consulting Inc. (September 18, 2023).
- Arborist Report & Tree Protection Plan, prepared by Canopy Consultants (October 2, 2023)

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<sup>1</sup> Note that part of the Open Space Block on the east side of the property has been used for Stormwater Management

The intention of this report is to demonstrate that the proposed Draft Plan of Subdivision 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 Manual (May 2022);
- Credit Valley Conservation Stormwater Management Criteria;
- Ministry of the Environment's Stormwater Management Planning and Design Manual;
- Toronto and Region Conservation Authority Erosion and Sediment Control Guide for Urban Construction (2019); 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

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### 2.1. EXISTING CONDITIONS

The subject site currently operates as a 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** in **Appendix A**.

### 2.2. PROPOSED CONDITIONS

Site grading design considers the following objectives and constraints:

- Conforms to Town of Erin design criteria;
- Respects existing boundary conditions;
- Optimizes 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 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 walls are proposed around the site boundary where required:
  - Within future lots, proposed retaining walls are envisioned as precast concrete block landscape walls (subject to detailed design) falling under private ownership and responsibility in accordance with agreements of purchase and sale;
  - Within the North SWM Facility, proposed retaining walls will fall under public ownership and shall be constructed in accordance with Town requirements.
- Road centerline grades have been set at 0.5% to 5.0%; and
- A continuous overland flow path has been provided via proposed right-of-ways (ROWs) to the north SWM facility.

Preliminary Grading Plans, Cross Sections, and Details have been prepared to further describe proposed grading and boundary conditions. Refer to Preliminary Grading Plans **Drawings 2.2B to 2.2F** in **Appendix A**. **Note Drawing 2.2E** illustrates preliminary cut and fill across the site.

Proposed ROWs 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. Erosion and Sediment Control

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

- Sediment fencing/construction (snow) fencing will be placed along the perimeter of the site prior to construction to delineate the limit of disturbance and protect natural features;
- Sediment ponds and/or traps will be provided at each outlet;
- Cut-off swales/diversions to direct runoff to control devices and to keep construction areas dry. Swales to include check dams at regular intervals to reduce erosive velocities;
- Construction traffic access mud mats will be provided at construction vehicle access point(s) to minimize off-site tracking of sediments;
- All 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.

A detailed Erosion & Sediment Control Brief and Soil Management Plan, including Site Alteration Plans will be provided at detailed design stage.

### 2.2.2. Tree Preservation

A detailed tree inventory and tree preservation plan and has been prepared by Canopy Consulting for the subject site (October 2023). Trees that are in conflict with site grading have been identified and are to be removed. Where possible, along the site boundary, trees have been preserved and protected. Please refer to the Arborist Report and Tree Protection Plan by Canopy Consulting for further detail. For information, Urbantech **Drawing 1001** (Site Alteration – Stage 1A Tree Removal) has been included in **Appendix A**.

### 3 STORM DRAINAGE

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#### 3.1. EXISTING CONDITIONS

As illustrated on **Drawing 1.2** in **Appendix A**, existing drainage from the subject site is conveyed to the main branch of the West Credit River along the north boundary of the site, and to 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

The subject site consists of 13.86 ha of drainage area, plus 1.75 ha of external drainage. As illustrated on **Drawing 4.0** in **Appendix A**, post-development stormwater management conditions are as follows:

- A total catchment area of 9.32 ha is conveyed to the North SWM facility via proposed storm sewers and ROWs, including 0.86 ha of external road drainage from the future urbanized 8<sup>th</sup> Line, and 0.89 ha of external drainage from the Erin Heights residential development;
- A total catchment area of 0.37 ha is conveyed to the East SWM facility overland;
- A total rooftop area of 3.26 ha is conveyed to the North SWM facility via proposed 3<sup>rd</sup> pipe cleanwater collector sewer;
- A total rooftop area of 0.60 ha is conveyed to the East SWM facility via proposed 3<sup>rd</sup> pipe cleanwater collector sewer; and
- 2.06 ha of drainage from rear lots, open space, and park is conveyed overland uncontrolled to NHS and onward to the main branch and tributary CR1-1 of the West Credit River.

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

##### 3.2.1. Minor System

Storm sewers are proposed throughout the subject site to convey runoff 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.

Proposed storm sewers are illustrated on Post-Development Storm Drainage **Drawing 3.1** in **Appendix A**. Contributing drainage areas exclude roof drainage which will be directed to the clean water collection system (**Section 3.2.3**). 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 conform 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<sup>2</sup>/s.

### 3.2.3. *Cleanwater Collector System*

A cleanwater collector 3<sup>rd</sup> 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. A total of 0.60 ha of roof area is proposed to be conveyed to the East SWM facility, and a total of 3.26 ha of roof area 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.

Proposed cleanwater collector sewers are illustrated on Post-Development Storm Drainage **Drawing 3.1** in **Appendix A**. Cleanwater collector sewer design calculations 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 the 24-hour SCS Type II storm distribution. The hydrology of the subject site is assessed based on the intensity-duration-frequency (IDF) curves from the Town’s Design Standards (2022).
- **Climate Change Considerations:** The Town’s updated IDF curves incorporate considerations for climate change in accordance with recommendations from the CVCA. A 17% increase in rainfall IDF was applied to the MTO 2010 rainfall intensity data.
- **Quality Control:** Enhanced Level of control based on MOE (2003) Guidelines (i.e., 80% Total Suspended Solids removal) through the implementation of a treatment train approach including end-of-pipe SWM facilities and/or LID measures.
- **Erosion Control:** On-site detention of the 5 mm rainfall event as per CVC criteria (2012). For SWM ponds, 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 (15.61 ha, including external drainage areas) 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 <sup>3</sup> /s)
2-year	0.306
5-year	0.530
10-year	0.700
25-year	0.949
50-year	1.136
100-year	1.310

### 4.2. SWM DESIGN

The proposed stormwater management strategy includes two SWM facilities; the North SWM facility and the East SWM facility. The North SWM facility will consist of a dry pond and a separate underground flood storage and infiltration chamber. The North dry pond will be lined to prevent infiltration and protect the adjacent PSW 5a. The East SWM facility will consist of a dry pond with a stone infiltration layer. Oil-grit Separators (OGS) units will also be implemented prior to the North SWM facility.

#### 4.2.1. Quantity Control

The VO6 hydrologic model was used to size the two (2) proposed SWM facilities, including the two dry pond volumes and the underground storage volume. As noted in **Section 4.1**, the Town's rainfall intensity-duration-frequency (IDF) curves were used for the quantity control analysis for both pre- and post-development conditions. Various storm distributions, including the 4-hour Chicago Storm and Hurricane Hazel, were tested in the hydrologic model. The 24-hour SCS Type II 100-year storm distribution was ultimately selected as the controlling event as it produced the highest storage volume requirements.

The VO6 model considered the flows from the uncontrolled rear-lot and park areas (2.06 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**, 3.26 ha of roof drainage is to be collected by the proposed cleanwater collector 3<sup>rd</sup> pipe system (as shown on **Drawing 3.1** and **Drawing 4.0** in **Appendix A**) and conveyed to the underground storage tank in the North SWM block. As the proposed 3<sup>rd</sup> 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 3.26 ha of roof drainage. For storm events greater than the 5-year return period, discharge from the North cleanwater collector 3<sup>rd</sup> 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**, 0.60 ha of roof drainage is to be collected by the proposed cleanwater collector 3<sup>rd</sup> 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 0.37 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, 2022 Town IDF)**

Storm Event	Pre-Development Target Flows (m <sup>3</sup> /s)	Post-Development Uncontrolled Flows (m <sup>3</sup> /s)	North SWM Facility (Block 29)				East SWM Facility (Block 31)		Total Post-Development Flows* (m <sup>3</sup> /s)
			Controlled Release Rate – Underground Storage (m <sup>3</sup> /s)	Total Storage Required – Underground Storage (m <sup>3</sup> )	Controlled Release Rate – Dry Pond (m <sup>3</sup> /s)	Total Storage Required – Dry Pond (m <sup>3</sup> )	Controlled Release Rate – Dry Pond (m <sup>3</sup> /s)	Total Storage Required – Dry Pond (m <sup>3</sup> )	
2-Year	0.306	0.145	0.017	1556	0.193	2106	0.008	387	0.303
5-Year	0.530	0.210	0.033	1985	0.408	2705	0.012	497	0.521
10-Year	0.700	0.253	0.044	2269	0.520	3128	0.015	569	0.691
25-Year	0.949	0.312	0.058	2641	0.727	3690	0.020	664	0.927
50-Year	1.136	0.380	0.069	2900	0.875	4190	0.024	730	1.134
100-Year	1.310	0.423	0.102	3040	0.899	4420	0.025	840	1.294

\* Total post development flows from VO (hydrologic model) are not arithmetic sums; they consider different catchment peak times and routing effects.

#### 4.2.2. Climate 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. The Town has updated their rainfall IDF curves, which is two-fold. The reference location for base data was updated and consideration for climate change was incorporated in keeping with recommendations from the Credit Valley Conservation (CVC). Please note that the results from the VO6 hydrology model in the **Table 4-2** above have used Town's updated rainfall IDF, therefore demonstrating that the proposed SWM facilities can adequately accommodate future climate change considerations. Refer to section 8.3.3 in Town of Erin Engineering Design Standards Manual (2022).

#### 4.2.3. Quality Control

Quality controls are provided via a treatment train of low impact developments (infiltration facilities, oil-grit separators) and end-of-pipe facilities (dry ponds) to exceed the 80% TSS removal requirement for the entire site. The proposed SWM facilities were sized to provide Total Suspended Solids (TSS) removal as per to Table 3.2 in the MOE's Stormwater Planning and Design Manual.

Quality control for drainage areas to the North SWM facility is to be provided by a treatment train approach consisting of two (2) proposed oil/grit separator (OGS) units and the dry pond facility. The proposed OGS will provide 50% TSS removal and the dry pond (sedimentation facility) will provide 60% TSS removal, resulting in an effective 80% TSS removal for the 9.32 ha of lots and road ROW draining to 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, as the roof drainage is assumed to be inherently clean runoff which does not require additional water quality treatment.

Quality controls for drainage areas to the East SWM facility are 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 sized to provide 80% TSS removal for the 0.37 ha of lots and road ROW. 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 4-3** and **Table 4-4** below, for which the detailed sizing calculations are provided in **Appendix B**. The site's overall TSS removal based on weighted area average is presented in **Table 4-5** below, showing that the 80% TSS removal requirement is exceeded.

**Table 4-3 – Quality Control Summary (North SWM Facility – Dry Pond, 60% Basic Level)**

Area (ha)	Imperviousness (%)	Unit Volume Requirement (m <sup>3</sup> /ha)	Dry Pond Volume Required (m <sup>3</sup> )	Dry Pond Volume Provided (m <sup>3</sup> )
9.32	68	190	1175	4,420

**Table 4-4 – Quality Control Summary (East SWM Facility – Infiltration, 80% Enhanced Level)**

Area (ha)	Imperviousness (%)	Unit Volume Requirement (m <sup>3</sup> /ha)	Infiltration Volume Required (m <sup>3</sup> )	Infiltration Volume Provided (m <sup>3</sup> )
0.37	62	33	12	145

**Table 4-5 – Overall Site TSS Removal**

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
<b>North SWM Facility</b>					
Roof Drainage	Inherently Clean	100%	3.26	26%	26%
Lots and ROW	OGS Units + Dry Pond (Sedimentation)	80%*	9.32	74%	59%
<b>Subtotal</b>			<b>12.58</b>	<b>100%</b>	<b>85%</b>
<b>East SWM Facility</b>					
Roof Drainage	Inherently Clean	100%	0.60	62%	62%
Lots and ROW	Infiltration	80%	0.37	38%	31%
<b>Subtotal</b>			<b>0.97</b>	<b>100%</b>	<b>92%</b>
<b>Uncontrolled Drainage</b>					
Park and Open Space	Inherently Clean	80%	1.22	59%	47%
Rear Lots and Roofs	Inherently Clean	100%	0.84	41%	41%
<b>Subtotal</b>			<b>2.06</b>	<b>100%</b>	<b>88%</b>
<b>Total Site</b>					
<b>Total</b>			<b>15.61</b>	<b>100%</b>	<b>86%</b>

\* Based on treatment train of OGS (50% TSS removal) & Dry Pond (60% TSS Removal)

#### 4.2.4. 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 to provide on-site retention of the first 5 mm of precipitation, as per CVC criteria (2012) and the Town’s engineering standards. As discussed further in **Section 5.2**, LID measures in the SWM facilities are sized to provide infiltration of 20 mm of the rooftop runoff collected by the cleanwater 3<sup>rd</sup> pipe system in order to meet the water balance requirements. Hence, the total infiltration volume provided exceeds the 5 mm retention volume over the total site area, therefore providing downstream erosion benefits. Required and proposed infiltration volumes are summarized in **Table 4-6** below.

**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 <sup>3</sup> )	Total Roof Area to Infiltration (ha)	Minimum Infiltration Volume Provided (mm)	Minimum Infiltration Volume Provided (m <sup>3</sup> )
North SWM Facility (Block 29)	12.58	5	629	3.26	20	652
East SWM Facility (Block 31)	0.97		48.5	0.60		120

In addition to the on-site retention, the North SWM facility will also provide extended detention of the 25 mm event as per CVC criteria (2012) for SWM facilities. This will provide further reduction of the peak and duration of storm flows to mitigate erosion impacts.

**Table 4-7** below compares the required and provided storage volume and release rate for extended detention in the North SWM facility, as per the MOE unit rate criteria of 40 m<sup>3</sup>/ha and minimum detention of 48 hours. The release rate is provided by implementing an 80mm orifice plate at the outlet control manhole. Outlet details are discussed in further detail in **Section 4.3.4**. Extended detention and drawdown calculations (orifice sizing) are provided in **Appendix B**.

**Table 4-7 – North Facility Extended Detention Summary**

Drainage Area (ha)	9.32
Extended Detention Unit Rate (m <sup>3</sup> /ha)	40
Extended Detention Runoff* (mm)	16.77
Required Erosion Control Volume (m <sup>3</sup> )	1563
Required Release Rate** (m <sup>3</sup> /s)	0.009
Provided Erosion Control Volume (m <sup>3</sup> )	1606
Erosion Control Water Level (m)	406.95
Drawdown Time (hours)	71

\* Rainfall volume to North SWM Facility extracted from VO modelling (25 mm event)

\*\* Based on a minimum detention period of 48 hours

Extended detention of the 25 mm event is not implemented for the East SWM facility due to the small drainage area (0.97 ha), which would require an orifice size smaller than the minimum Town standard of 75 mm. Smaller orifice sizes are prone to plugging and maintenance issues.

### 4.3. FACILITY DESIGN

#### 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** in **Appendix A**, respectively.

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

- **Underground Storage & Infiltration 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 stone base of the underground storage facility provides infiltration storage for water balance;
- **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 (sedimentation) of drainage to the North SWM facility in conjunction with the proposed OGS units; and
- **OGS:** Two (2) proposed OGS units contribute to the overall quality control treatment of drainage to the North SWM facility in conjunction with the proposed 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; and
- **Dry Pond:** Provides quantity control and storage attenuation for up to and including the 100-year storm event. The dry pond also provides quality control treatment to the East SWM block in conjunction with the base infiltration layer.

#### 4.3.2. General SWM Facility Design Guidance

As per the Town of Erin design criteria and engineering standards, the following design considerations are required 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.

#### 4.3.3. Inlet Spillway

The proposed inlet spillway to the North SWM dry pond has been sized to accommodate the overland / major system flow up to the uncontrolled 100-year storm less the 5-year storm (approximately 1.0 m<sup>3</sup>/s). The inlet spillway is sized as follows: 0.10m depth, 3:1 side slope, and 3.0m bottom width. The inlet spillway has a total capacity of 1.25 m<sup>3</sup>/s.

Additionally, the road right-of-way conveyance capacity of Street B (leading to the North SWM dry pond) was also confirmed via Hydraflow Express to be sufficient (1.7 m<sup>3</sup>/s). The inlet spillway calculations and Hydraflow Express results are included in **Appendix B**.

There is no inlet spillway to the East SWM dry pond as the facility only receives surface runoff from rear-lots and clean roof runoff via the 3<sup>rd</sup> pipe system.

#### 4.3.4. Outlet Structures

The proposed outlet control structures for the two SWM dry ponds and underground storage tank are designed to control the extended detention (North dry pond only) and 2-year to 100-year flows to the outlet pipes and ultimately to the West Credit River.

To achieve the target flows noted in **Table 4-2**, the outlet structures were designed as follows:

##### North SWM Dry Pond

- Extended Detention – Orifice plate at an invert of 406.45 m with a diameter of 80 mm. The proposed orifice control provides an approximate drawdown time of 3 days.
- 2-year to 100-year Control – A concrete box manhole structure with the following openings acting as compound weirs:
  - A 1.90 m wide x 0.17 m high weir with an invert elevation at 407.00 m
  - A 2.00 m wide x 0.08 m high weir with an invert elevation at 407.50 m
- The dry pond outlet pipe is 825 mm with a conveyance capacity of 1.02 m<sup>3</sup>/s to convey the 100-year controlled flow of 0.899 m<sup>3</sup>/s. Outlet invert is set at approximately 398.0 m above the 25-year water level of 395.20 m (CVC West Credit River HEC-RAS model).
- Discharge to West Credit River - The outfall is proposed to discharge to a swale that conveys flows to the West Credit River to mitigate any negative impacts on the adjacent wetlands. The proposed swale is sized to convey the uncontrolled 100-year flows (see **Appendix B** for Hydraflow Express calculations):
  - Bottom width = 6 m, Depth = 0.2 m, Side slopes 3H : 1V
  - Hydraulic Capacity = 2.93 m<sup>3</sup>/s

##### Underground Storage Tank

- 2-year to 100-year Control – A concrete box manhole structure with the following openings acting as compound weirs:
  - A 0.09 m wide x 0.10 m high weir with an invert elevation at 404.80 m
  - A 0.13 m wide x 0.20 m high weir with an invert elevation at 405.30 m

- A 0.50 m wide x 0.10 m high weir with an invert elevation of 405.65 m
- The underground storage outlet pipe is 450 mm with a conveyance capacity of 0.20 m<sup>3</sup>/s to convey the 100-year controlled flow of 0.10 m<sup>3</sup>/s.

### East SWM Dry Pond

- 2-year to 100-year Control – A concrete box manhole structure with the following openings acting as compound weirs:
  - A 0.05 m wide x 0.07 m high weir with an invert elevation at 405.45 m
  - A 0.06 m wide x 0.08 m high weir with an invert elevation at 406.40 m
  - A 0.06 m wide x 0.06 m high weir with an invert elevation of 407.70 m
- The dry pond outlet pipe is 450 mm with a conveyance capacity of 0.20 m<sup>3</sup>/s to convey the 100-year controlled flow of 0.025 m<sup>3</sup>/s.

In conjunction with the pond gradings, the outlet structures result in the following rating curves as listed in **Table 4-8**, **Table 4-9** and **Table 4-10**. The detailed design calculations for the proposed outlet control structures are provided in **Appendix B**.

**Table 4-8 – North SWM Dry Pond Rating Curve**

Design Event	Stage (m)	Design Flows (m <sup>3</sup> /s)	Provided Volume Storage (m <sup>3</sup> )
Extended Detention	406.95	0.009	1606
2-year	407.15	0.193	2250
5-year	407.30	0.408	2764
10-year	407.45	0.520	3305
25-year	407.60	0.727	3871
50-year	407.70	0.875	4265
100-year	407.75	0.899	4420
Emergency	407.75	2.577*	-

\* Uncontrolled 100-year flows for emergency spillway

**Table 4-9 – Underground SWM Storage Rating Curve**

Design Event	Stage (m)	Design Flows (m <sup>3</sup> /s)	Provided Volume Storage (m <sup>3</sup> )
2-year	405.30	0.017	1641
5-year	405.45	0.033	2133
10-year	405.50	0.044	2297
25-year	405.65	0.058	2789
50-year	405.70	0.069	2953
100-year	405.75	0.102	3117

**Table 4-10 – East SWM Dry Pond Rating Curve**

Design Event	Stage (m)	Design Flows (m <sup>3</sup> /s)	Provided Volume Storage (m <sup>3</sup> )
2-year	406.30	0.008	387
5-year	406.50	0.012	511
10-year	406.60	0.015	577
25-year	406.75	0.020	684
50-year	406.85	0.024	760
100-year	406.95	0.025	840
Emergency	406.95	0.286*	-

\* Uncontrolled 100-year flows for emergency spillway

#### 4.3.5. Emergency Spillways

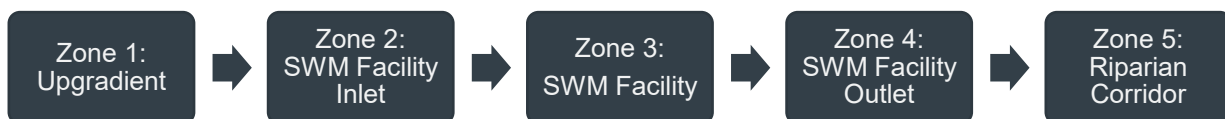
If the outlet control structures / weirs are blocked, or the ponds do not function as expected, emergency flows will spill via the emergency spillway channels for each pond. The proposed emergency spillway channels are sized to convey the uncontrolled 100-year flows. The pond berms are graded to provide a 0.3m freeboard above the routed uncontrolled 100-year elevation in the emergency spillways, as per the Town design standards. The emergency spillway characteristics are summarized in **Table 4-11** below. Sizing calculations are included in **Appendix B**.

**Table 4-11 – Emergency Spillway Characteristics**

Facility Emergency Spillway	Bottom Width (m)	Design Flow Depth (m)	Spillway Capacity (m <sup>3</sup> /s)	Weir Invert (m)	UC 100-year Water Level (m)	Berm Elevation (m)
North Dry Pond	15.0	0.25	2.95	407.75	408.00	408.30
East Dry Pond	6.0	0.10	0.30	406.95	407.05	407.35

#### 4.3.6. Thermal Mitigation

In 2011, the CVC released the report "Thermal Impacts of Urbanization including Preventative and Mitigation Techniques," which was reviewed to develop the following list of potential thermal mitigation measures. Implementation of these measures will mitigate impacts on the thermal regime of the West Credit River that supports Brook Trout and other coldwater species. The CVC Thermal Impacts Report identified five "zones" where thermal mitigation measures can be implemented, as presented below.



**Table 4-12** outlines the thermal mitigation measures reviewed and those recommended for implementation throughout the site and specifically at the North SWM facility. If a measure is not applicable, a rationale for this recommendation is provided.

**Table 4-12 – CVC Thermal Mitigation Measures**

Mitigation Measure	Zone	Proposed Measures	Implementation & Feasibility Notes
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓	Implemented as part of the proposed urban stormwater sewer system.
LID measures (infiltration facilities)	Zone 1	✓	Implemented in Zone 3 as infiltration facilities in the North & East SWM facilities.
Downspout disconnection	Zone 1	X	Most rooftops are discharged to the roof drain collector, conveying flows to the infiltration facilities.
Buried inlet pipe	Zone 2	X	Not applicable for dry ponds.
Inlet cooling trench	Zone 2	X	Not recommended due to grading, capacity, or maintenance constraints.
Inlet plantings	Zone 2	✓	Recommended for implementation at the North and East SWM facilities at detailed design stage.
Shading of open water areas by maximizing canopy	Zone 3	✓	Recommended for implementation at the North and East SWM facilities at detailed design stage.
Artificial shade systems	Zone 3	X	Not recommended for dry ponds with no permanent pools.
Reduce open water area	Zone 3	✓	Dry ponds with quick drawdown times minimize open water after storm events.
Deep Permanent Pool (3.0 m)	Zone 3	X	Not applicable for dry ponds.
Increased L:W ratio	Zone 3	X	Not recommended for dry ponds.
Pond orientation to reduce solar inputs	Zone 3	X	Not recommended for dry ponds.
Landscaped jetties for shading	Zone 3	X	Not recommended for dry ponds.
Sub-surface SWM storage	Zone 3	✓	Implemented at the North SWM facility, with subsurface storage for roof runoff up to the 5-year event.
Sub-surface cooling trench	Zone 4	X	MNRF no longer recommends cooling trenches.
Outlet shading	Zone 4	✓	Recommended for implementation at the North and East SWM facilities at detailed design stage.
Concrete outlet pipe	Zone 4	✓	Concrete outlet pipe from North dry discharges to ~85m swale that conveys flows to West Credit River.
Reversed slope pond outlet / extra permanent pool depth at outlet	Zone 4	✓	Not applicable for dry ponds.
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	✓	For the North SWM facility, subsurface storage outlet is separate from the dry pond outlet, taking advantage of the NHS shading.
Night-time release	Zone 4	X	Night-time release requires complex control systems that would have to be maintained by the Town. These measures are therefore not recommended at this time.
Pocket wetland/stone core trench at outfall	Zone 5	✓	Recommended for implementation at the North and East SWM facilities at detailed design stage.
Watercourse shading	Zone 5	✓	West Credit River NHS has natural shading.

## 5 WATER BALANCE

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### 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, 2023), in support of the Draft Plan of Subdivision.

The study prepared by Terra-Dynamics includes an overall site-specific water balance analysis to determine the existing and proposed annual infiltration volumes based on pre- and post-development groundwater recharge rates, as well as an impact assessment of the existing downgradient features, including Provincially Significant Wetlands (PSWs) located north of the site. Impacts to the site and feature-based water balances are 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 Report 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 3<sup>rd</sup> pipe cleanwater collection system to convey 3.26 ha of clean roof drainage to the North SWM facility;
- An infiltration gallery proposed within the North SWM facility to infiltrate a minimum of 20 mm over the 3.26 ha roof area collected by the 3<sup>rd</sup> pipe system, by providing a total infiltration storage volume of 655 m<sup>3</sup> in the clear stone base of the underground storage facility;
- A 3<sup>rd</sup> pipe cleanwater collection system to convey 0.60 ha of clean roof drainage to the East SWM facility; and
- An infiltration gallery proposed within the East SWM facility to infiltrate a minimum of 20 mm over the 0.60 ha roof area collected by the 3<sup>rd</sup> pipe system, by providing a total infiltration storage volume of 145 m<sup>3</sup> in the clear stone base of the East SWM facility.

As per the assessment by Terra-Dynamics, the above-mentioned LID measures will be able to maintain a significant amount (80%) of the annual pre-development infiltration volume over the subject site area, as well as maintaining the required groundwater recharge rates upgradient of the existing PSWs.

The configuration of the proposed 3<sup>rd</sup> pipe systems is shown on **Drawing 3.1** in **Appendix A**, 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**.

### 5.3. SITE WATER BALANCE

Terra Dynamics completed a daily precipitation analysis to determine a precipitation infiltration threshold to maintain pre-development levels of groundwater recharge. This threshold was then used as a criterion for design of 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 (see Table 5 in the attached Hydrogeological report included in **Appendix C**). These values exceed the modelled site pre-development recharge rate of 340 mm/year, with an average '10 mm or

17

greater precipitation' value of 425 mm/year exceeding the modelled recharge by 25%. However, a larger amount of precipitation abstraction is required for the site as 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) 20 mm, or less, precipitation events are infiltrated from "clean" impervious surface roof runoff and (b) fill is of loam quality or higher infiltration rate. If a higher recharge rate is required more permeable soils than loam could be specified for fill areas. **Table 5-1** summarizes the site pre- and post development recharge volumes and is further explained below:

- (a) Infiltration of 'clean' runoff from 3.86 hectares of impervious areas (i.e., multiplied by 727 mm/year for capture or precipitation events from 1-15 mm) via a 3<sup>rd</sup> pipe system to infiltration areas at the stormwater management facilities resulting in an estimated annual recharge volume of 28,062 m<sup>3</sup>; and
- (b) 4.90 hectares of continuing recharge for the permeable areas of lots, the park and the stormwater management areas.
  - a. 3.10 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 4,278 m<sup>3</sup>.
  - b. 1.80 hectares multiplied by 302 mm/year (representing areas where native soils will be at-surface not fill) for an annual recharge volume of 5,436 m<sup>3</sup>. This was calculated in the southern portion of the Site to include areas of less than 2 m of excavation.

The eastern infiltration area will provide groundwater recharge to, and discharge to, the eastern tributary.

It is also noted that recent annual precipitation amounts are generally above the 1980-2010 climate normal of 946 mm/year. 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 and increase in winter groundwater recharge (Shifflett, 2014).

**Table 5-1 – Pre-development & Post-development Annual Estimated Site Recharge Volumes**

Scenario	Area (ha)	Recharge (mm/year)	Volume (m <sup>3</sup> )
Pre-development	13.86	340	<b>47,081</b>
Post-development	3.86 (clean impervious roof areas via 3rd pipe to infiltration systems)	727	28,062
	3.10 (pervious areas fill)	138	4,278
	1.80 (pervious areas native)	302	5,436
<b>Total</b>			<b>37,776</b>

#### 5.4. FEATURE BASED WATER BALANCE

The feature based water balance was completed for the two adjacent wetlands, PSW 4a and PSW 5a. The wetlands are primarily supported by groundwater recharge at the wetlands and recharge upgradient of the wetlands. This is shown by the 2 years of water level monitoring (see Hydrogeology Report in **Appendix C**) which show:

- Ponding was only measured to occur at the western poplar wetland when groundwater discharge was occurring.

- Pondered water doesn't occur at eastern cedar wetland, so groundwater is the supply because no surface water ponding was monitored to occur.

The analysis determined that the water balances for the wetlands can be maintained post-development and excess / increased recharge can continue to flow in the subsurface downgradient of the wetlands. **Table 5-2** summarized the pre- and post-development wetland water balance volumes and is further explained below:

- Direct precipitation will continue to the wetlands.
- 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).
- 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 20 mm.
- Described uncontrolled drainage areas will provide recharge as well as discharge from impervious areas.
- Lot-level infiltration will occur in pervious areas upgradient on-site.

**Table 5-2 – Pre-development & Post-development Annual Estimated Wetland Recharge**

East Cedar Wetland 4a Catchment	Area – on and off site (ha)	Recharge (mm/year)	Volume (m <sup>3</sup> )
Pre-development	2.16	374	<b>8,078</b>
Post-development	0.60 (clean roof runoff infiltrated at SWM)	727	4,362
	0.78 (preserved off-site upgradient buffer area)	374	2,917
	0.53 (uncontrolled drainage area recharge)	138	729
	0.14 (uncontrolled drainage area discharge)	996	1,394
	0.17 (pervious drainage upgradient on-site)	138	229
	<b>Total</b>		
West Poplar Wetland 5a Catchment	Area – on and off site (ha)	Recharge (mm/year)	Volume (m <sup>3</sup> )
Pre-development	7.56	359	<b>27,140</b>
Post-development	3.26 (clean roof runoff infiltrated at SWM)	727	23,700
	1.51 (preserved off-site upgradient buffer area)	374	5,647
	0.89 (uncontrolled drainage area recharge)	138	1,227
	0.11 (uncontrolled drainage area discharge)	996	1,084
	1.03 (pervious drainage upgradient on-site)	138	1,421
	<b>Total</b>		

## 6 WATER DISTRIBUTION SYSTEM

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### 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 250mm PVC watermain currently exists on 8<sup>th</sup> Line that will supply the proposed development. The conceptual location of the existing water infrastructure on 8<sup>th</sup> Line is shown on Watermain Plan **Drawing 6.1** in **Appendix A**.

As per the Town's Water Class EA Study prepared by Triton Engineering, new municipal wells and additional elevated storage have to be constructed in order to accommodate all proposed development within the Town of Erin. It is our understanding the Town has retained WSP to develop a new water model for existing and future conditions. A draft analysis has been provided to Urbantech for review generally indicating service for the subject site is available in existing conditions.

### 6.2. DESIGN CRITERIA

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

- Average Daily Demand Rate, Residential (ADD) = 290 L/capita/day;
- Minimum Hourly Demand (MHD) Peaking Factor = 0.40;
- Maximum Daily Demand (MDD) Peaking Factor = 2.75;
- Maximum Hourly Demand (PHD) Peaking Factor = 4.13;
- Population Density, Single Family = 2.8 people/unit;
- Population Density, Townhouses = 2.8 people/unit;
- Residential Fire Flows = 76 L/s @ 140 kPa (preferred), 57 L/s @ 138 kPa (minimum).

### 6.3. DESIGN FLOWS

With reference to the sanitary design calculations included in **Appendix B**, the proposed Draft Plan projects a population of 859 (excluding existing Erin Heights). Associated water demand is as follows:

- $ADD = 859 \text{ people} * 290 \text{ L/capita/day} = 2.88 \text{ L/s}$ ;
- $MHD = 0.40 * ADD = 1.15 \text{ L/s}$ ;
- $MDD = 2.75 * ADD = 7.93 \text{ L/s}$ ;
- $PHD = 4.13 * ADD = 11.91 \text{ L/s}$ .

Hydrant testing will be conducted at detailed design stage to confirm adequate fire flow is available.

### 6.4. PROPOSED CONDITIONS

Two (2) connections to the existing 250mm PVC watermain on 8<sup>th</sup> Line are proposed via Streets A and B. The subject site will be serviced internally by local watermains. Internal watermain sizes are to be confirmed following completion of modelling by WSP. Further coordination with the Town will also be required regarding the timing of the new infrastructure.

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

## 7 SANITARY SERVICING

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### 7.1. EXISTING CONDITIONS

There is currently no existing wastewater infrastructure within the subject site or on 8<sup>th</sup> 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 Daily Sewage Rate = 290 L/capita/day;
- Inflow and Infiltration = 0.29 L/s/ha;
- Population Density, Single Family = 2.8 people/unit;
- Population Density, Townhouses = 2.8 people/unit.

### 7.3. PROPOSED CONDITIONS

The subject site will be serviced by a network of local gravity sewers. A gravity connection to the Town's trunk wastewater sewer within the Elora-Cataract Trail (currently under construction) via 8<sup>th</sup> Line and Sideroad 17 will be required at Street B in coordination with proposed Mattamy development lands located on the west side of 8<sup>th</sup> Line.

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

These two (2) options for wastewater servicing are conceptually illustrated on Sanitary Drainage Plan **Drawing 7.1** in **Appendix A**. Sanitary design calculations are also included in **Appendix B**.

## 8 PROPOSED ROAD CROSS SECTIONS AND SIDEWALK NETWORK

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The subject site proposes approximately 4 ha of municipal right-of-ways (ROW):

### 8.1. 18 m URBAN MINOR LOCAL RIGHT-OF-WAYS

18 m urban minor local right-of-ways are proposed on Streets 'C', 'D' and 'E' (length +/-750 m). Town of Erin Standard Drawing 101 is applicable. Drawing 101 is proposed to be modified for the addition of the cleanwater collector sewer system as discussed in **Section 3.2.3**.

For details, refer to **Figure 8.1A** in **Appendix A**.

### 8.2. 20 m URBAN/SUBURBAN RIGHT-OF-WAYS

20 m urban/suburban right-of-ways are proposed on Streets 'A' and 'B' (length +/-1420m). Town of Erin Standard Drawing 102 is applicable. Drawing 102 is proposed to be modified for the addition of the cleanwater collector sewer system as discussed in **Section 3.2.3**.

For details, refer to **Figure 8.1B** in **Appendix A**.

### 8.3. 23 m MINOR COLLECTOR RIGHT-OF-WAY

23 m minor collector right-of-way is proposed on Street 'A' (length +/- 60 m), at the entrance to the subdivision from 8<sup>th</sup> Line. The 23 m cross section transitions to the 20 m cross-section described in **Section 8.2** between Street 'B' and Street 'C'. Town of Erin Standard Drawing 103 is applicable. There are no modifications required.

For details, refer to **Figure 8.1C** in **Appendix A**.

### 8.4. 26 m 3-LANE MAJOR COLLECTOR RIGHT-OF-WAY

Existing 8<sup>th</sup> Line is proposed to be widened from 20m to a 26m 3-lane major collector right-of-way. Town of Erin Standard Drawing 104 is applicable. Drawing 104 is proposed to be modified for the addition of a dual minor system storm sewer. Widening will be accomplished by the additional of approximately 3 m along the Empire Erin frontage along with 3 m from proposed development lands located on the west side of 8<sup>th</sup> Line.

The east side of 8<sup>th</sup> Line will be urbanized by Empire Erin in conjunction with their development. The extent of 8<sup>th</sup> Line urbanization is to be confirmed by the Town prior to draft plan approval.

For details, refer to **Figure 8.1D** in **Appendix A**.

## 9 CONCLUSION

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This FSR demonstrates that:

- 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 facilities which are sized to infiltrate 20 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 8<sup>th</sup> 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:



Dragan Zec, P. Eng.  
*Partner*

## **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 9-9 to 10-10, 11-11,13-13)
Drawing 2.2E	Preliminary Cut-Fill Plan
Figure 2.2F	Concrete Block Landscaping Wall (Private) Typical Cross Sections
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	23.0m ROW Cross Section
Figure 8.1D	Modified 26.0m ROW Cross Section
Drawing 1001	Site Alteration – Stage 1A Tree Removal

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



**LEGEND:**



**SUBJECT LANDS**

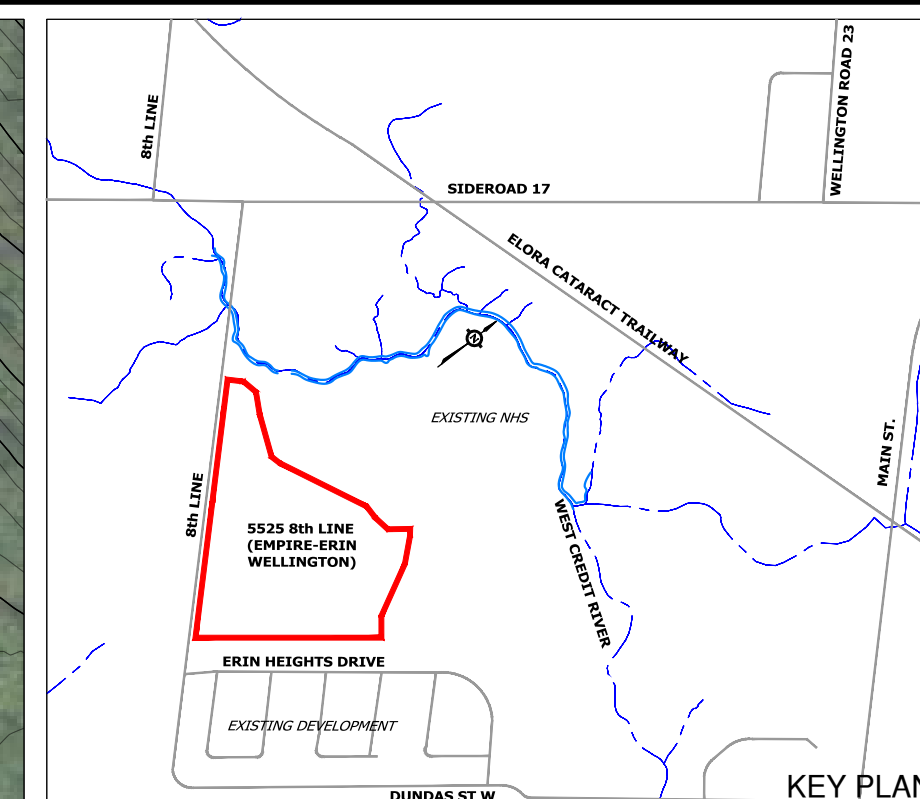


**FIGURE 1.0  
LOCATION MAP**



**September 2023**

**Scale: N.T.S.**



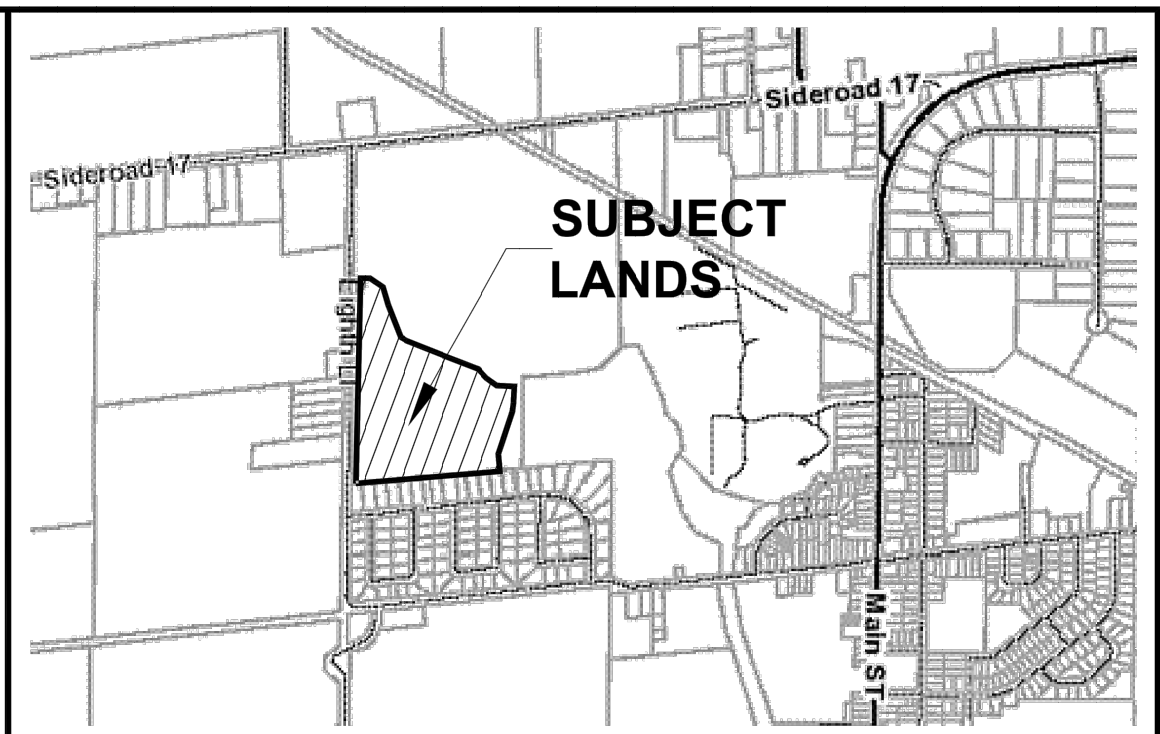
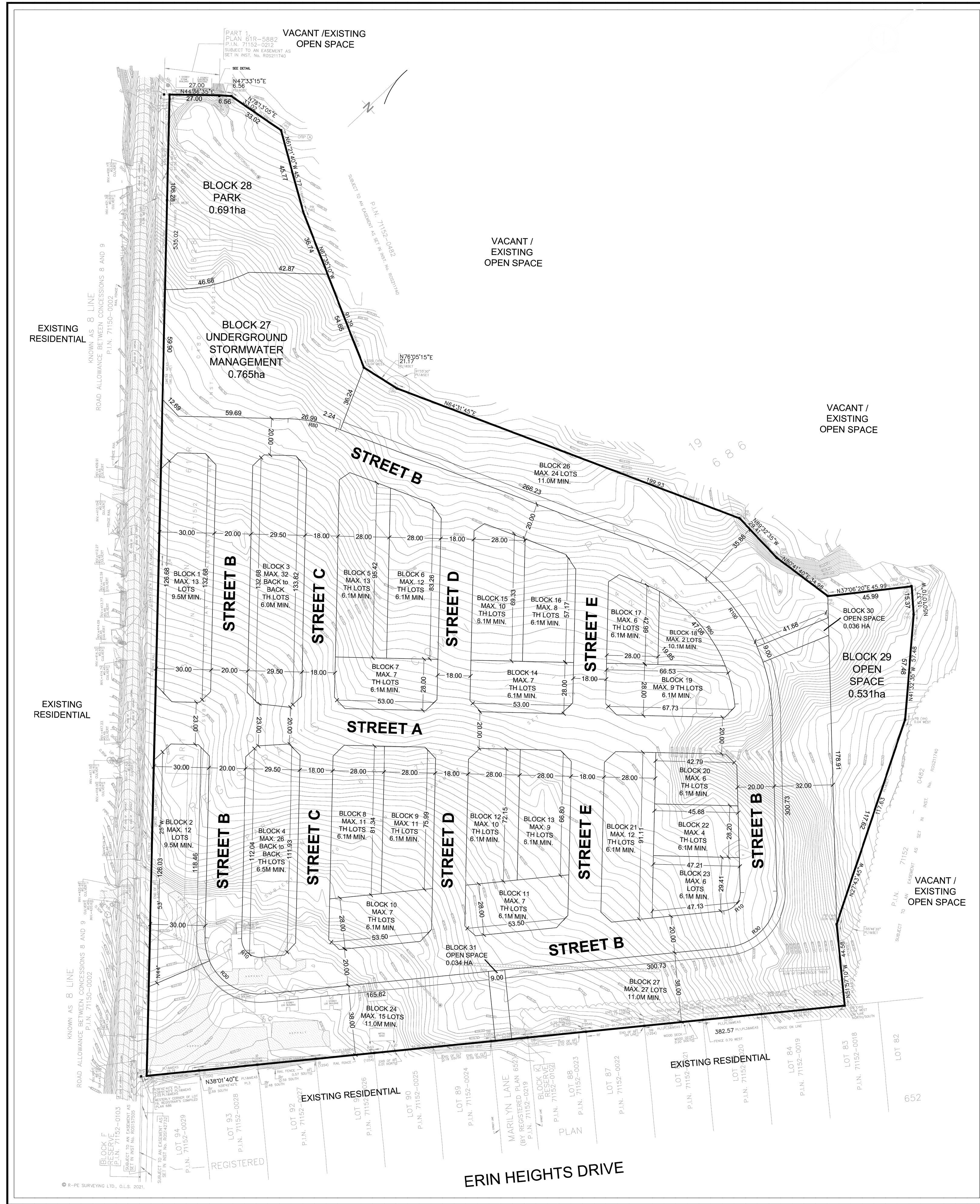
- Legend:**
- Property Boundary
  - Existing Watercourse
  - Existing Contour Elevation
  - Existing Overland Flow
  - ▨ Existing Wetland
  - Pre-Development Drainage Area Boundary to Wetland
- A=2.16 ha** Drainage Area in hectares



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

**PRE-DEVELOPMENT DRAINAGE PLAN**

PROJECT NO.:	DATE:	SCALE:	DRAWING NO.:
21-684	Sept.2023	1:1250	<b>1.2</b>



**KEYMAP** N.T.S

**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 11.0m	Blocks 24-26	2.955
2) Residential Singles 10.1m	Block 18	0.090
Rear Access		
3) Residential Singles 9.5m	Blocks 1,2	0.768
Back-to-Back		
4) Townhouses 6.50m	Blocks 3, 4	0.727
5) Street Townhouses 6.1m	Blocks 5-17,19-23	3.312
6) Park	Block 28	0.690
7) Stormwater Management	Block 27	0.769
8) Open Space	Blocks 29-31	0.602
9) Roads		3.945
<b>Total Site Area</b>		<b>13.859</b>

**Proposed Summary Yield**

Unit Mix	Units
Residential Singles 11.0m	66
Residential Singles 10.1m	2
Rear Access Residential Singles 9.5 m	25
Street Townhouses 6.1 m	155
Back-to Back Townhouses 6.50 m	58
<b>Total Dwelling Units</b>	<b>306</b>

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.

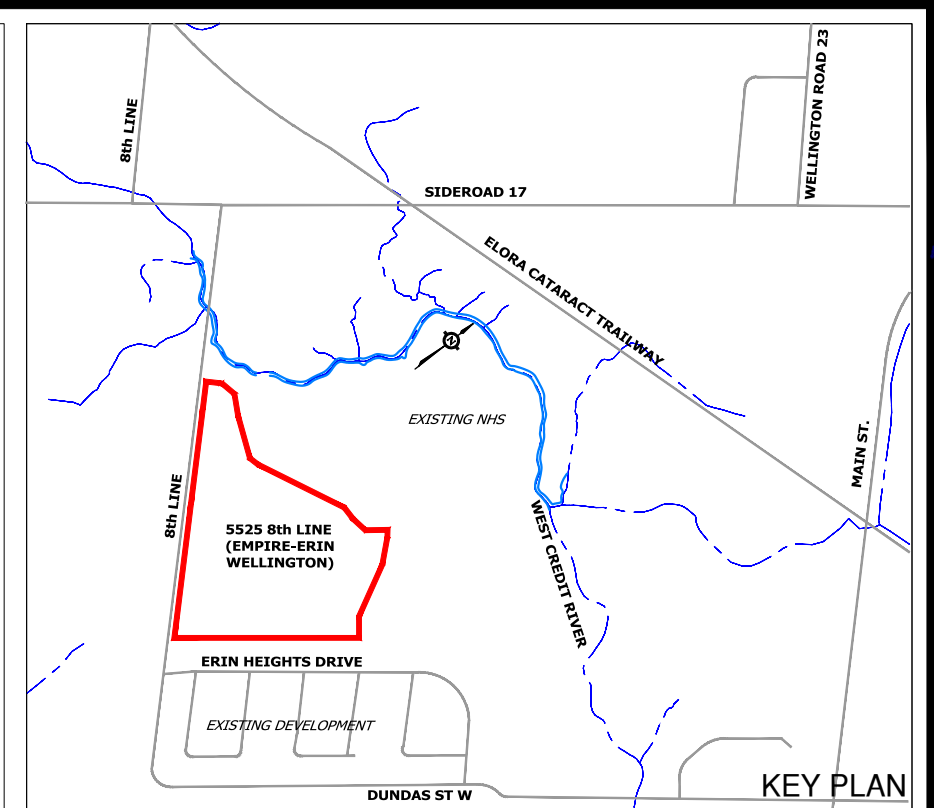
SIGNED \_\_\_\_\_ DATE \_\_\_\_\_

S. GOONEWARDENA, D.L.S.  
 P.R.E. 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

DESIGN		DRAWN		SCALE	1:750
APPROVED		DATE		PROJECT No.	21.2842.00
		August 4, 2023		DRAWING No.	1



**KEY PLAN**

**Legend:**

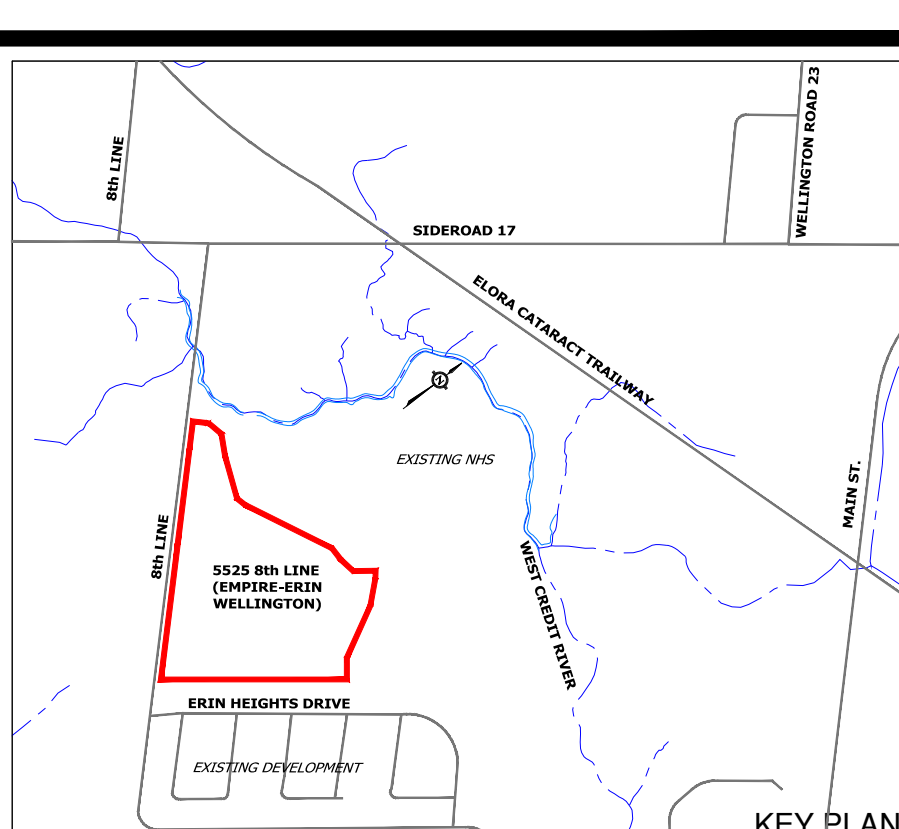
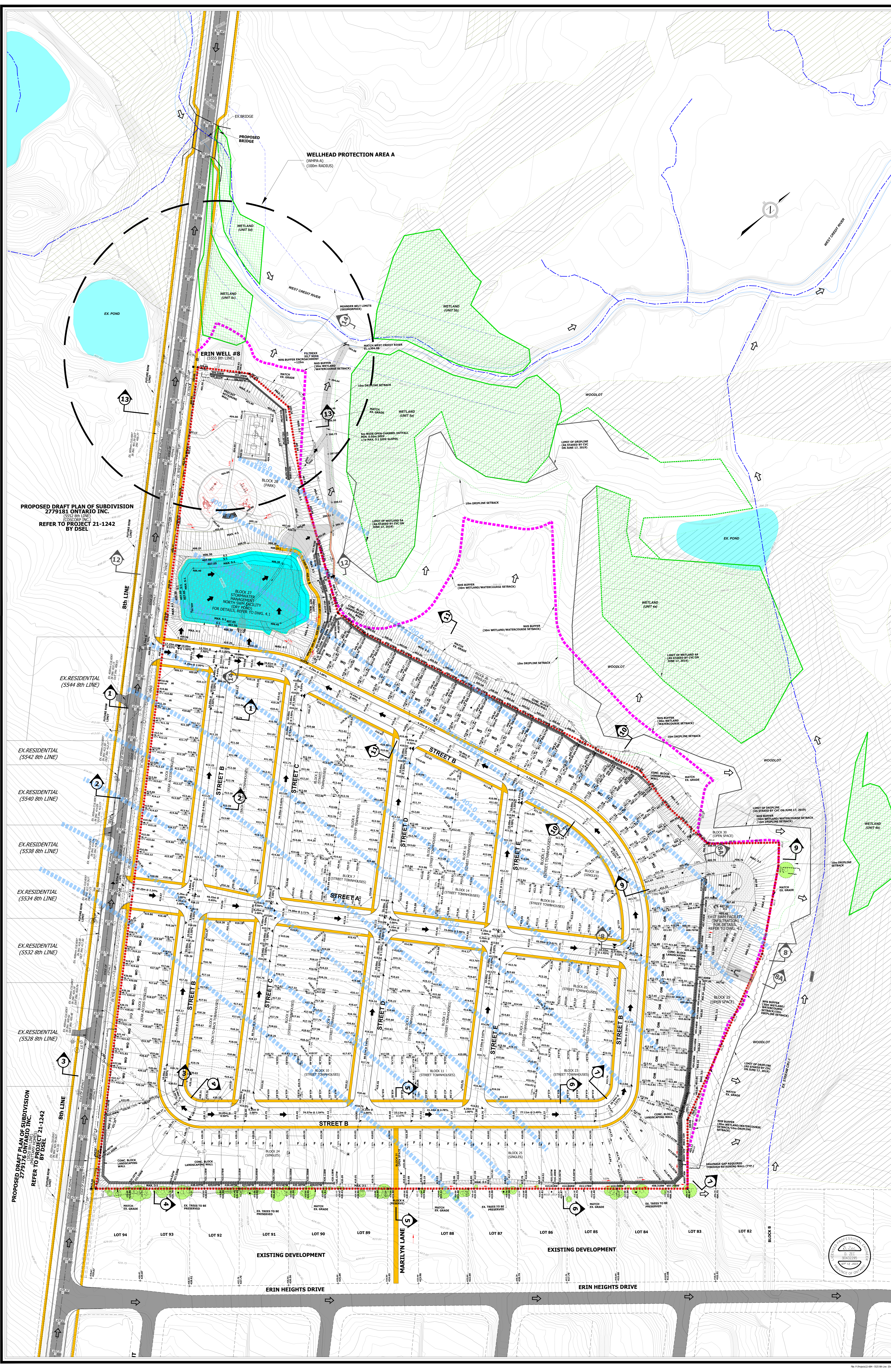
- 3125 8th Line (Empire-Erin Wellington)
- EXISTING DEVELOPMENT
- EXISTING HWS
- EXISTING ROADWAY
- ERIN HEIGHTS DRIVE
- SIDEROAD 17
- WELLINGTON ROAD 23



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

**PROPOSED DRAFT PLAN**

PROJECT No.:	DATE:	SCALE:	DRAWING No.:
21-684	Sept.2023	N.T.S.	2.2A



- Legend:**
- SUBJECT LANDS
  - EXISTING CONTOUR ELEVATION
  - EXISTING ELEVATION
  - EXISTING OVERLAND FLOW DIRECTION
  - EXISTING WETLAND
  - EXISTING WOODLAND
  - EXISTING POND
  - NPS BUFFER
  - EXISTING TREE TO BE PRESERVED
  - PROPOSED ELEVATION
  - PROPOSED OVERLAND FLOW DIRECTION
  - INTERPRETED GROUNDWATER ELEVATION CONTOUR
  - PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
  - PROPOSED PRECAST CONCRETE RETAINING WALL ON PUBLIC PROPERTY (TYPE OF WALL TO BE APPROVED BY TOWN)
  - PROPOSED CONCRETE BLOCK LANDSCAPING WALL ON PRIVATE PROPERTY
  - SWM POND BLOCK (DRY POND)
  - UNDERGROUND STORAGE TANK/STONE INFILTRATION TRENCH
  - PROPOSED GRAVEL ACCESS
  - PROPOSED SIDEWALK
  - FILTRIX SILT SOCK
  - RIP-RAP SPILLWAY
  - F** FRONT DRAINING LOT
  - S** SPLIT DRAINING LOT
  - LO** LOOK OUT CONDITION
  - WO** WALK OUT CONDITION

**NOTES:**

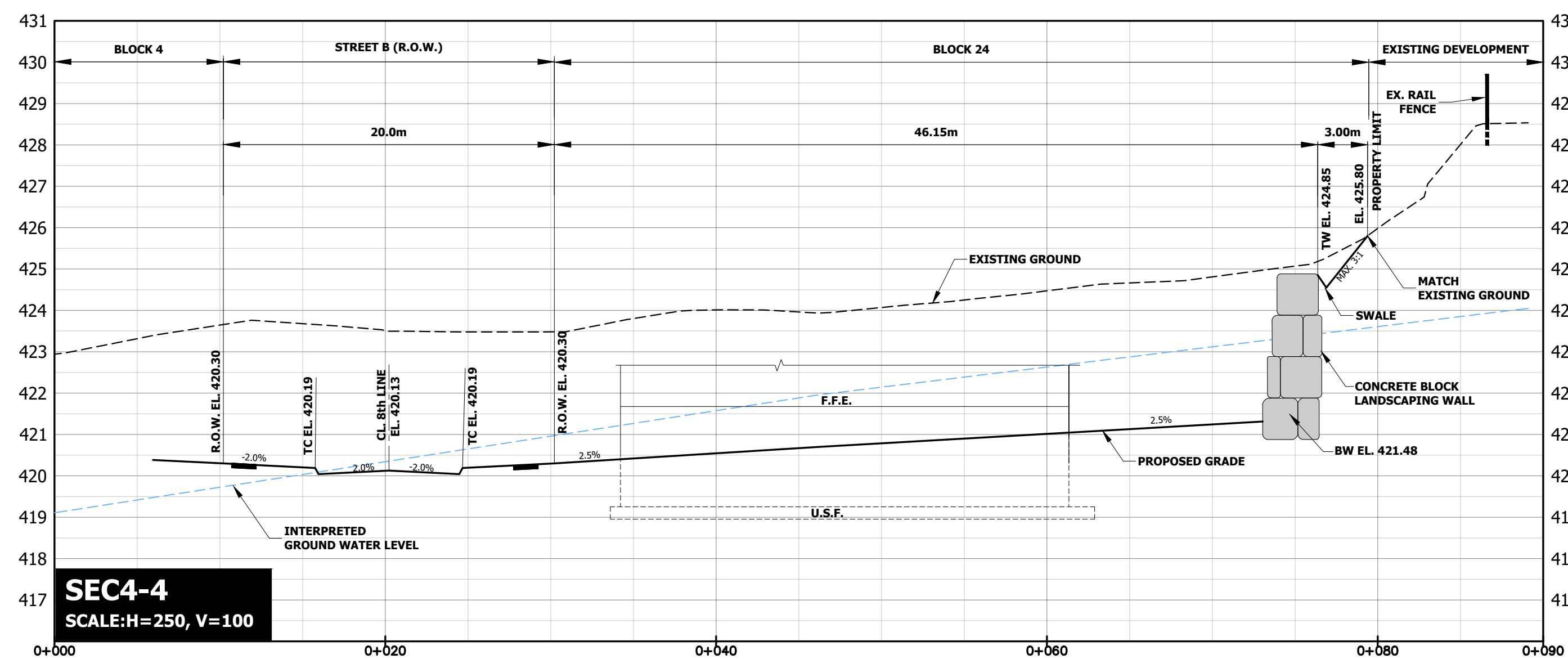
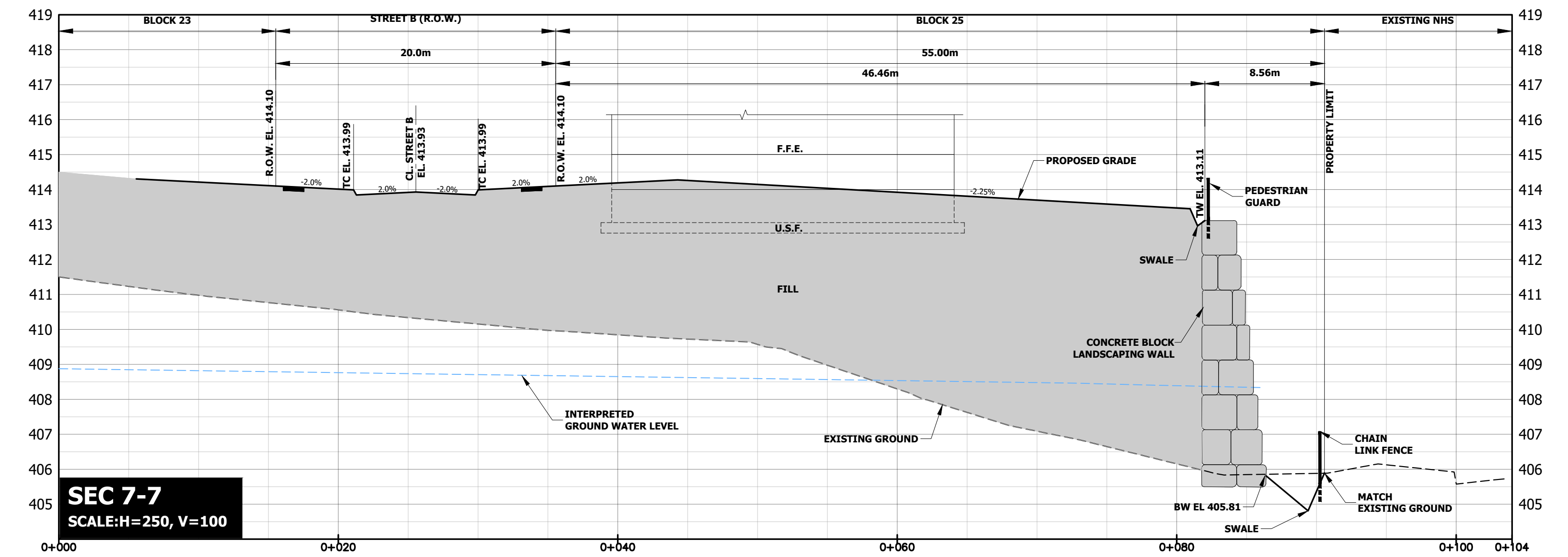
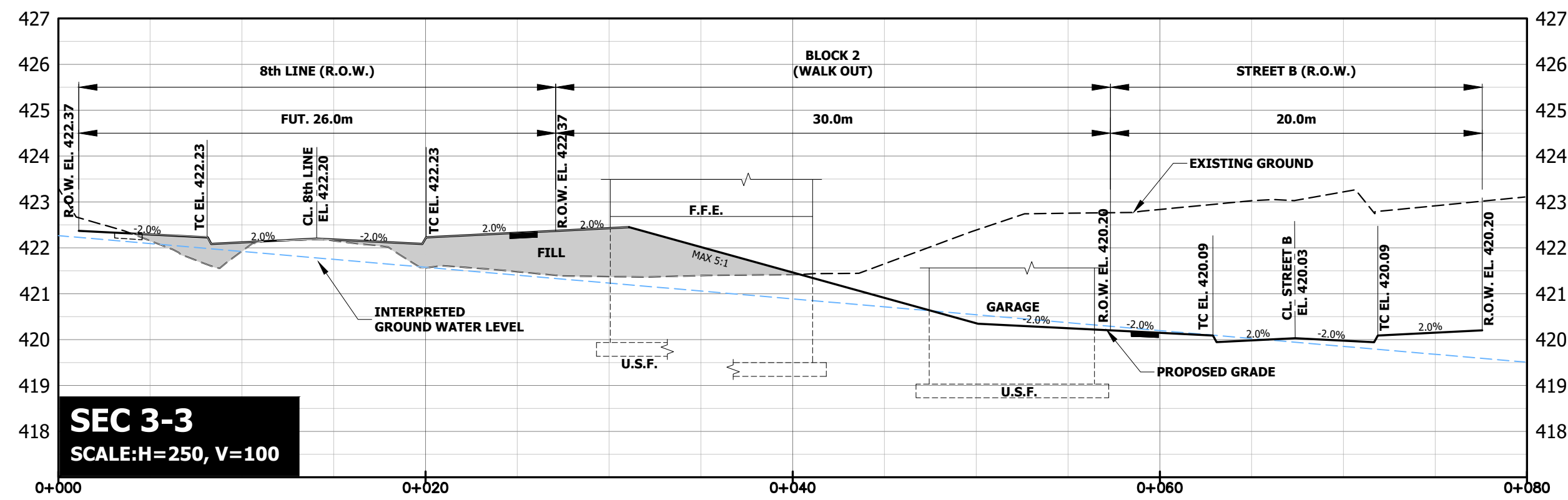
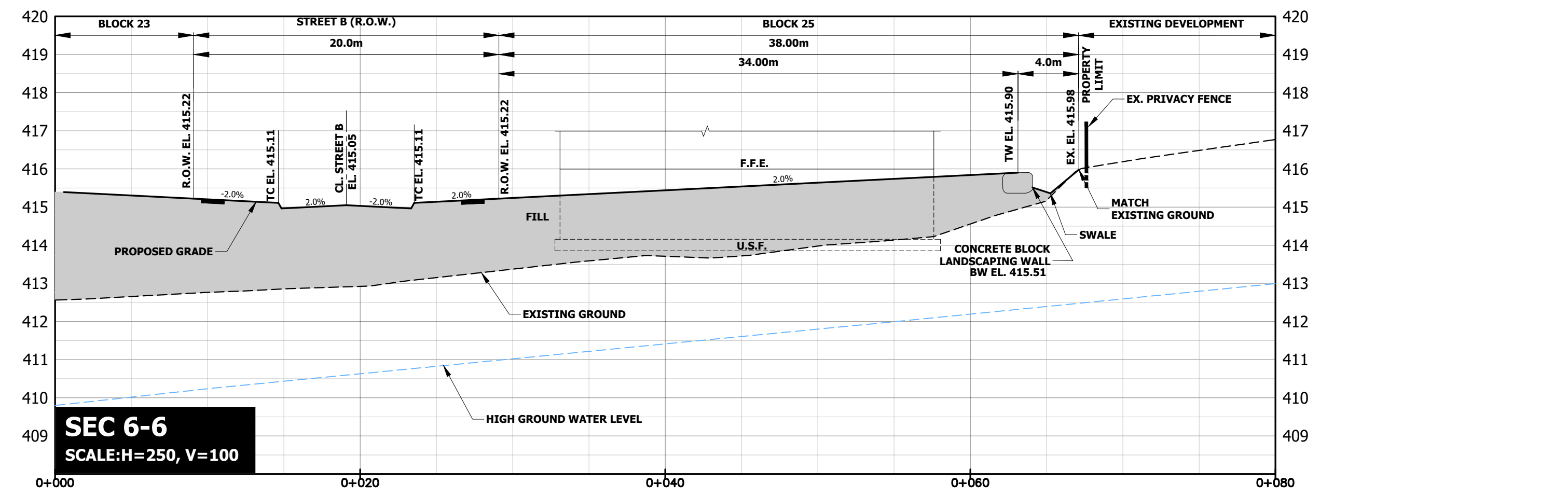
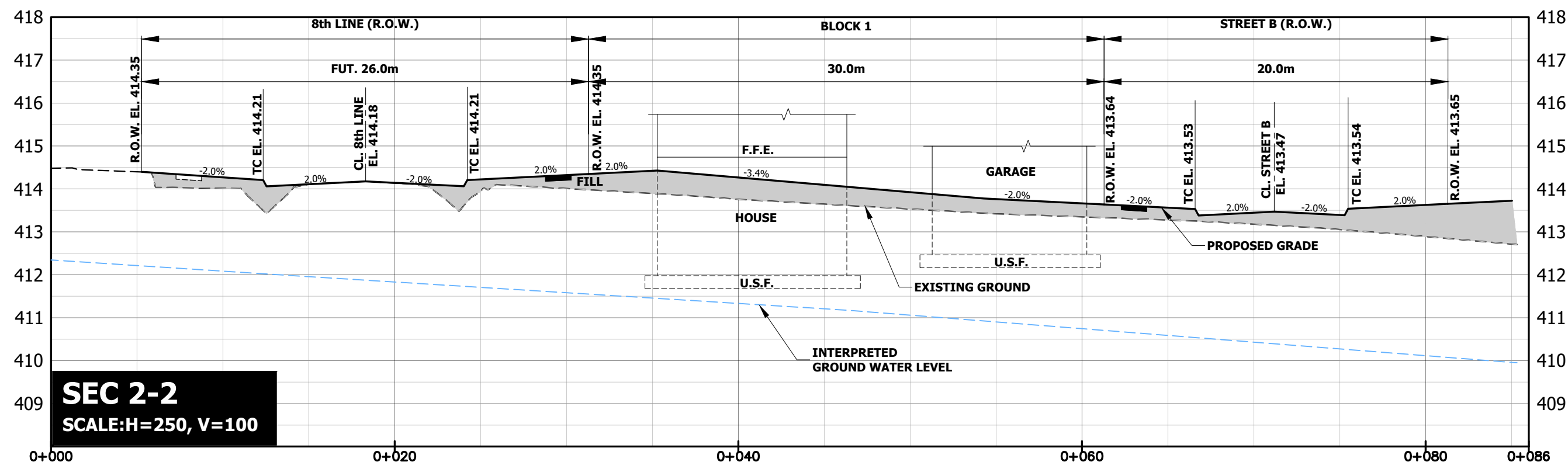
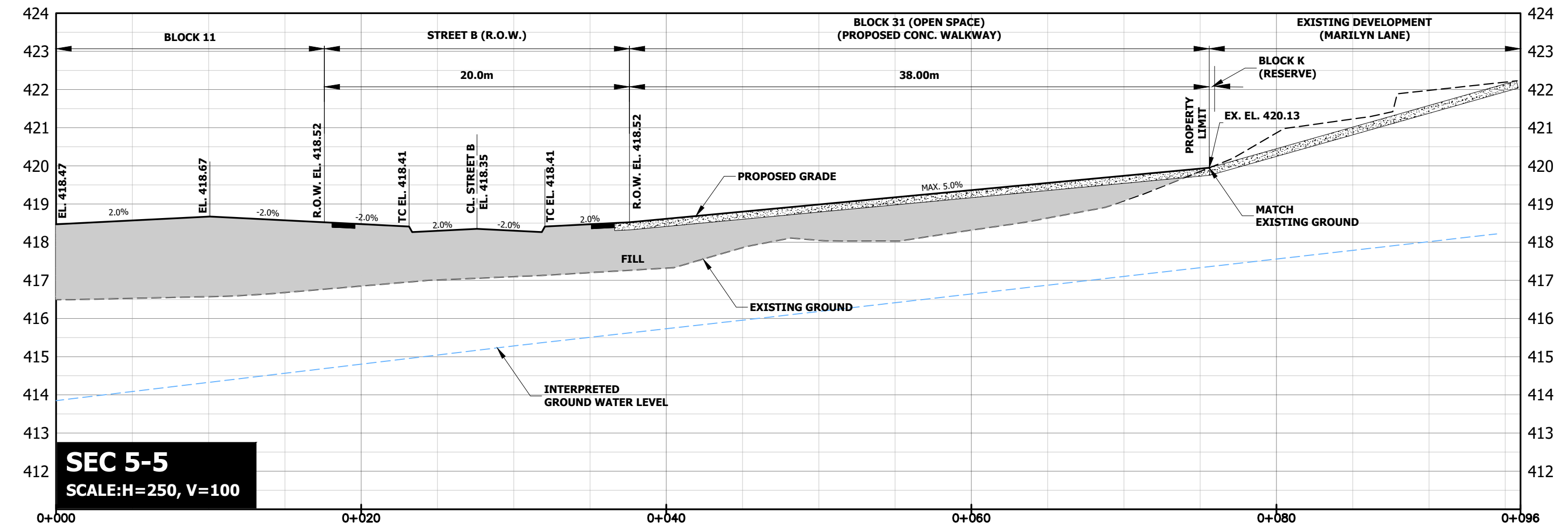
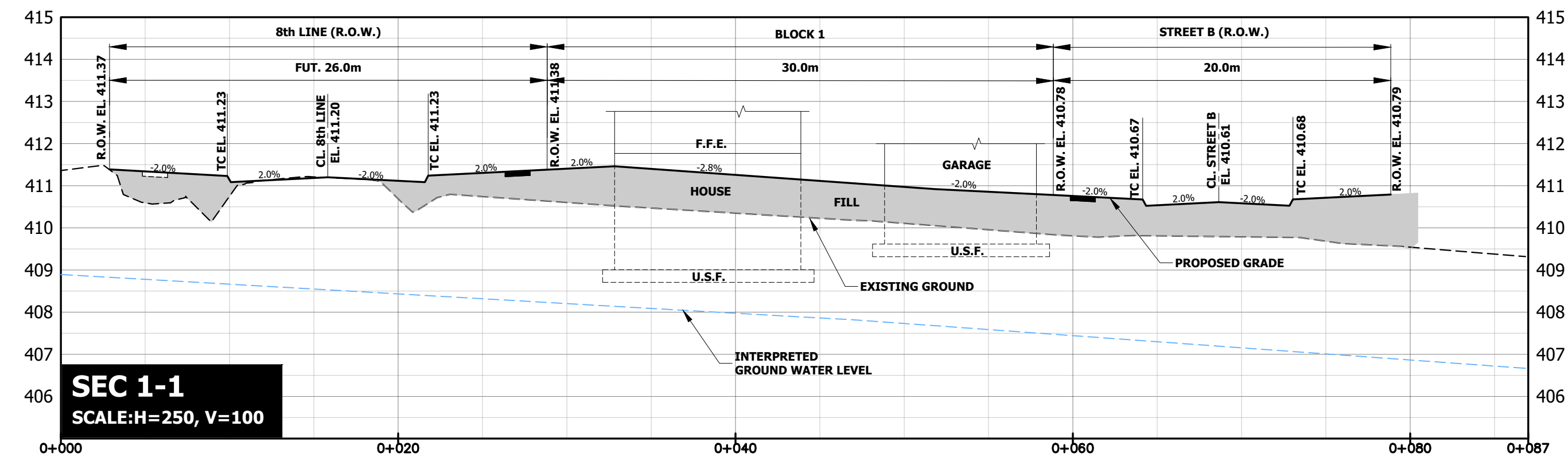
1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY BETWEEN DUNDAS STREET AND SIDEROAD 17 TO THE TOWN SATISFACTION. DETAILS TO BE FURTHER COORDINATED WITH THE TOWN AND MATTAMY TO CONFIRM LIMITS OF URBANIZATION BASED UPON HOLDOUT PROPERTIES ALONG THE 8th LINE FRONTAGE. CVC PERMISSION WILL BE REQUIRED FOR PROPOSED GRADING AND RESTORATION WITHIN THE NPS BUFFER.
2. REFER TO DRAWINGS 2.2C TO 2.2D FOR GRADING CROSS SECTIONS 1-1 TO 7-7, 9-9 TO 11-11, 13-13.
3. REFER TO FIGURE 2.2F FOR TYPICAL LANDSCAPING RETAINING WALL CROSS SECTIONS.
4. REFER TO DRAWING 4.1 FOR NORTH SWM FACILITY DETAILS INCLUDING CROSS SECTIONS 12-12, 14-14.
5. REFER TO DRAWING 4.2 FOR EAST SWM FACILITY DETAILS INCLUDING CROSS SECTIONS 8-8, 8A-8A.

**URBANTECH**  
 Functional Servicing Report  
 5525 8th Line  
 (Empire - Erln, Wellington)  
**PRELIMINARY GRADING PLAN**

PROJECT NO.:	DATE:	SCALE:	DRAWING NO.:
21-684	Sept.2023	1:750	2.2B

PROPOSED DRAFT PLAN OF SUBDIVISION  
 2779181, ONTARIO INC.  
 (5552 8th LINE)  
 REFER TO PROJECT 21-1242  
 BY DSEL

PROPOSED DRAFT PLAN OF SUBDIVISION  
 2779176, ONTARIO INC.  
 (5528 8th LINE)  
 REFER TO PROJECT 21-1242  
 BY DSEL



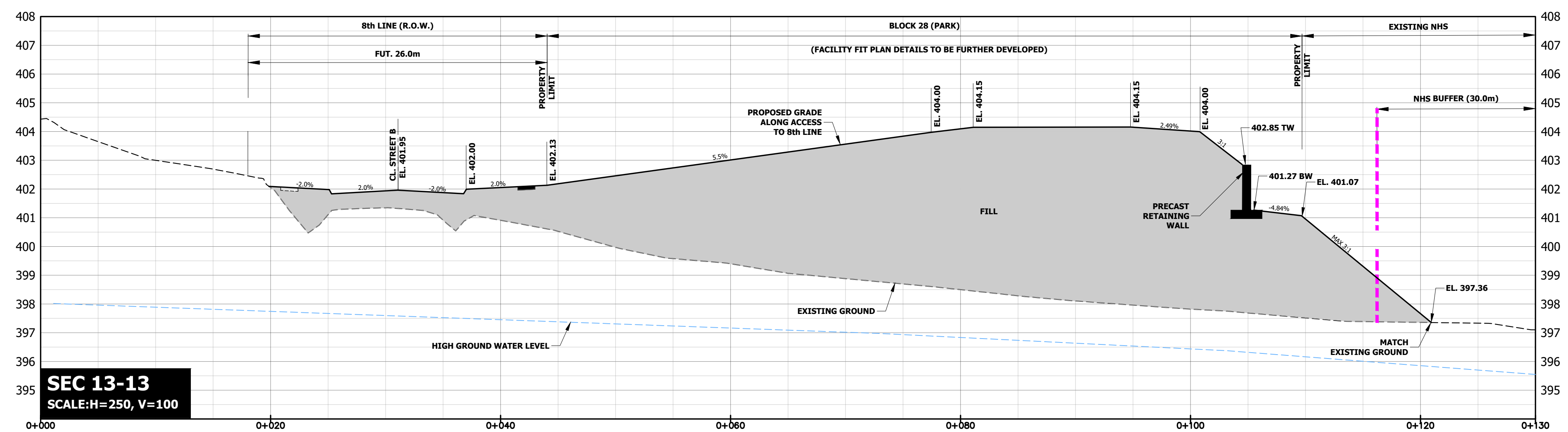
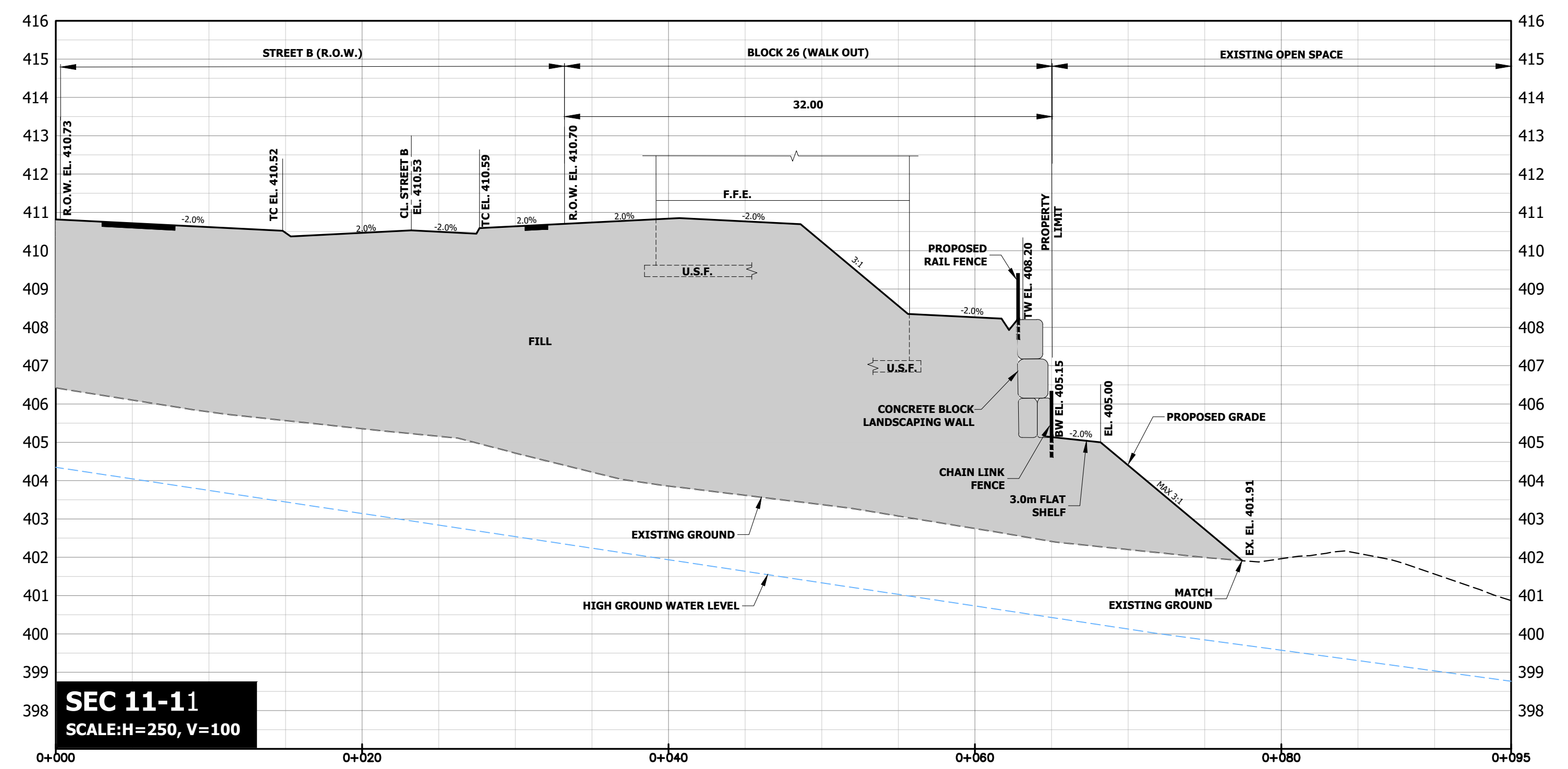
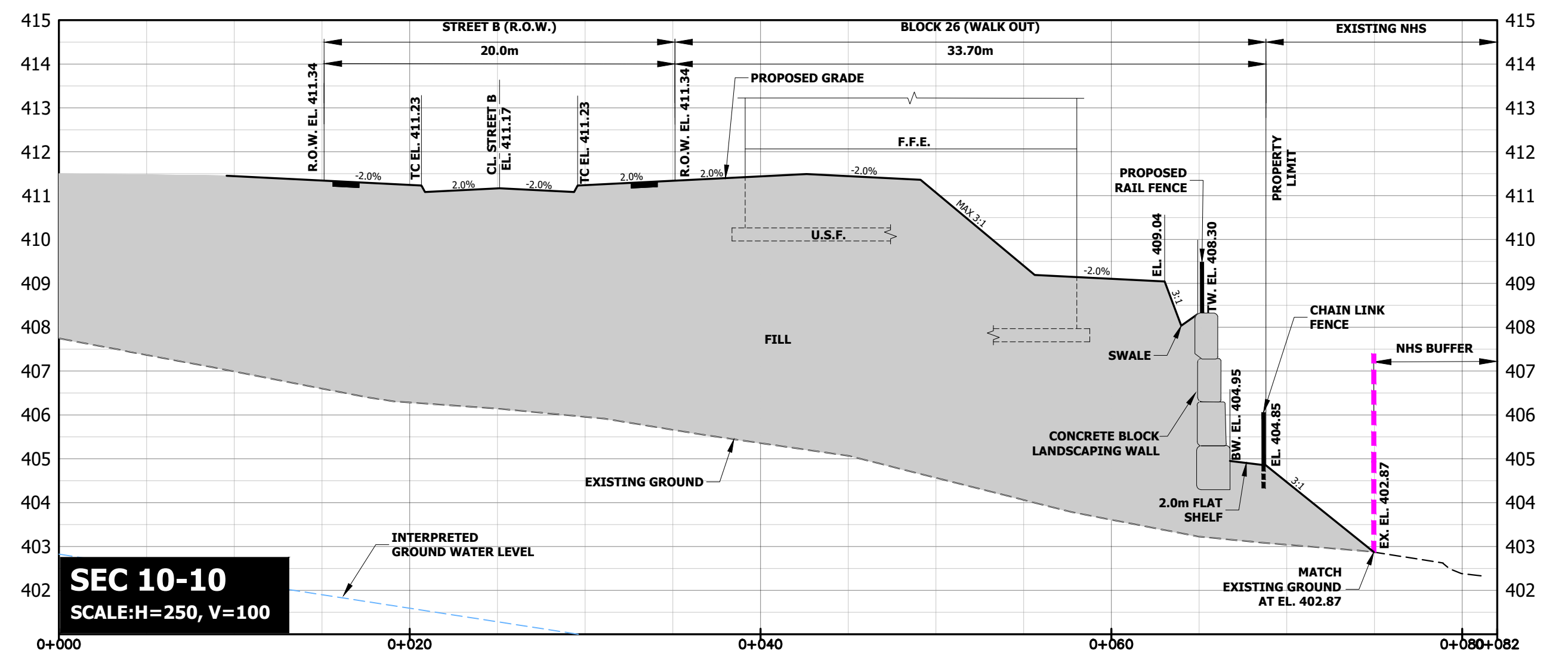
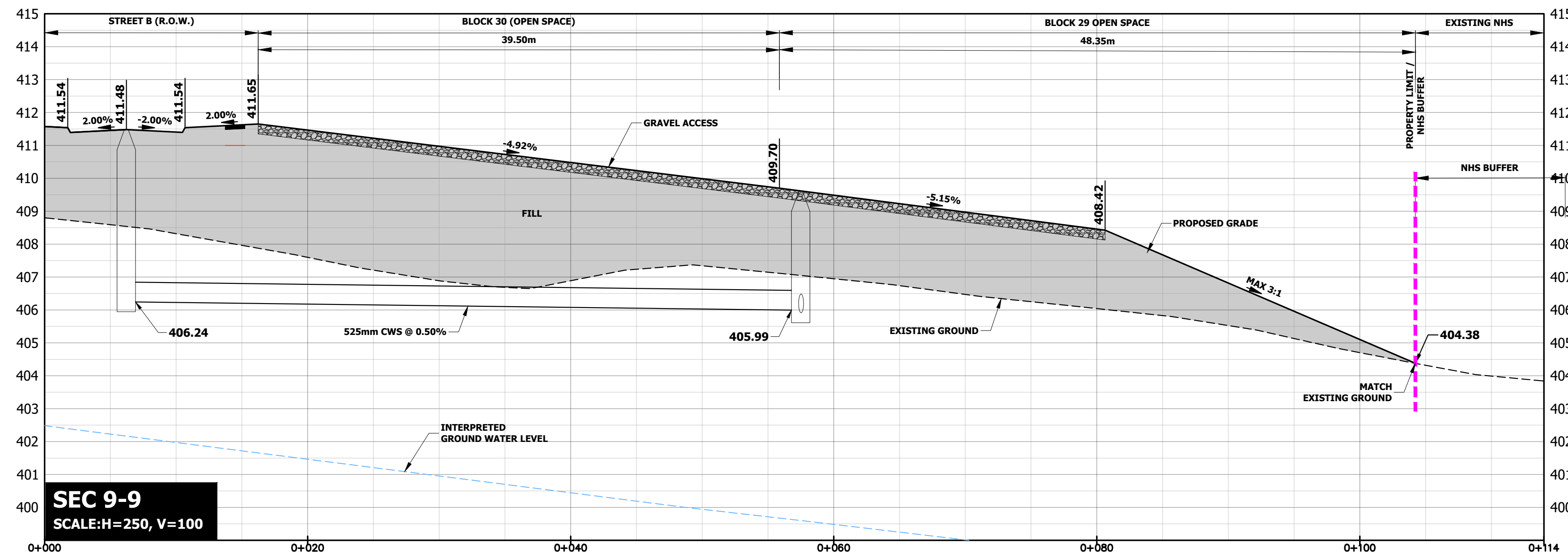
**NOTE:**  
FOR SECTION LOCATIONS PLEASE REFER  
TO GRADING PLAN DRAWING 2.2B.



**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	June 2023	AS SHOWN	<b>2.2C</b>



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



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

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

PROJECT NO.:	DATE:	SCALE:	DRAWING NO.:
21-684	July, 2023	AS SHOWN	2.2D



**PROPOSED DRAFT PLAN OF SUBDIVISION  
2779181 ONTARIO INC.**  
(5552 8th LINE)  
(COSCORP INC.)  
REFER TO PROJECT 21-1242  
BY DSEL

**PROPOSED DRAFT PLAN OF SUBDIVISION  
2779176 ONTARIO INC.**  
(5520 8th LINE)  
(MATTAMY HOMES)  
REFER TO PROJECT 21-1242  
BY DSEL

ERIN WELL #8 (5555 8th LINE)

**WELLHEAD PROTECTION AREA A  
(WHPA-A)**  
(100m RADIUS)

WETLAND (UNIT 5b)

WETLAND (UNIT 5a)

WOODLOT

**WETLAND (UNIT 4a)**

WOODLOT

EX. POND

WOODLOT

WETLAND (UNIT 4b)

(OPEN SPACE)

EX. STREAM CRT-1

8th LINE

8th LINE

MARILYN LANE

STREET A  
(STREET TOWNHOUSES)

STREET B  
(STREET TOWNHOUSES)

STREET C  
(STREET TOWNHOUSES)

STREET D  
(STREET TOWNHOUSES)

STREET E  
(STREET TOWNHOUSES)

STREET F  
(STREET TOWNHOUSES)

STREET G  
(STREET TOWNHOUSES)

STREET H  
(STREET TOWNHOUSES)

STREET I  
(STREET TOWNHOUSES)

STREET J  
(STREET TOWNHOUSES)

STREET K  
(STREET TOWNHOUSES)

STREET L  
(STREET TOWNHOUSES)

STREET M  
(STREET TOWNHOUSES)

STREET N  
(STREET TOWNHOUSES)

STREET O  
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STREET P  
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STREET Q  
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STREET Z  
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STREET AA  
(STREET TOWNHOUSES)

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STREET BV  
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STREET BW  
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STREET BX  
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STREET BY  
(STREET TOWNHOUSES)

STREET BZ  
(STREET TOWNHOUSES)

STREET CA  
(STREET TOWNHOUSES)

STREET CB  
(STREET TOWNHOUSES)

STREET CC  
(STREET TOWNHOUSES)

STREET CD  
(STREET TOWNHOUSES)

STREET CE  
(STREET TOWNHOUSES)

STREET CD  
(STREET TOWNHOUSES)

**Legend:**

SUBJECT LANDS

**INTERPOLATED DEPTH BETWEEN ORIGINAL GROUND AND PROPOSED GRADE SURFACE**

	-3.000	-4.776	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	7.858	FILL



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

**PRELIMINARY EARTHWORKS PLAN  
(CUT-FILL CONTOUR RANGE PLAN)**

PROJECT No.:	DATE:	SCALE:	DRAWING NO.:
21-684	Sept.2023	N.T.S.	2.2E

# Functional Servicing Report

## 5525 8th Line (Empire - Erin, Wellington)

Legend:

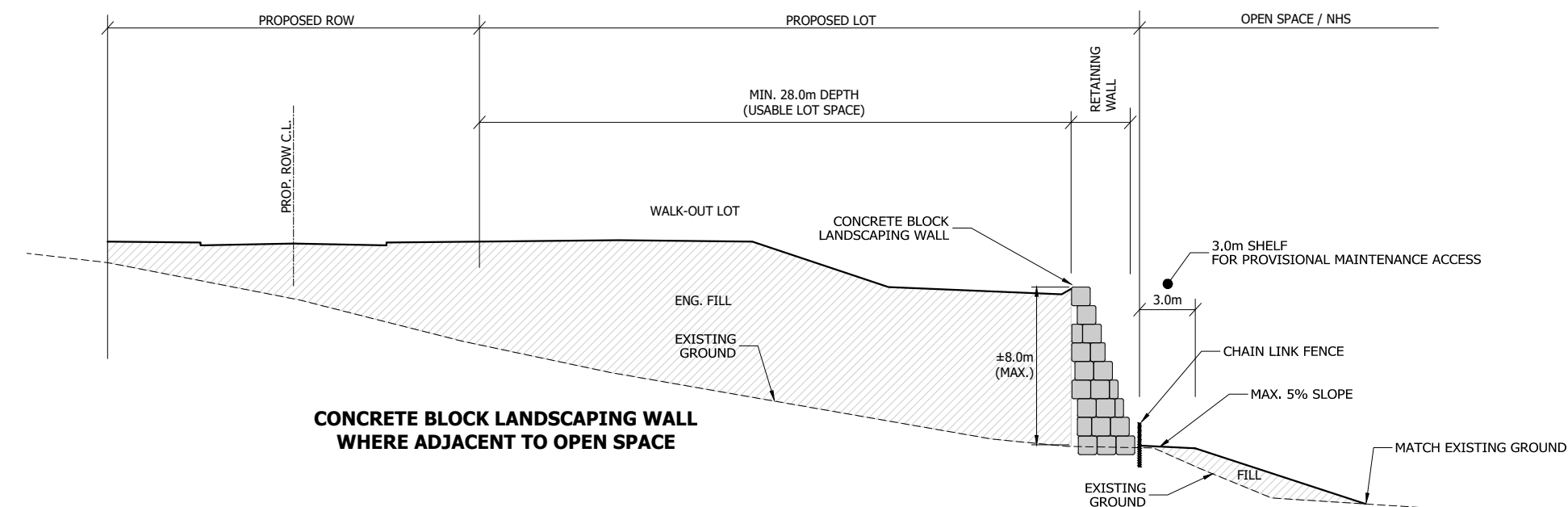
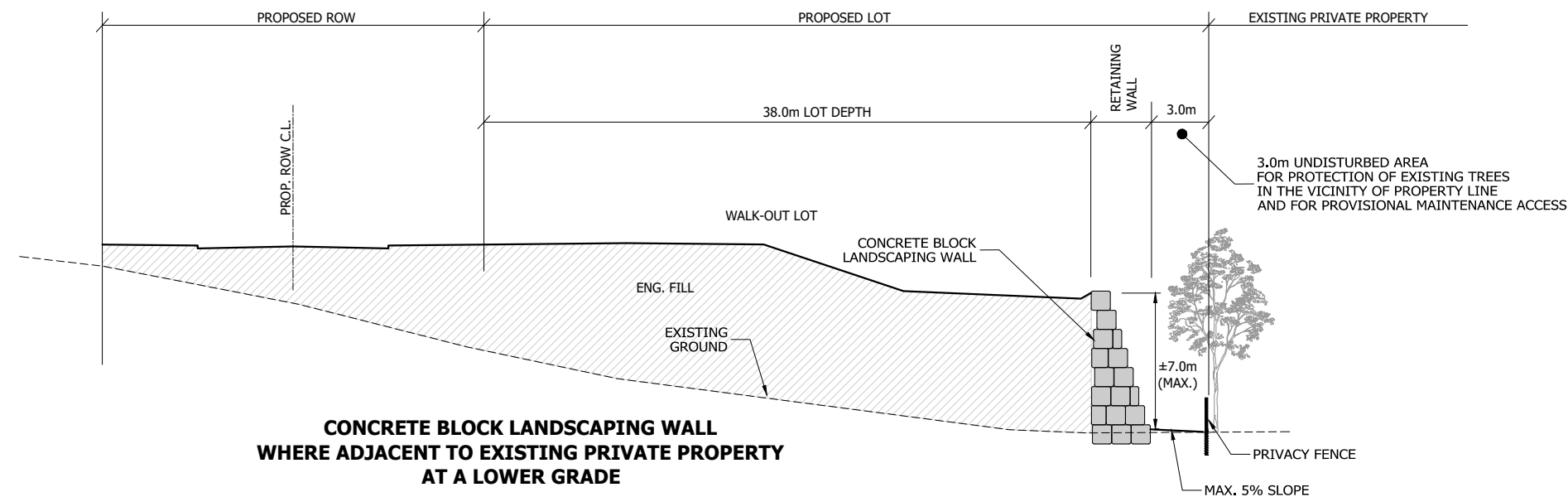
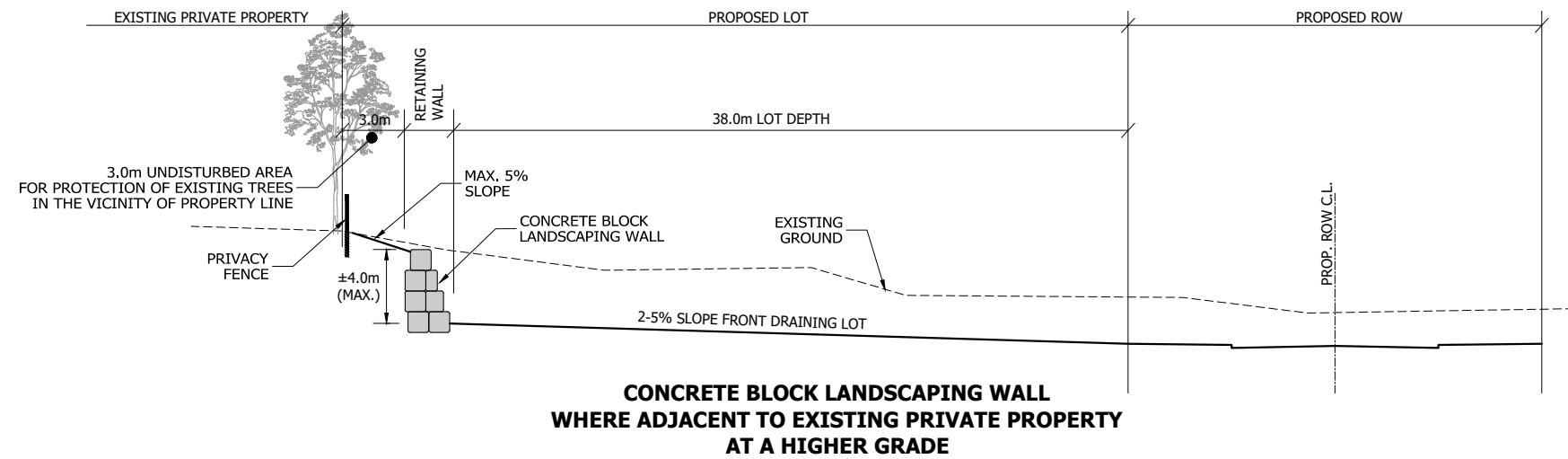


**NOTES:**

\* CONCRETE BLOCK LANDSCAPING WALLS ARE PROPOSED ALONG THE FUTURE DEVELOPMENT BOUNDARY TO ADDRESS THE EXISTING GRADING CONSTRAINTS WHERE NEEDED. THE TYPE OF WALL TO BE CONFIRMED AT DETAILED DESIGN AND APPROVED BY THE TOWN PRIOR TO CONSTRUCTION.

\* IF A RETAINING WALL IS REQUIRED ON PRIVATE OR PUBLICLY OWNED LANDS, A 3.0m OF UNDISTURBED OR FLAT GRADED SPACE TO BE ACCOMMODATED BEHIND THE WALL FOR FUTURE MAINTENANCE ACCESS.

\* REFER TO PRELIMINARY GRADING PLAN ON DRAWING 2.2B AND CROSS SECTION DRAWINGS 2.2C & 2.2D FOR ADDITIONAL PROPOSED SITE GRADING DETAILS.

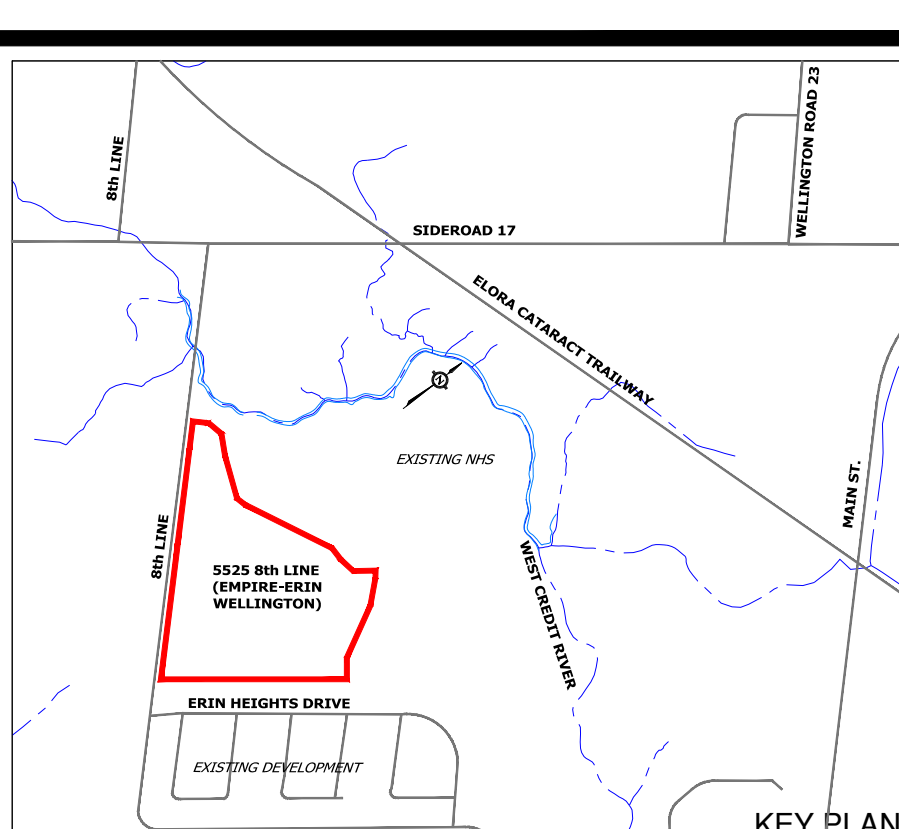
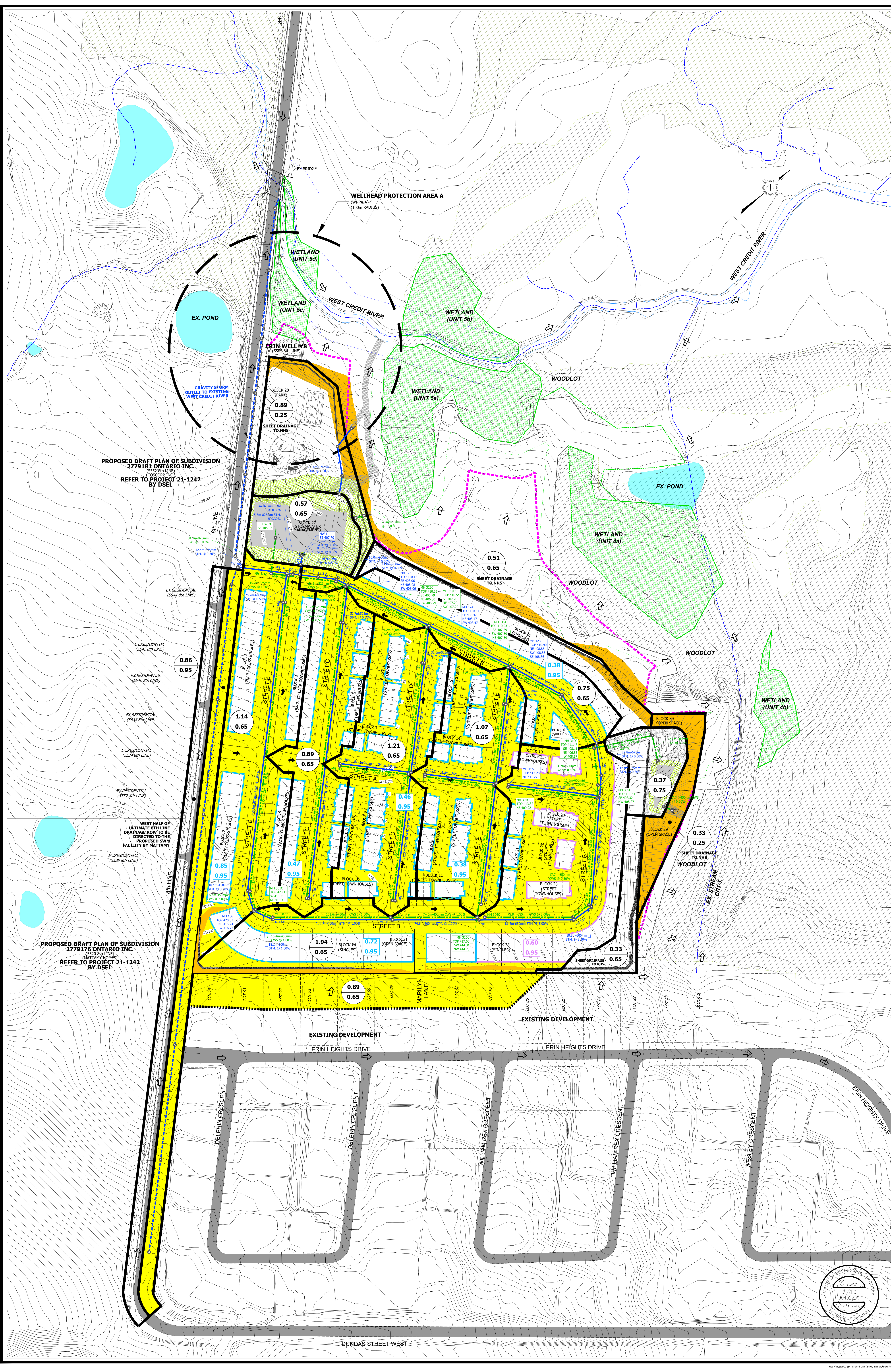


**FIGURE 2.2F**  
**CONCRETE BLOCK LANDSCAPING WALL (PRIVATE)**  
**TYPICAL CROSS SECTIONS**



September 2023

Scale: NTS



- 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
  - DRAINAGE BOUNDARY (TO STORMWATER MANAGEMENT)
  - EXTERNAL DRAINAGE BOUNDARY (TO STORMWATER MANAGEMENT)
  - DRAINAGE AREA (ha)
  - RUNOFF COEFFICIENT
  - ROOF DRAIN COLLECTOR DRAINAGE AREA TO NORTH STORAGE TANK (ROOF AREA + 80% x LOT AREA OR ACTUAL BUILDING FOOTPRINT)
  - ROOF DRAIN COLLECTOR DRAINAGE AREA TO EAST POND (ROOF AREA + 80% x LOT AREA OR ACTUAL BUILDING FOOTPRINT)
  - ROOF DRAIN COLLECTOR DRAINAGE AREA (ha)
  - RUNOFF COEFFICIENT
  - ROOF DRAIN COLLECTOR DRAINAGE AREA (ha)
  - RUNOFF COEFFICIENT
  - STORM SEWER FLOW DIRECTION AND MANHOLE
  - CLEAN WATER SEWER FLOW DIRECTION AND MANHOLE FOR CONVEYANCE OF ROOF DRAINAGE
  - STORM MH ID
  - PROPOSED GROUND ELEVATION (UNLESS SPECIFIED AS INVERT)
  - PROPOSED SEWER OVERBTS (UNLESS SPECIFIED AS INVERT)
  - CLEAN WATER MH ID
  - PROPOSED GROUND ELEVATION (UNLESS SPECIFIED AS INVERT)
  - PROPOSED SEWER OVERBTS (UNLESS SPECIFIED AS INVERT)

- NOTES:**
1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY BETWEEN DUNDAS STREET AND SIDEROAD 17 TO THE TOWN SATISFACTION DETAILS TO BE FURTHER COORDINATED WITH THE TOWN AND MATTAMY TO CONFIRM LIMITS OF URBANIZATION BASED UPON 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 CROSS SECTION.
  3. EMPIRE'S 8th LINE FRONTAGE NORTH OF STREET B INTERSECTION CANNOT BE CAPTURED IN THE PROPOSED SWM FACILITY DUE TO GRADING CONSTRAINTS. THIS SECTION OF 8th LINE WILL BE DISCHARGED TO THE EXISTING CREEK IN THE VICINITY OF EXISTING BRIDGE STRUCTURE. FURTHER COORDINATION WITH THE TOWN IS REQUIRED.
  4. MINOR SYSTEM DRAINAGE TO BE DIRECTED TO A NORTH SWM FACILITY. ROOF DRAIN COLLECTORS TO BE CONNECTED TO THE INFILTRATION FACILITIES WITHIN BOTH THE NORTH AND EAST SWM FACILITIES FOR GROUNDWATER RECHARGE. REFER TO DRAWING 4.1 FOR NORTH SWM FACILITY DETAILS.
  5. REFER TO DRAWING 4.2 FOR EAST SWM FACILITY DETAILS.

**URBANTECH**

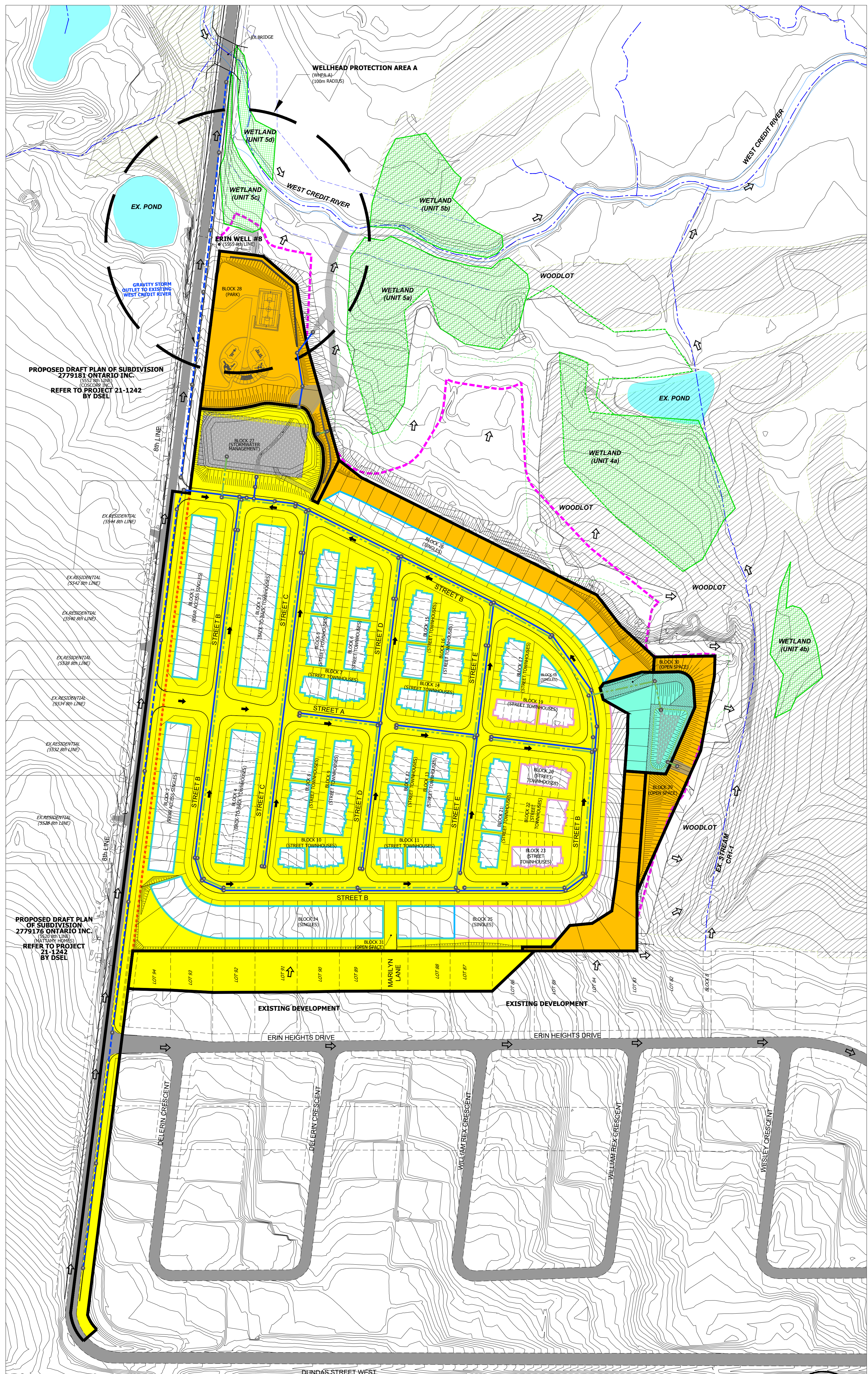
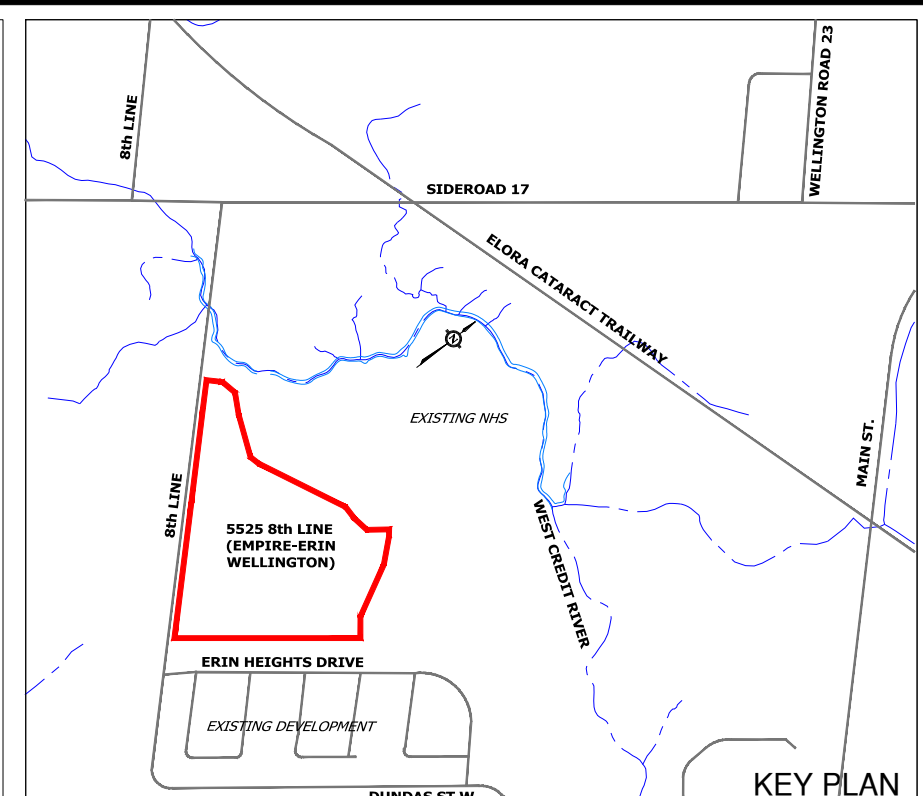
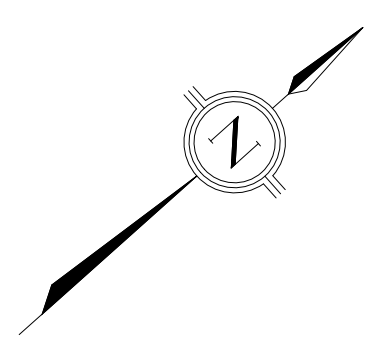
**Functional Servicing Report**  
5525 8th Line  
(Empire - Erin, Wellington)

**POST-DEVELOPMENT**  
**STORM DRAINAGE PLAN**

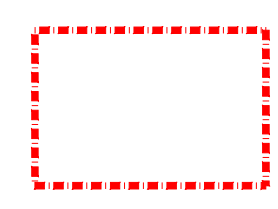

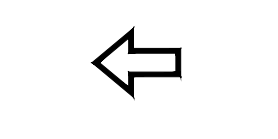
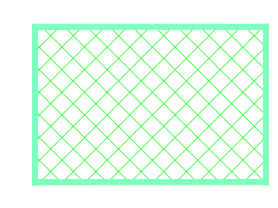
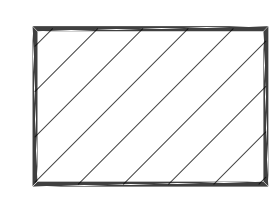

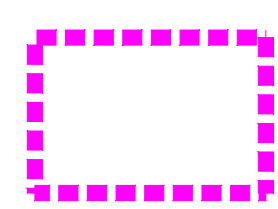
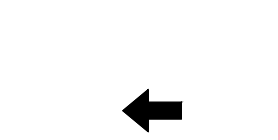

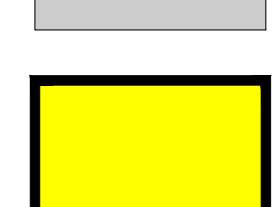

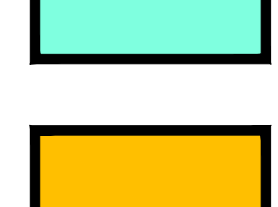
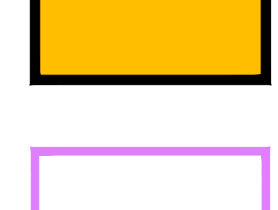
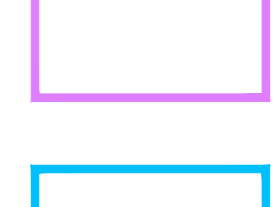
PROJECT No.:	DATE:	SCALE:	DRAWING No.:
21-684	Sept.2023	1:1000	3.1



File: P:\Projects\21-684 - 5525 8th Line - Storm Drainage - UrbanTech\Functional Servicing Report\21-684 - Post-Development Storm Drainage Plan - Sheet 3 - 2023 - Rev. No. 3 (2023-09-14).dwg



**Legend:**

-  SUBJECT LANDS
-  SUBJECT LANDS EXISTING CONTOUR ELEVATION
-  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 24) (AREA: 8.43Ha, IMP: 44%)
-  CONTRIBUTING DRAINAGE AREA TO EAST SWM FACILITY (BLOCK 25) (AREA: 0.37Ha, IMP: 79%)
-  UNCONTROLLED DRAINAGE AREA DISCHARGE TO WATERCOURSE (AREA: 2.06Ha, IMP: 31%)
-  CONTRIBUTING DRAINAGE AREA TO EAST SWM FACILITY (BLOCK 25) VIA ROOF DRAINAGE COLLECTOR (AREA: 0.60Ha, IMP: 100%)
-  CONTRIBUTING DRAINAGE AREA TO UNDERGROUND TANK (BLOCK 24) VIA ROOF DRAINAGE COLLECTOR (AREA: 3.26Ha, IMP: 100%)

**NOTES:**

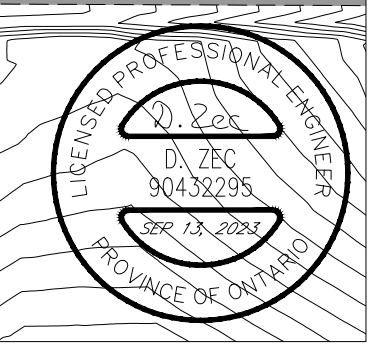
1. 1. 8th LINE TO BE URBANIZED BY EMPIRE AND MATTAMY BETWEEN DUNDAS STREET AND SIDEROAD 17 TO THE TOWN SATISFACTION. DETAILS TO BE FURTHER COORDINATED WITH THE TOWN AND MATTAMY TO CONFIRM LIMITS OF URBANIZATION BASED UPON HOLDOUT PROPERTIES ALONG THE 8th LINE FRONTAGE.
2. PROPOSED SWM FACILITIES WITHIN THE EMPIRE AND MATTAMY DEVELOPMENTS TO CAPTURE GRAVITY 8th LINE STORM OUTLETS ALONG BOTH PROPERTY FRONTAGES. EACH DEVELOPMENT TO CAPTURE HALF OF THE URBANIZED CROSS SECTION.
3. EMPIRE'S 8th LINE FRONTAGE NORTH OF STREET B INTERSECTION CANNOT BE CAPTURED IN THE PROPOSED SWM FACILITY DUE TO GRADING CONSTRAINTS. THIS SECTION OF 8th LINE WILL BE DISCHARGED TO THE EXISTING CREEK IN THE VICINITY OF EXISTING BRIDGE STRUCTURE. FURTHER COORDINATION WITH THE TOWN IS REQUIRED.
4. MINOR SYSTEM DRAINAGE TO BE DIRECTED TO A NORTH SWM FACILITY. ROOF DRAIN COLLECTORS TO BE CONNECTED TO THE INFILTRATION FACILITIES WITHIN BOTH THE NORTH AND EAST SWM FACILITIES FOR GROUNDWATER RECHARGE.

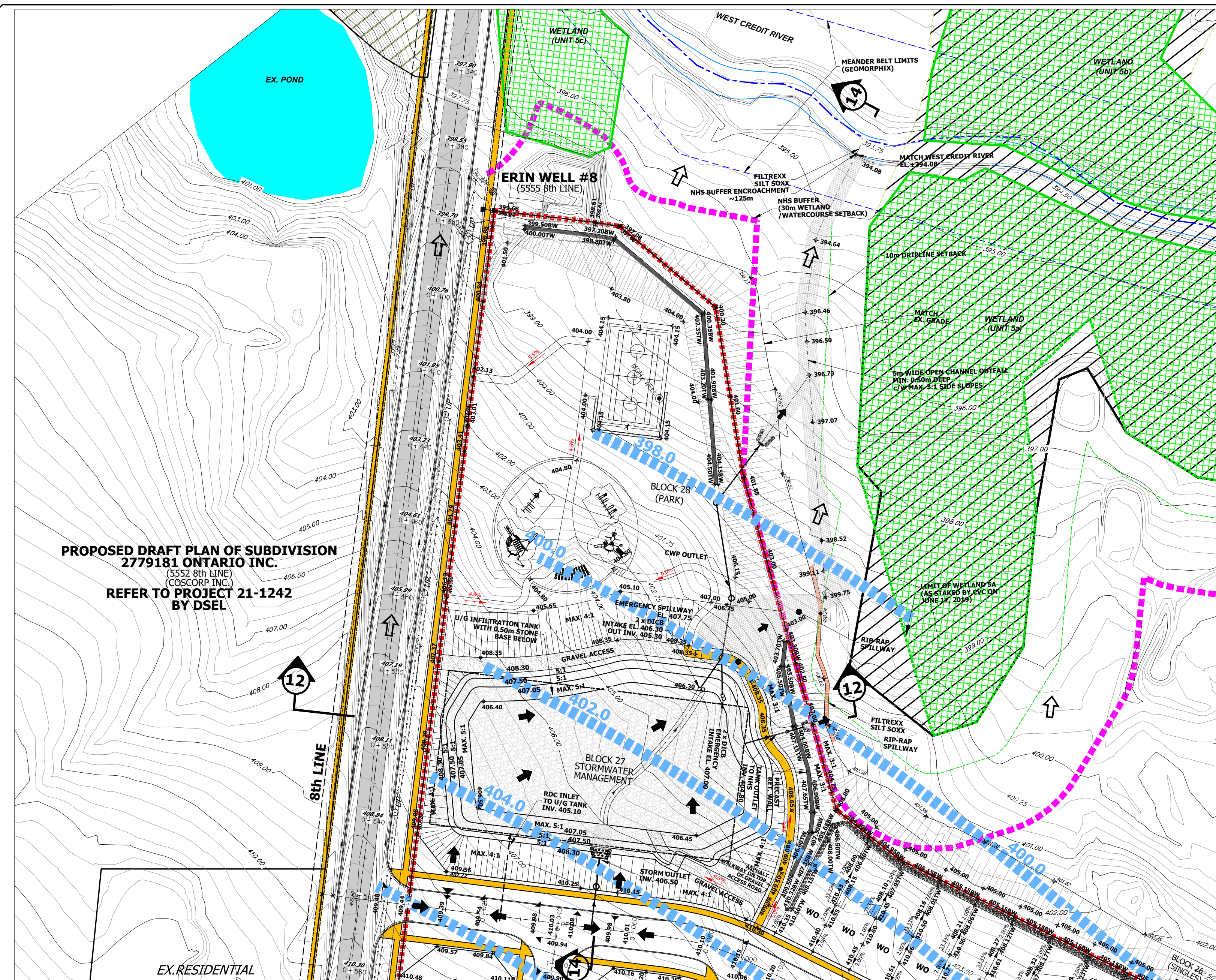


**Functional Servicing Report**  
**5525 8th Line**  
**(Empire - Erin, Wellington)**

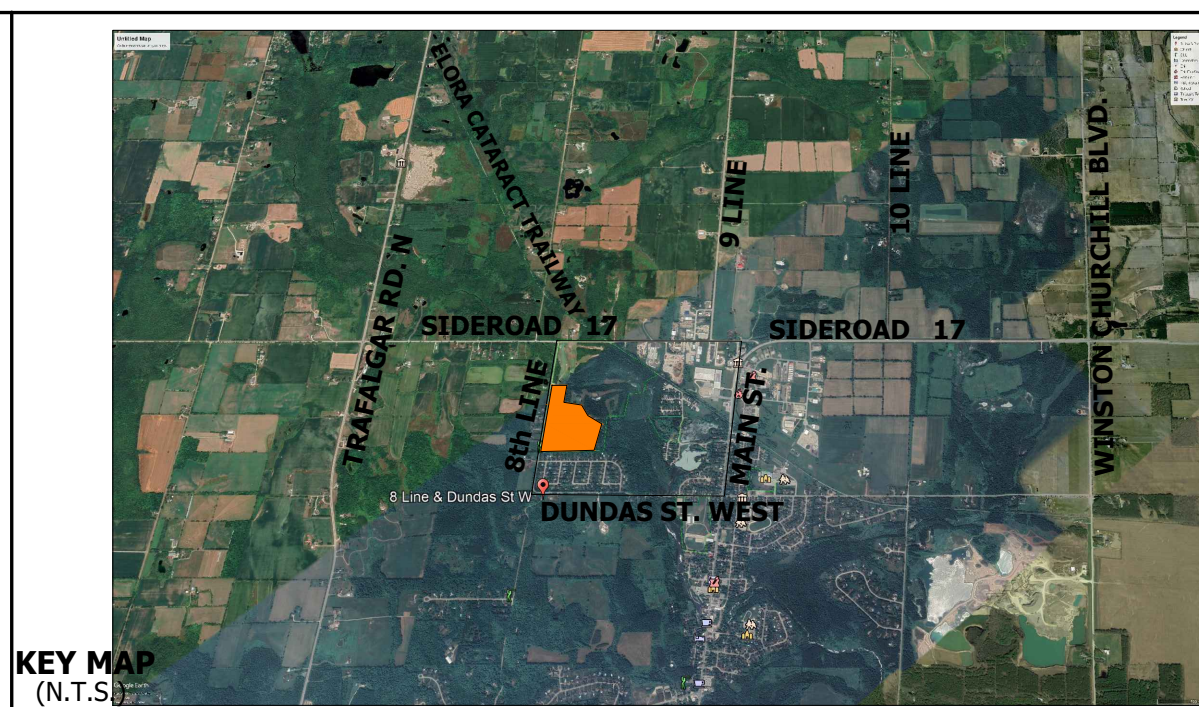
**STORMWATER MANAGEMENT PLAN**

PROJECT No.:	DATE:	SCALE:	DRAWING No.:
21-684	Sept.2023	1:1500	4.0

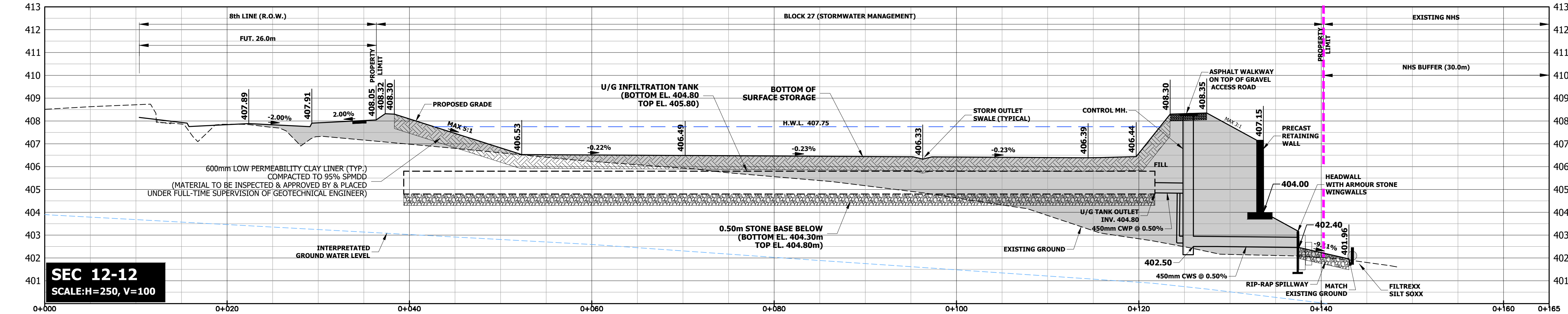
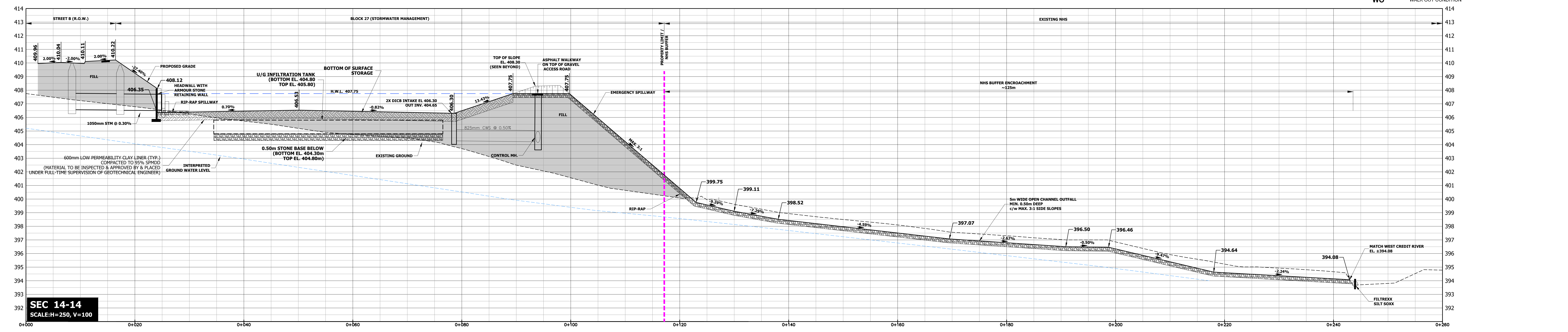




NORTH SWM FACILITY TABLE		PROVIDED
ROOF DRAINAGE AREA		3.26ha
INFILTRATION STORAGE VOLUME		655cu.m (1638cu.m STONE MEDIA VOID SPACE RATIO = 0.4)
UNDERGROUND TANK STORAGE VOLUME (5 YR. QUANTITY CONTROL FOR ROOF DRAINAGE)		3,040cu.m
100YR SURFACE AREA STORAGE (INCL. CLIMATE CHANGE PROJECTION)		4,420cu.m



- KEY MAP**  
1:1.5
- SUBJECT LANDS
  - EXISTING CONTOUR ELEVATION
  - EXISTING ELEVATION
  - EXISTING OVERLAND FLOW DIRECTION
  - EXISTING WETLAND
  - EXISTING WOODLAND
  - NHS BUFFER
  - PROPOSED ELEVATION
  - PROPOSED OVERLAND FLOW DIRECTION
  - INTERPRETED GROUNDWATER ELEVATION CONTOUR
  - PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
  - PROPOSED SIDEWALK
  - F** FRONT DRAINING LOT
  - S** SPLIT DRAINING LOT
  - LO** LOOK OUT CONDITION
  - WO** WALK OUT CONDITION



**BENCHMARK NOTE**  
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO FIRST ORDER VERTICAL BENCHMARK NUMBER 0802799433 HAVING AN ANTIPODORIC ELEVATION OF 396.60 METRES. ELEVATIONS ARE REFERENCED TO THE CANADIAN GEODETIC VERTICAL DATUM OF 1928, 1978 ADJUSTMENT (CGVD-1988).  
TABLE SET POSITIONED FULLY IN THE NORTH FACE OF THE CONCRETE FOUNDATION OF A GUY BUILDING (GREENING DONALD CO. LTD.) ON THE EAST SIDE OF HWY 24, 1.5 KM NORTH OF THE PROJECT OFFICE AT 1001, 0.3 KM SOUTH OF WELLINGTON CT RD, 2 KM 080, EAST OF THE CENTRELINE OF HWY 24, 1.5 KM WEST OF THE CORNER OF SAID BUILDING, 7 CM BELOW CONCRETE SLAB AND 7 CM ABOVE GROUND LEVEL.

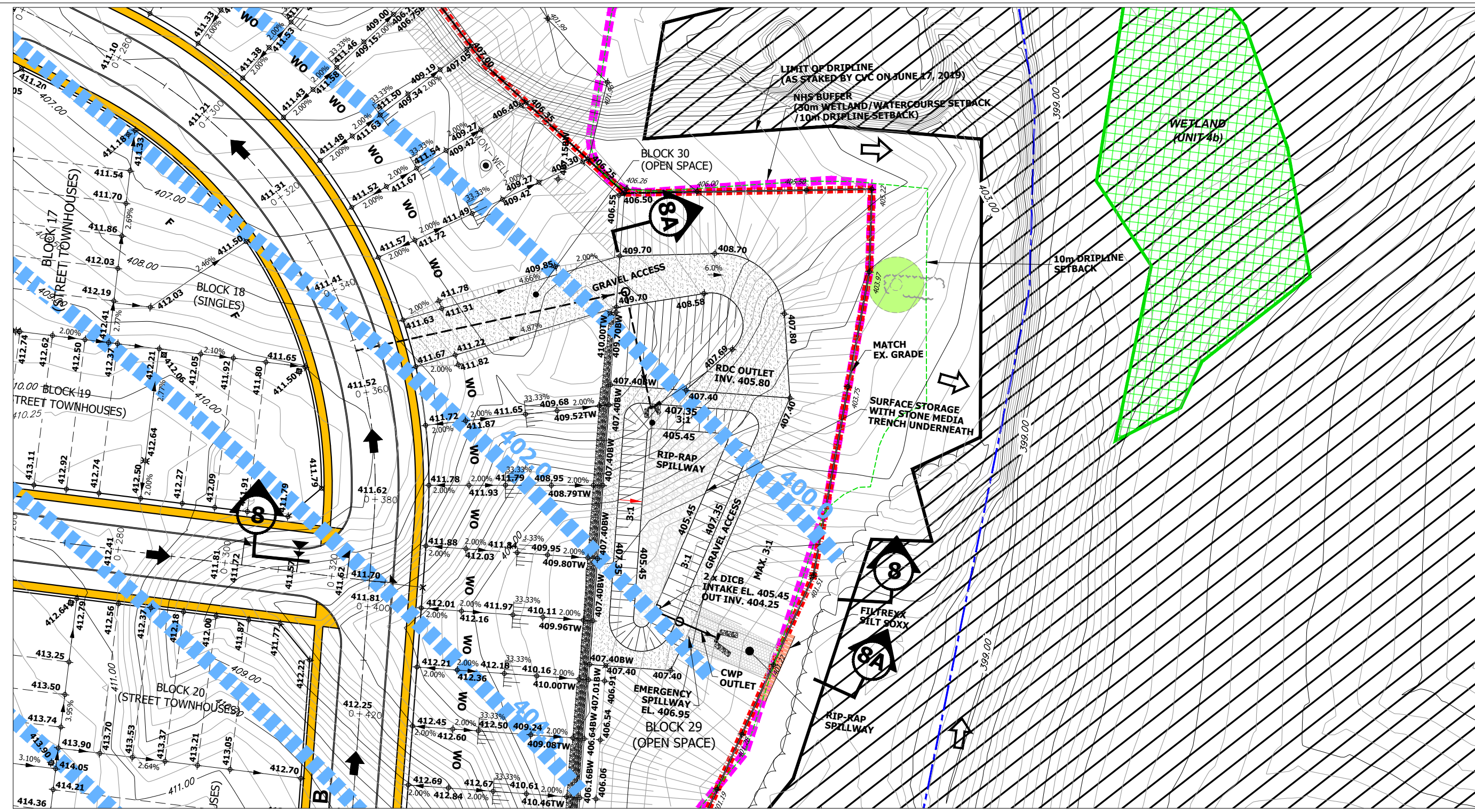
No.	REVISION	DATE	BY
5			
4			
3			
2			
1			

**5528 8th LINE  
TOWN OF ERIN  
COUNTY OF WELLINGTON**

URBANTECH<sup>®</sup> Consulting  
A Division of Leighton-Zac Ltd.  
2750 10th Avenue, Suite 301  
Markham, ON L3R 3T7  
TEL: 905.946.9461 • urbantech.com

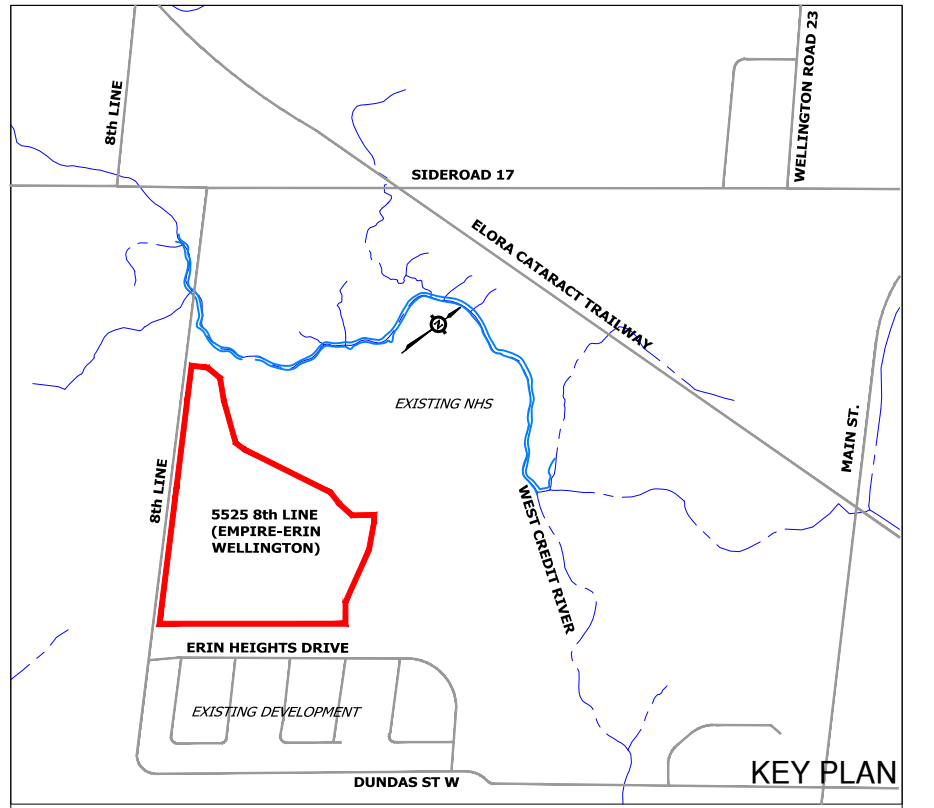
**NORTH SWM FACILITY**

DESIGNED: D.Z. CHECKED: D.Z. PROJECT No.: 21-644  
DRAWN: J.B. DATE: MAY 2021 SHEET No.:  
SCALE: AS DRAWING No.: 4.1  
SHOWN

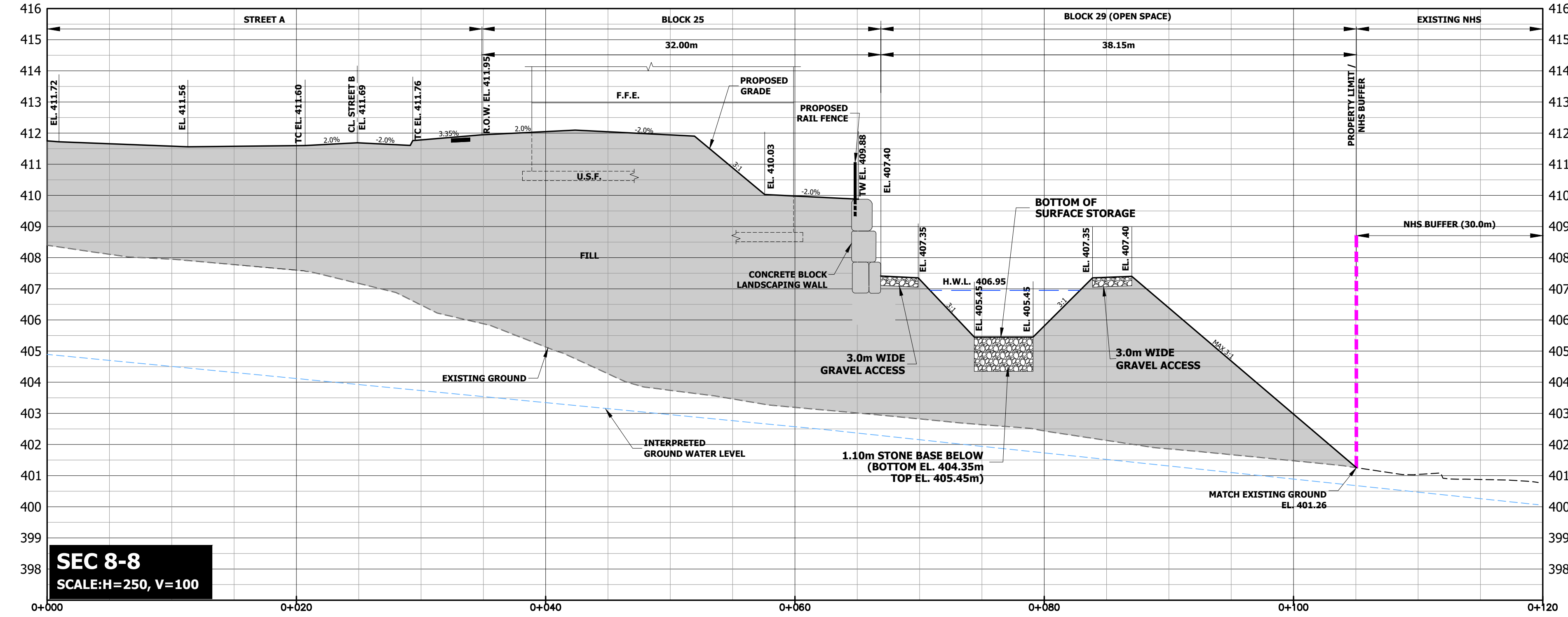


PLAN VIEW - SCALE 1:750

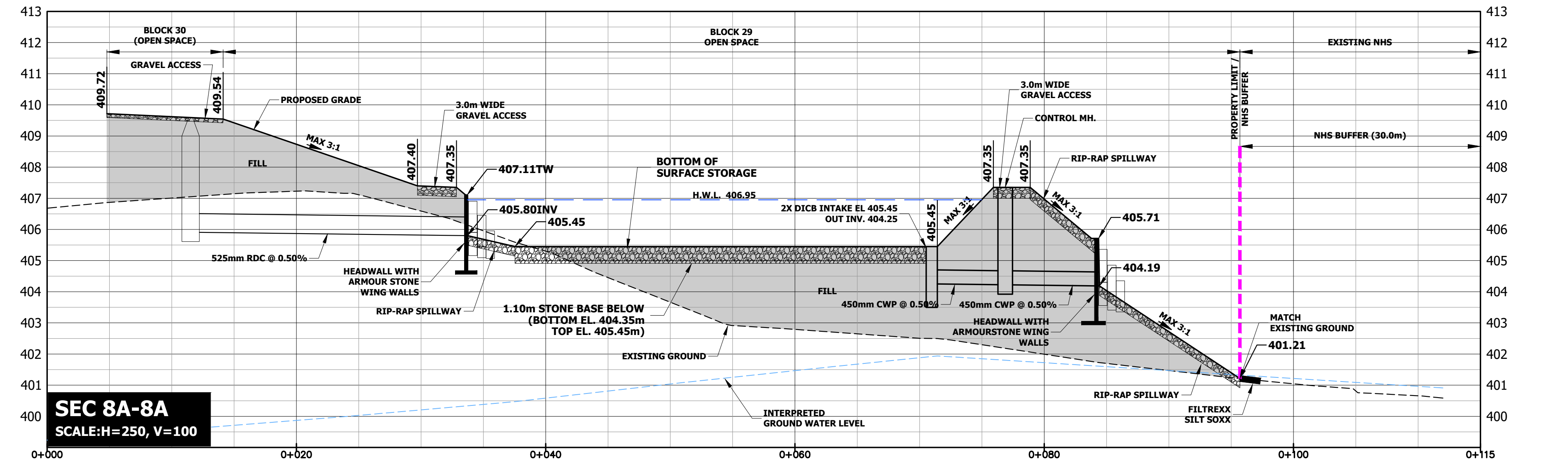
EAST SWM FACILITY TABLE		PROVIDED
ROOF DRAINAGE AREA		0.60ha
INFILTRATION STORAGE VOLUME		145cu.m (363cu.m STONE MEDIA (VOID SPACE RATIO = 0.4))
100YR SURFACE AREA STORAGE (INCL. CLIMATE CHANGE PROJECTION)		840cu.m



- Legend:**
- SUBJECT LANDS
  - EXISTING CONTOUR ELEVATION
  - EXISTING ELEVATION
  - EXISTING OVERLAND FLOW DIRECTION
  - EXISTING WETLAND
  - EXISTING WOODLAND
  - NHS BUFFER
  - PROPOSED ELEVATION
  - PROPOSED OVERLAND FLOW DIRECTION
  - INTERPRETED GROUNDWATER ELEVATION CONTOUR
  - PROPOSED 3:1 GRADE TRANSITION AND RESTORATION AREA
  - PROPOSED SIDEWALK
  - F** FRONT DRAINING LOT
  - S** SPLIT DRAINING LOT
  - LO** LOOK OUT CONDITION
  - WO** WALK OUT CONDITION



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



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



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

**EAST SWM FACILITY**

PROJECT No.:	DATE:	SCALE:	DRAWING No.:
21-684	Sept.2023	AS SHOWN	4.2

**Legend:**

- SUBJECT LANDS
- EXISTING 250mm PVC WATERMAIN
- PROPOSED 250mm PVC WATERMAIN
- PROPOSED 200mm PVC WATERMAIN
- PROPOSED 150mm PVC WATERMAIN

**NOTES:**

1. AS PER THE TOWN'S WATER CLASS EA STUDY PREPARED BY TRITON ENGINEERING, NEW MUNICIPAL WELLS AND ADDITIONAL STORAGE HAVE TO BE CONSTRUCTED TO ACCOMMODATE ALL PROPOSED DEVELOPMENT WITHIN THE TOWN OF ERIN. FURTHER COORDINATION WITH THE TOWN WILL BE REQUIRED REGARDING THE TIMING OF THE NEW INFRASTRUCTURE.
2. IT IS OUR UNDERSTANDING THE TOWN HAS RETAINED WSP TO DEVELOP A NEW WATER MODEL FOR EXISTING AND FUTURE CONDITIONS. FURTHER COORDINATION WITH THE TOWN WILL BE REQUIRED IN THIS REGARD.

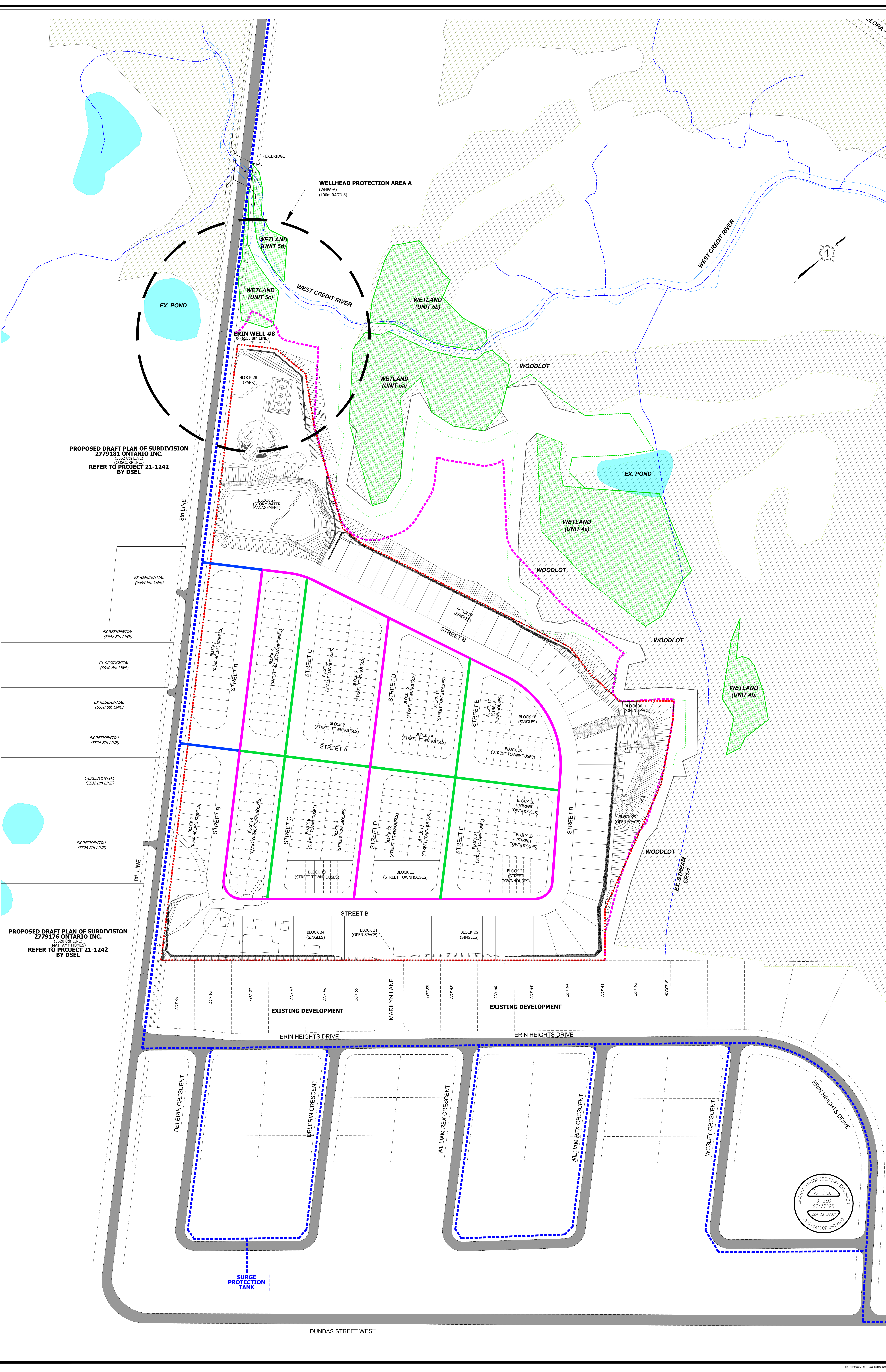


**Functional Servicing Report**  
**5525 8th Line**  
**(Empire - Erin, Wellington)**

**WATERMAIN PLAN**

PROJECT NO.:	DATE:	SCALE:	DRAWING NO.:
21-684	Sept.2023	1:1500	6.1

File: P:\Projects\21-684 - 5525 8th Line (Empire - Erin, Wellington)\Report\Functional Servicing Report\Drawings\6.1 - Watermain Plan.dwg - Date: 2023-09-08 - 10:00 AM - User: jz



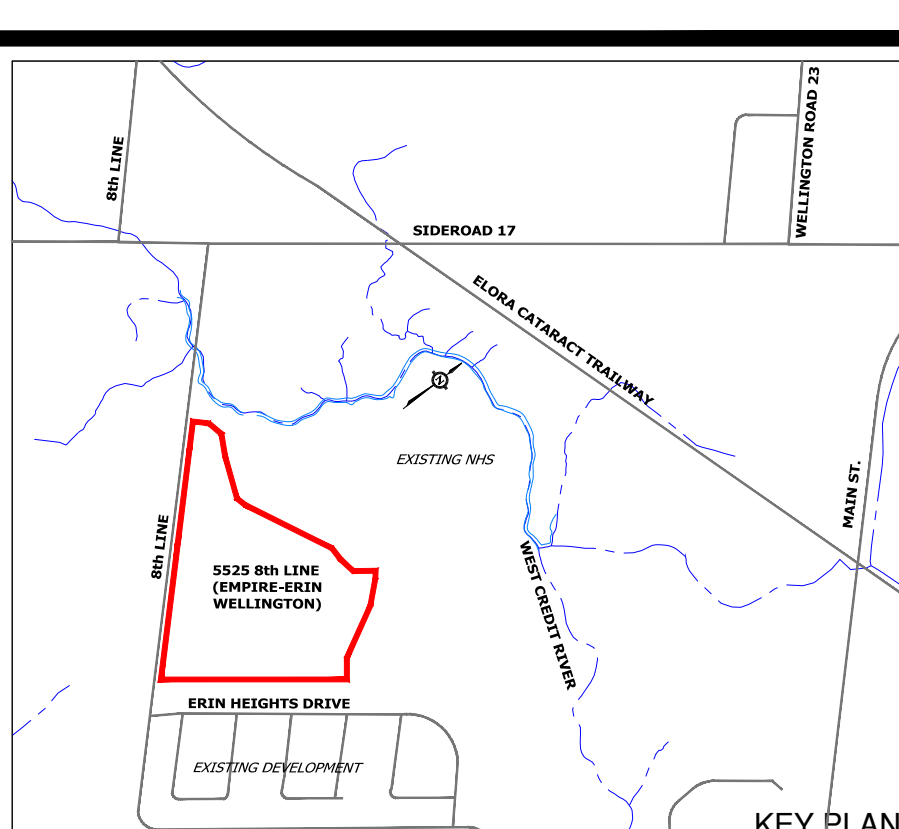
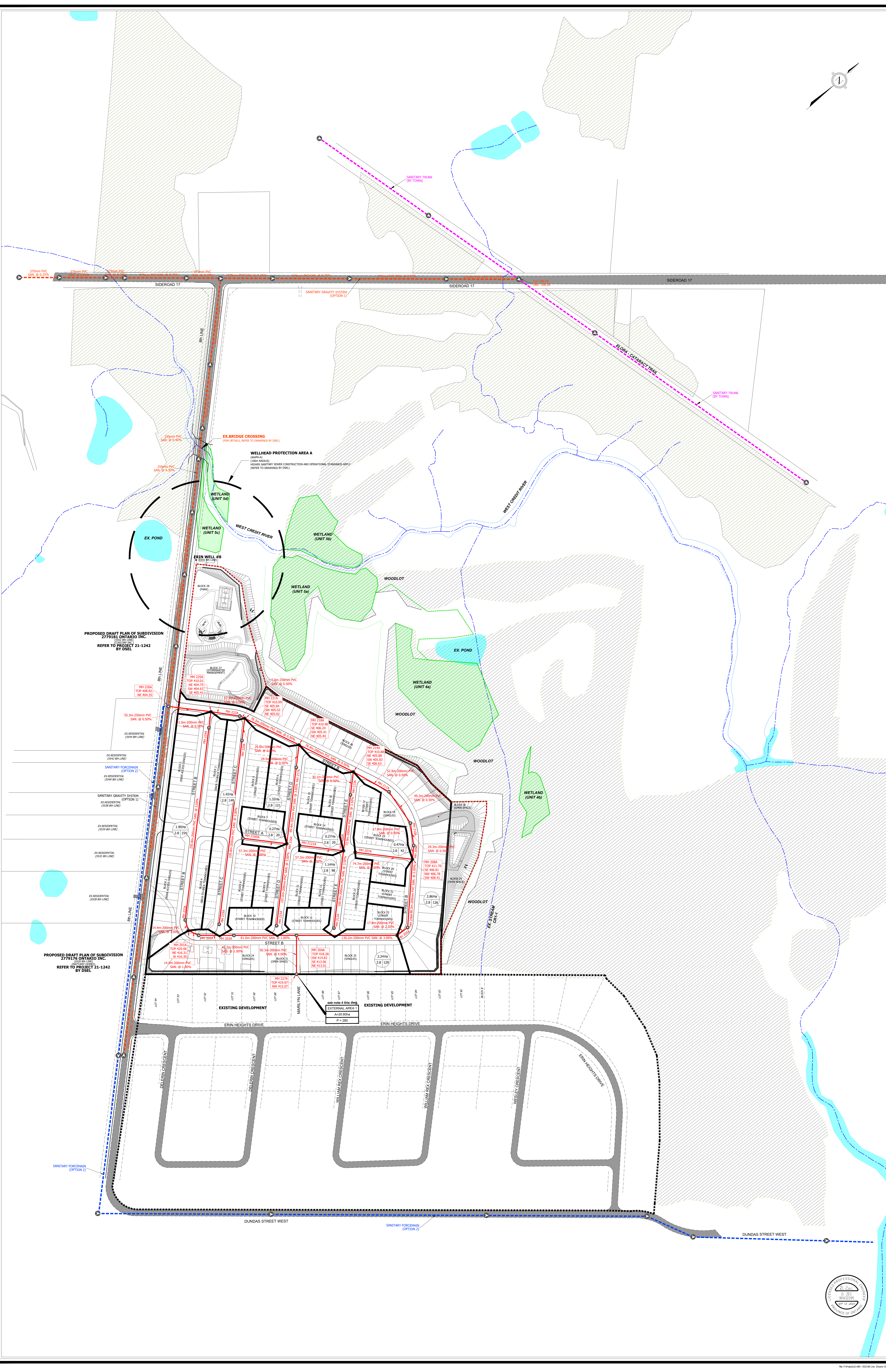
**PROPOSED DRAFT PLAN OF SUBDIVISION**  
**2779181 ONTARIO INC.**  
 (5532 8th LINE)  
 (COSCORP INC.)  
 REFER TO PROJECT 21-1242  
 BY DSEL

**PROPOSED DRAFT PLAN OF SUBDIVISION**  
**2779176 ONTARIO INC.**  
 (5520 8th LINE)  
 (HARTWAY HOMES)  
 REFER TO PROJECT 21-1242  
 BY DSEL



**SURGE PROTECTION TANK**

DUNDAS STREET WEST



**Legend:**

- SUBJECT LANDS
- INTERNAL SANITARY DRAINAGE BOUNDARY
- POTENTIAL EXTERNAL SANITARY DRAINAGE BOUNDARY
- SANITARY DRAINAGE AREA (HECTARES)
- POPULATION
- DENSITY (PERSONS PER UNIT)

EXTERNAL AREA 1	EXTERNAL AREA ID
A=20.60ha	EXTERNAL SANITARY DRAINAGE AREA (HECTARES)
P=280	POPULATION

- SANITARY SEWER FLOW DIRECTION AND MANHOLE
- EXTERNAL SANITARY SEWER FLOW DIRECTION AND MANHOLE (OPTION 1 - GRAVITY SYSTEM) (FOR DETAILS REFER TO DRAWINGS BY DSEL)
- EXTERNAL SANITARY SEWER FLOW DIRECTION AND MANHOLE (OPTION 2 - FORCEMAIN)
- EXTERNAL SANITARY TRUNK SEWER FLOW DIRECTION AND MANHOLE (CURRENTLY UNDER CONSTRUCTION BY TOWN)
- PROPOSED SANITARY MH ID
- PROPOSED GROUND ELEVATION
- PROPOSED SEWER OVERTS (UNLESS SPECIFIED AS INVERT)

**NOTES:**

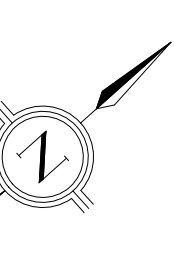
- SERVICING TO BE COORDINATED WITH THE PROPOSED DEVELOPMENT LANDS WEST OF 8th LINE.
- TOWN TO CONFIRM GRAVITY OUTLET TO TRUNK SEWER WITHIN ELOHA-CATARACT TRAIL.
- IF A GRAVITY OUTLET IS NOT A FEASIBLE SERVICING SOLUTION, EMPIRE AND MATTAMY TO EXPLORE A SEWAGE PUMP STATION AND FORCEMAIN TO CONVEY TO TRUNK SEWER ALONG MAIN STREET, WHERE DUNDAS STREET WEST COULD BE POTENTIALLY UTILIZED AS THE SANITARY FORCEMAIN CORRIDOR.
- REGARDLESS OF SOLUTION (GRAVITY vs. FORCEMAIN), TOWN TO CONFIRM WHETHER CAPACITY SHOULD BE PROVIDED FOR A FUTURE WASTEWATER SYSTEM WITHIN EXISTING ERIN HEIGHTS DEVELOPMENT TO BE PUMPED TO MH227A.

**URBANTECH**

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

**SANITARY DRAINAGE PLAN**

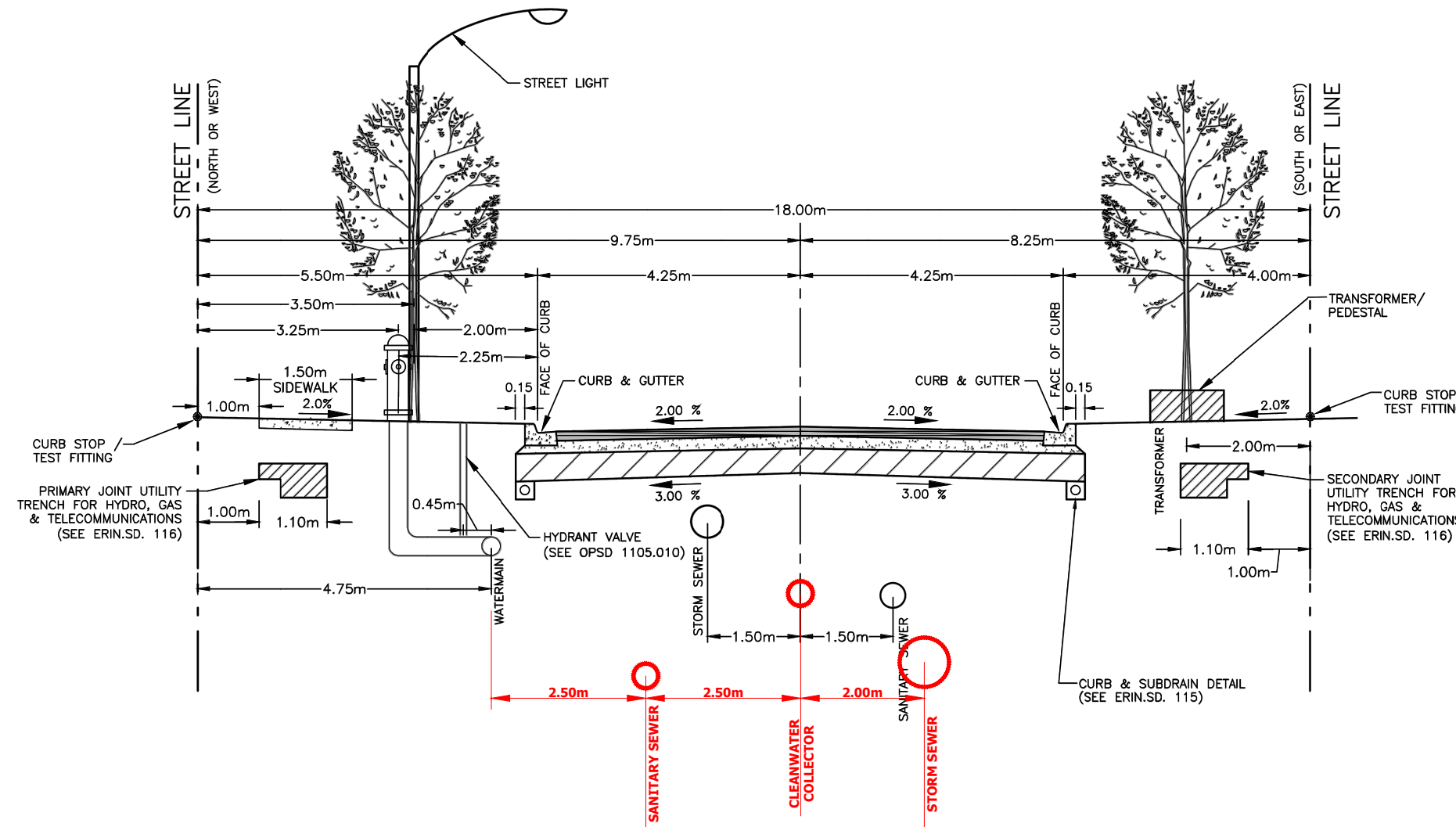
PROJECT NO.:	DATE:	SCALE:	DRAWING NO.:
21-684	Sept.2023	1:1500	7.1



# Functional Servicing Report

## 5525 8th Line (Empire - Erin, Wellington)

Legend:



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



**NOTES:**  
\* MODIFIED CIVIL INFRASTRUCTURE LAYOUT PROPOSED TO ACCOMMODATE CLEANWATER COLLECTOR SEWER SYSTEM.  
\* ALTERNATIVE PIPE LOCATION TO BE CONFIRMED BY THE TOWN.

					SCALE: N.T.S.
					DATE: NOV. 2021
<b>URBAN MINOR LOCAL (8.5m ROAD ON 18.0m RIGHT-OF-WAY)</b>					<b>ERIN SD. 101</b>
	NO.	REVISIONS	DATE	APR'D	

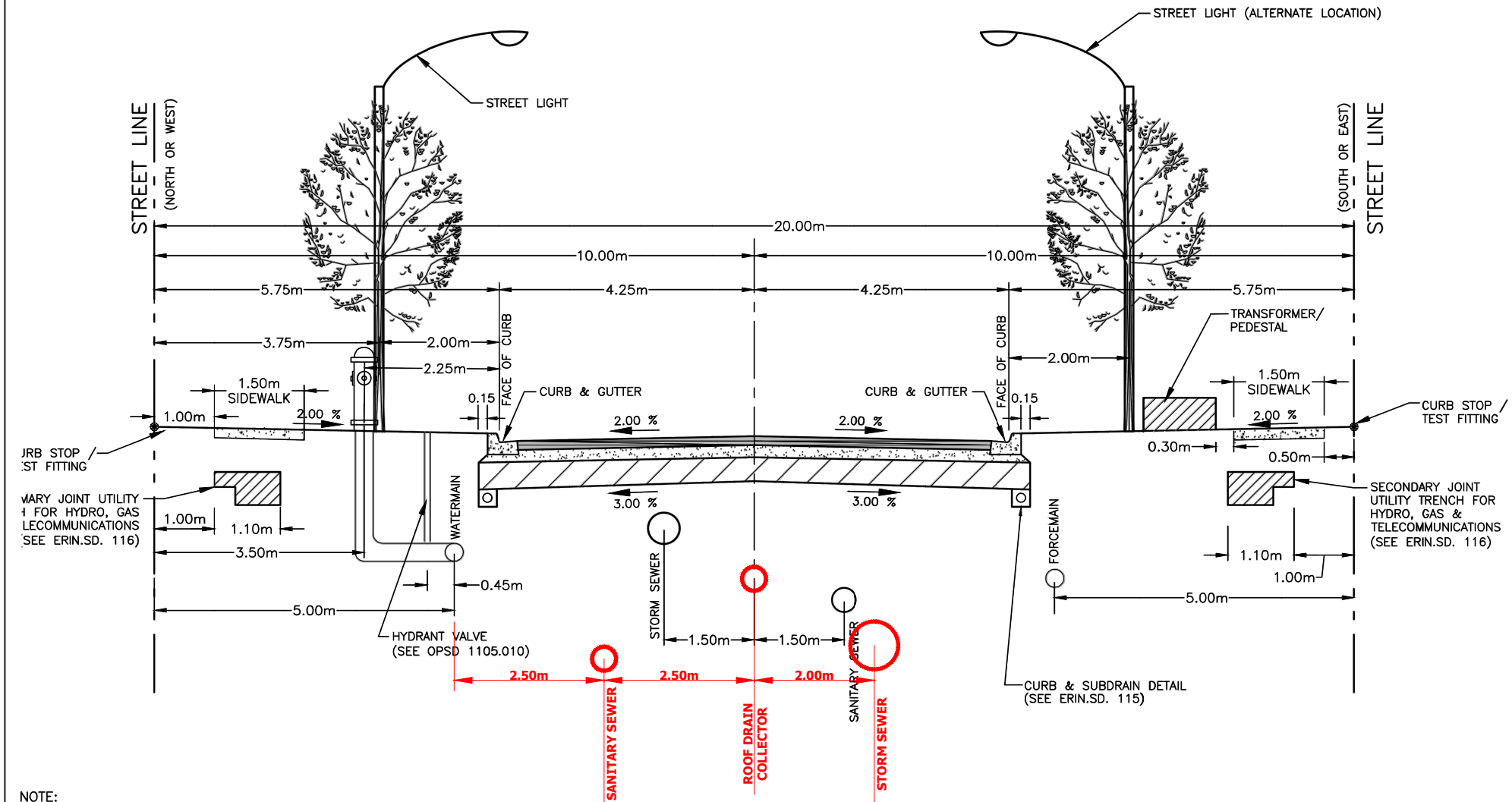
**FIGURE 8.1A**  
**18.0m URBAN MINOR LOCAL**  
**RIGHT-OF-WAY CROSS SECTION**  
**(MODIFIED)**

**September 2023**  
Scale: N.T.S.

# Functional Servicing Report

## 5525 8th Line (Empire - Erin, Wellington)

Legend:



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



**NOTES:**  
\* MODIFIED CIVIL INFRASTRUCTURE LAYOUT PROPOSED TO ACCOMMODATE CLEANWATER COLLECTOR SEWER SYSTEM.  
\* ALTERNATIVE PIPE LOCATION TO BE CONFIRMED BY THE TOWN.

				SCALE: N.T.S.
				DATE: NOV. 2021
<b>URBAN/ SUBURBAN ROAD SECTION (8.5m ROAD ON 20.0m RIGHT-OF-WAY)</b>				<b>ERIN SD. 102</b>
	NO.	REVISIONS	DATE	

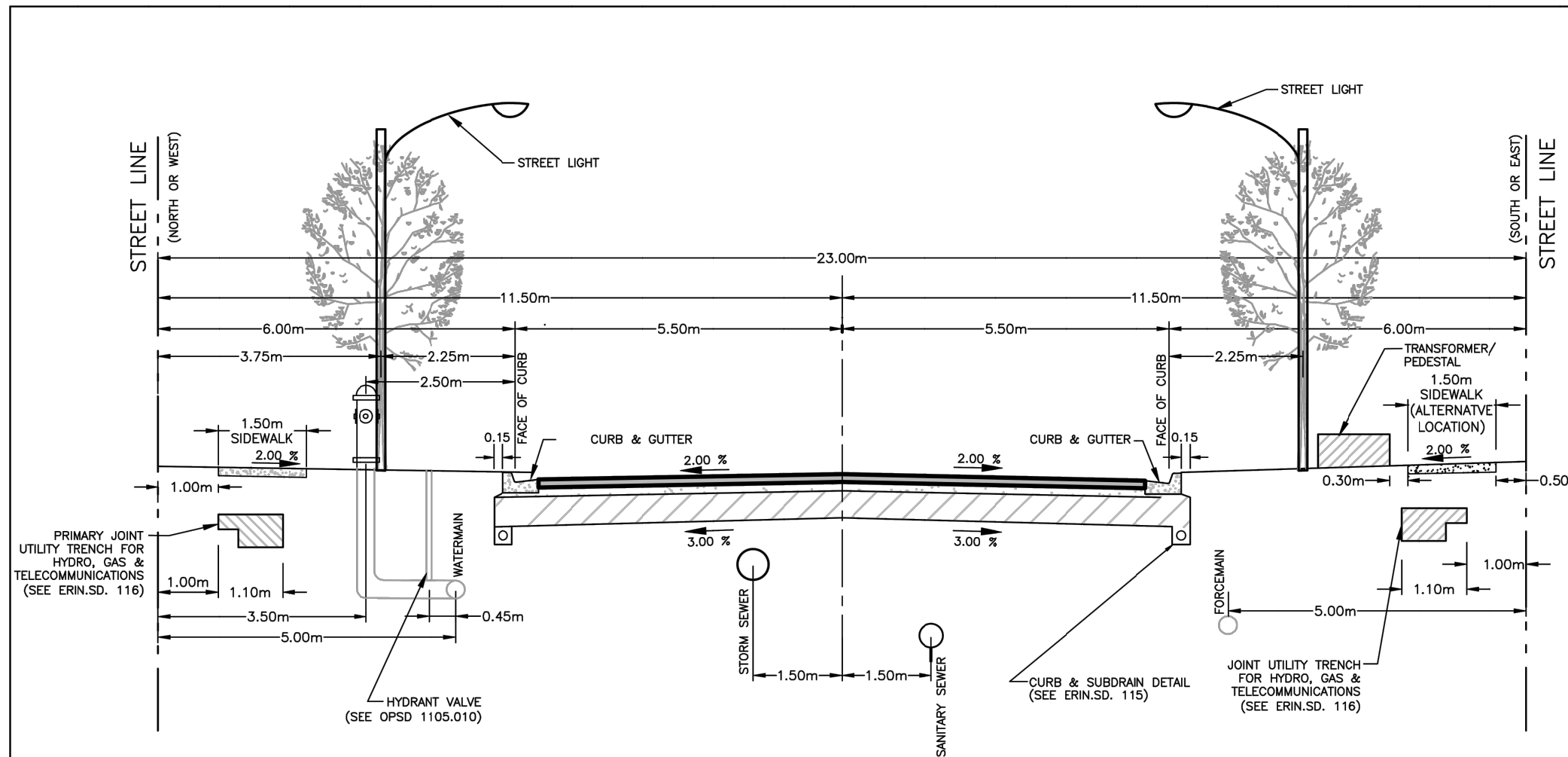
**FIGURE 8.1B**  
**20.0m URBAN/SUBURBAN**  
**RIGHT-OF-WAY CROSS SECTION**  
**(MODIFIED)**

**September 2023**  
Scale: N.T.S.

# Functional Servicing Report

## 5525 8th Line (Empire - Erin, Wellington)

Legend:



**NOTE:**

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



**NOTES:**

- \*EXISTING 8th LINE TO BE WIDENED TO 26.0m.
- \*SURFACE DRAINAGE FROM THE EAST HALF OF THE URBANIZED RIGHT-OF-WAY TO BE CAPTURED BY THE PROPOSED NORTH SWM FACILITY WITHIN THE EMPIRE-ERIN DEVELOPMENT. SURFACE DRAINAGE FROM THE WEST HALF OF THE URBANIZED RIGHT-OF-WAY TO BE DIRECTED TO A FUTURE SWM FACILITY BY OTHERS.
- \*ALTERNATIVE STORM SEWER LOCATION TO BE CONFIRMED BY THE TOWN.

					SCALE: N.T.S.
					DATE: NOV. 2021
<b>MINOR COLLECTOR (10.0m ROAD ON 23.0m RIGHT-OF-WAY)</b>					<b>ERIN SD. 103</b>
	NO.	REVISIONS	DATE	APR'D	

**FIGURE 8.1C  
23.0m MINOR COLLECTOR  
RIGHT-OF-WAY CROSS SECTION**



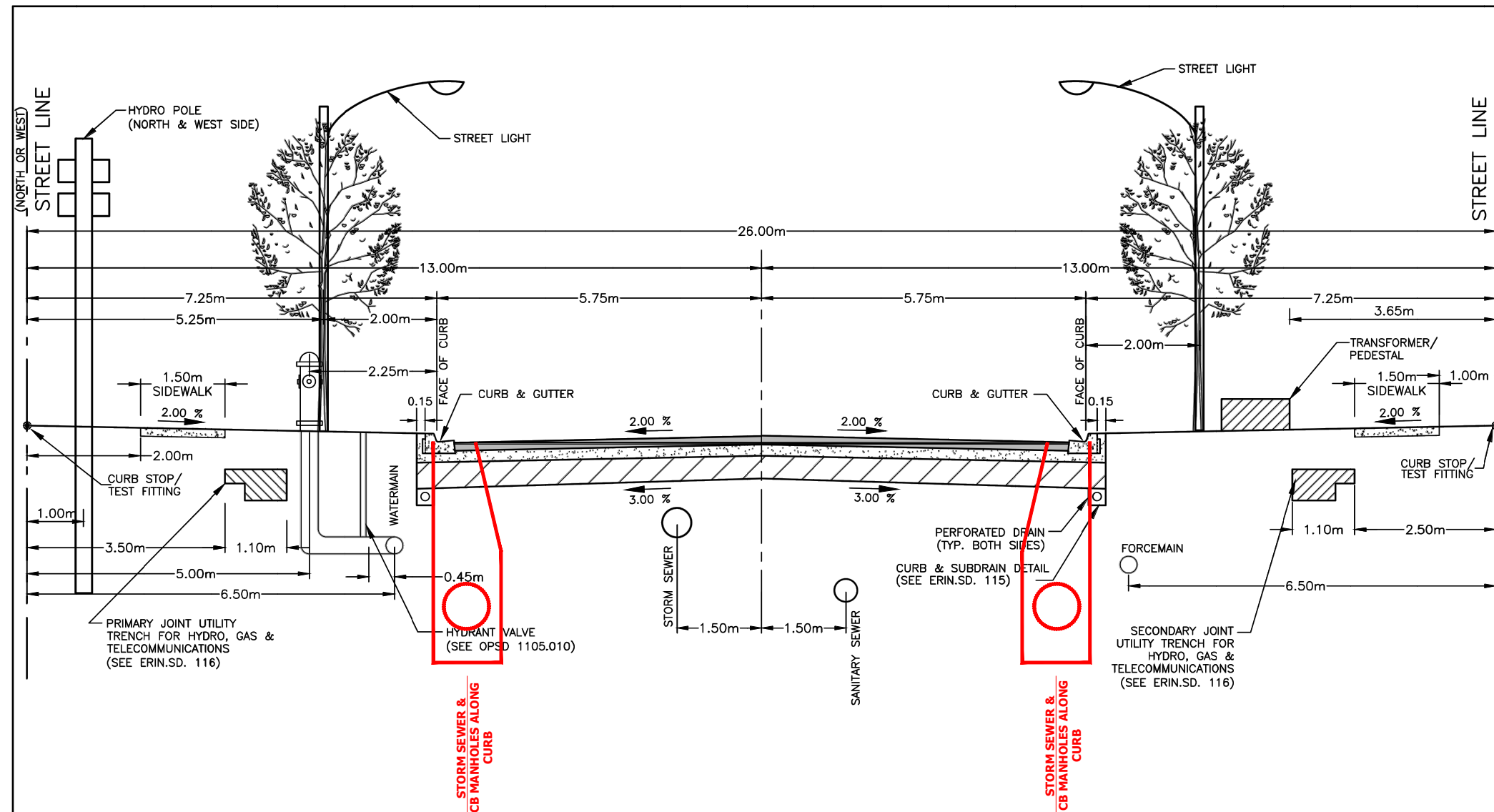
September 2023

Scale: N.T.S.

# Functional Servicing Report

## 5525 8th Line (Empire - Erin, Wellington)

Legend:



**NOTE:**

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



**NOTES:**

- \*EXISTING 8th LINE TO BE WIDENED TO 26.0m.
- \*SURFACE DRAINAGE FROM THE EAST HALF OF THE URBANIZED RIGHT-OF-WAY TO BE CAPTURED BY THE PROPOSED NORTH SWM FACILITY WITHIN THE EMPIRE-ERIN DEVELOPMENT. SURFACE DRAINAGE FROM THE WEST HALF OF THE URBANIZED RIGHT-OF-WAY TO BE DIRECTED TO A FUTURE SWM FACILITY BY OTHERS.
- \*ALTERNATIVE STORM SEWER LOCATION TO BE CONFIRMED BY THE TOWN.

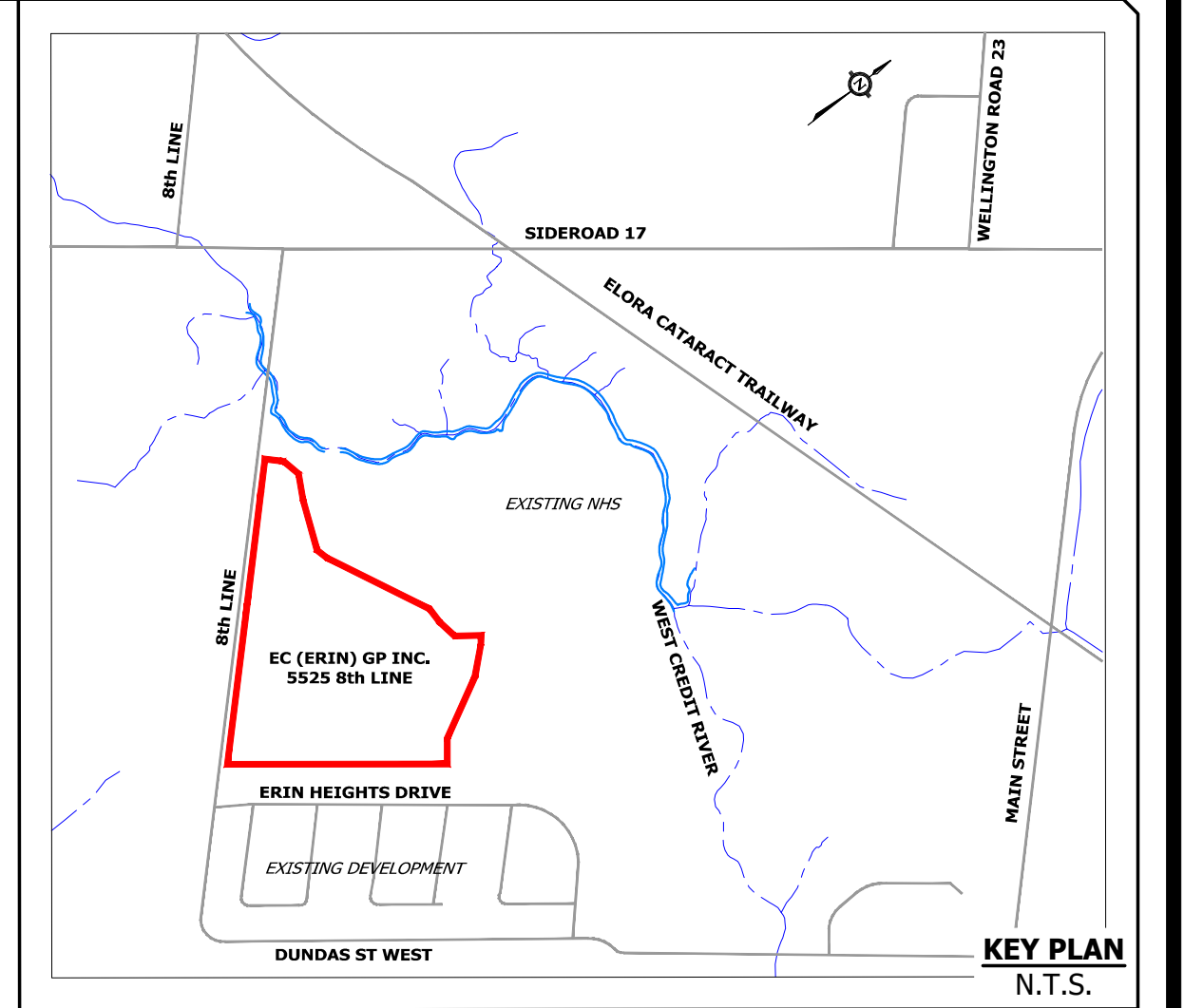
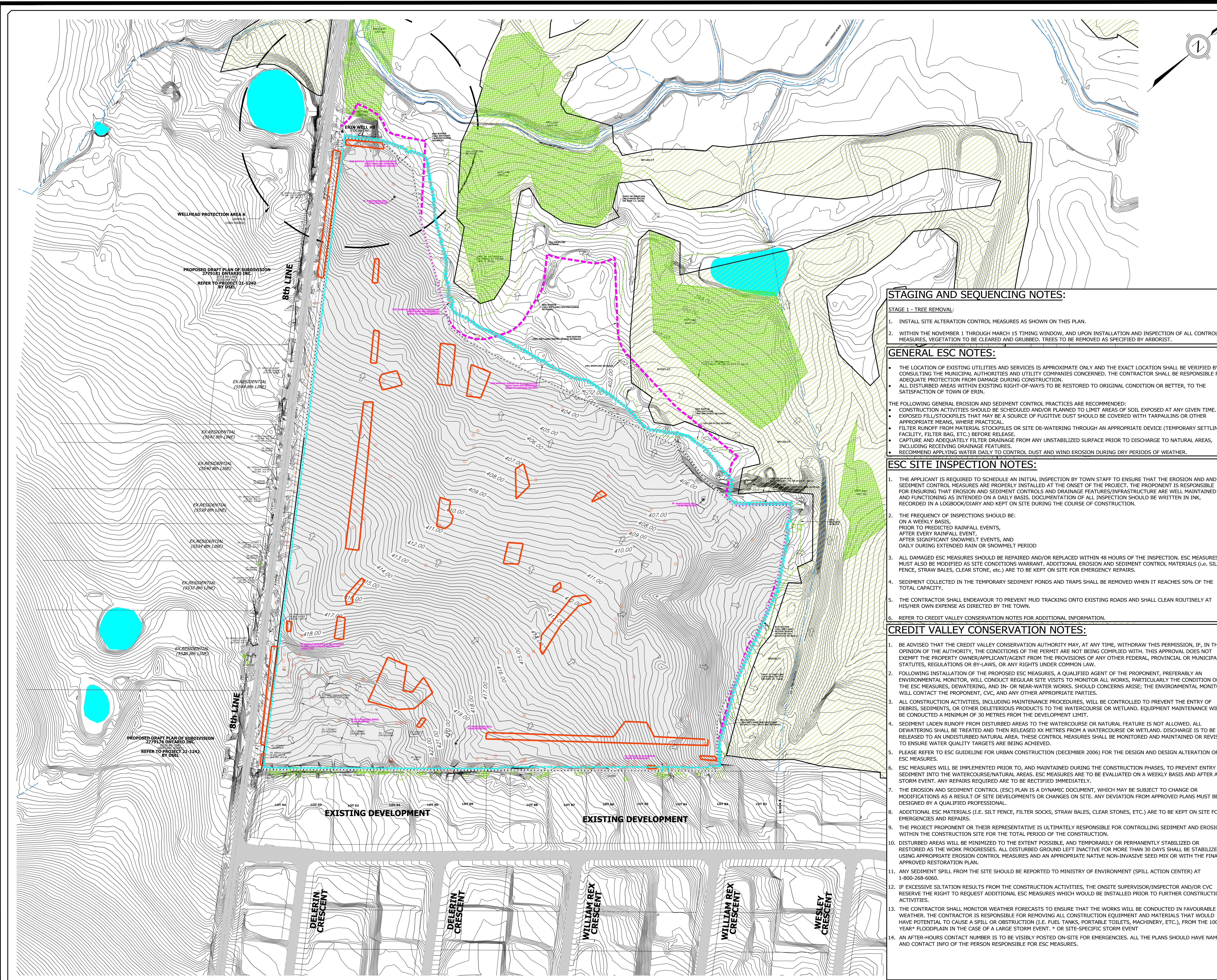
				SCALE: N.T.S.
				DATE: NOV. 2021
<b>3-LANE MAJOR COLLECTOR (11.5m ROAD ON 26.0m RIGHT-OF-WAY)</b>				<b>ERIN SD. 104</b>
	NO.	REVISIONS	DATE	

**FIGURE 8.1D**  
26.0m 3-LANE MAJOR COLLECTOR  
RIGHT-OF-WAY CROSS SECTION  
(MODIFIED)



September 2023

Scale: N.T.S.



**LEGEND**

- EXISTING STORM SEWER AND MANHOLE
- EXISTING SANITARY SEWER AND MANHOLE
- EXISTING WATERMAIN
- EXISTING CONTOUR AND ELEVATION
- PROPOSED ELEVATION
- EXISTING ELEVATION
- EXISTING TOP OF WALL ELEVATION
- EXISTING BOTTOM OF WALL ELEVATION
- SINGLE HEAVY DUTY SILT FENCE
- DOUBLE HEAVY DUTY SILT FENCE WITH STRAW BALES IN BETWEEN
- EXISTING OVERLAND FLOW DIRECTION
- CUT-OFF SWALE
- ROCK CHECK DAM
- ESC CONTRIBUTING DRAINAGE AREA (HECTARES)
- DRAINAGE BOUNDARY
- EXISTING WETLANDS
- EXISTING POND
- LIMIT OF PROPERTY
- LIMIT OF SITE DISTURBANCE
- EX. VEGETATION TO BE REMOVED (REFER TO ARBORIST REPORT & TREE PRESERVATION PLAN FOR DETAILS)
- EXISTING WOODLAND
- NHS BUFFER
- EX. VEGETATION TO BE PRESERVED (REFER TO ARBORIST REPORT & TREE PRESERVATION PLAN FOR DETAILS)

**STAGING AND SEQUENCING NOTES:**

- STAGE 1 - TREE REMOVAL:**
- INSTALL SITE ALTERATION CONTROL MEASURES AS SHOWN ON THIS PLAN.
  - WITHIN THE NOVEMBER 1 THROUGH MARCH 15 TIMING WINDOW, AND UPON INSTALLATION AND INSPECTION OF ALL CONTROL MEASURES, VEGETATION TO BE CLEARED AND GRUBBED, TREES TO BE REMOVED AS SPECIFIED BY ARBORIST.

**GENERAL ESC NOTES:**

- THE LOCATION OF EXISTING UTILITIES AND SERVICES IS APPROXIMATE ONLY AND THE EXACT LOCATION SHALL BE VERIFIED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE DURING CONSTRUCTION.
- ALL DISTURBED AREAS WITHIN EXISTING RIGHT-OF-WAYS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER, TO THE SATISFACTION OF TOWN OF ERIN.
- THE FOLLOWING GENERAL EROSION AND SEDIMENT CONTROL PRACTICES ARE RECOMMENDED:
  - CONSTRUCTION ACTIVITIES SHOULD BE SCHEDULED AND/OR PLANNED TO LIMIT AREAS OF SOIL EXPOSED AT ANY GIVEN TIME.
  - EXPOSED FILLS/STOCKPILES THAT MAY BE A SOURCE OF FUGITIVE DUST SHOULD BE COVERED WITH TARPULLINS OR OTHER APPROPRIATE MEANS, WHERE PRACTICAL.
  - FILTER RUNOFF FROM MATERIAL STOCKPILES OR SITE DE-WATERING THROUGH AN APPROPRIATE DEVICE (TEMPORARY SETTLING FACILITY, FILTER BAG, ETC.) BEFORE RELEASE.
  - CAPTURE AND ADEQUATELY FILTER DRAINAGE FROM ANY UNSTABILIZED SURFACE PRIOR TO DISCHARGE TO NATURAL AREAS, INCLUDING RECEIVING DRAINAGE FEATURES.
  - RECOMMEND APPLYING WATER DAILY TO CONTROL DUST AND WIND EROSION DURING DRY PERIODS OF WEATHER.

**ESC SITE INSPECTION NOTES:**

- THE APPLICANT IS REQUIRED TO SCHEDULE AN INITIAL INSPECTION BY TOWN STAFF TO ENSURE THAT THE EROSION AND SEDIMENT CONTROL MEASURES ARE PROPERLY INSTALLED AT THE ONSET OF THE PROJECT. THE PROPONENT IS RESPONSIBLE FOR ENSURING THAT EROSION AND SEDIMENT CONTROLS AND DRAINAGE FEATURES/INFRASTRUCTURE ARE WELL MAINTAINED AND FUNCTIONING AS INTENDED ON A DAILY BASIS. DOCUMENTATION OF ALL INSPECTIONS SHOULD BE WRITTEN IN INK, RECORDED IN A LOGBOOK/DIARY AND KEPT ON SITE DURING THE COURSE OF CONSTRUCTION.
- THE FREQUENCY OF INSPECTIONS SHOULD BE:
  - ON A WEEKLY BASIS,
  - PRIOR TO PREDICTED RAINFALL EVENTS,
  - AFTER EVERY RAINFALL EVENT,
  - AFTER SIGNIFICANT SNOWMELT EVENTS, AND
  - DAILY DURING EXTENDED RAIN OR SNOWMELT PERIOD
- ALL DAMAGED ESC MEASURES SHOULD BE REPAIRED AND/OR REPLACED WITHIN 48 HOURS OF THE INSPECTION. ESC MEASURES MUST ALSO BE MODIFIED AS SITE CONDITIONS WARRANT. ADDITIONAL EROSION AND SEDIMENT CONTROL MATERIALS (i.e. SILT FENCE, STRAW BALES, CLEAR STONE, ETC.) ARE TO BE KEPT ON SITE FOR EMERGENCY REPAIRS.
- SEDIMENT COLLECTED IN THE TEMPORARY SEDIMENT PONDS AND TRAPS SHALL BE REMOVED WHEN IT REACHES 50% OF THE TOTAL CAPACITY.
- THE CONTRACTOR SHALL ENDEAVOUR TO PREVENT MUD TRACKING ONTO EXISTING ROADS AND SHALL CLEAN ROUTINELY AT HIS/HER OWN EXPENSE AS DIRECTED BY THE TOWN.
- REFER TO CREDIT VALLEY CONSERVATION NOTES FOR ADDITIONAL INFORMATION.

**CREDIT VALLEY CONSERVATION NOTES:**

- BE ADVISED THAT THE CREDIT VALLEY CONSERVATION AUTHORITY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH, THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.
- FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT, PREFERABLY AN ENVIRONMENTAL MONITOR, WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE; THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, CVC, AND ANY OTHER APPROPRIATE PARTIES.
- ALL CONSTRUCTION ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF DEBRIS, SEDIMENTS, OR OTHER DELETERIOUS PRODUCTS TO THE WATERCOURSE OR WETLAND. EQUIPMENT MAINTENANCE WILL BE CONDUCTED A MINIMUM OF 30 METRES FROM THE DEVELOPMENT LIMIT.
- SEDIMENT LADEN RUNOFF FROM DISTURBED AREAS TO THE WATERCOURSE OR NATURAL FEATURE IS NOT ALLOWED. ALL DEWATERING SHALL BE TREATED AND THEN RELEASED XX METRES FROM A WATERCOURSE OR WETLAND. DISCHARGE IS TO BE RELEASED TO AN UNDISTURBED NATURAL AREA. THESE CONTROL MEASURES SHALL BE MONITORED AND MAINTAINED OR REVISED TO ENSURE WATER QUALITY TARGETS ARE BEING ACHIEVED.
- PLEASE REFER TO ESC GUIDELINE FOR URBAN CONSTRUCTION (DECEMBER 2006) FOR THE DESIGN AND DESIGN ALTERATION OF ESC MEASURES.
- ESC MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATERCOURSE/NATURAL AREAS. ESC MEASURES ARE TO BE EVALUATED ON A WEEKLY BASIS AND AFTER ANY STORM EVENT. ANY REPAIRS REQUIRED ARE TO BE RECTIFIED IMMEDIATELY.
- THE EROSION AND SEDIMENT CONTROL (ESC) PLAN IS A DYNAMIC DOCUMENT, WHICH MAY BE SUBJECT TO CHANGE OR MODIFICATIONS AS A RESULT OF SITE DEVELOPMENTS OR CHANGES ON SITE. ANY DEVIATION FROM APPROVED PLANS MUST BE DESIGNED BY A QUALIFIED PROFESSIONAL.
- ADDITIONAL ESC MATERIALS (I.E. SILT FENCE, FILTER SOCKS, STRAW BALES, CLEAR STONES, ETC.) ARE TO BE KEPT ON SITE FOR EMERGENCIES AND REPAIRS.
- THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
- DISTURBED AREAS WILL BE MINIMIZED TO THE EXTENT POSSIBLE, AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE NATIVE NON-INVASIVE SEED MIX OR WITH THE FINAL APPROVED RESTORATION PLAN.
- ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6060.
- IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ONSITE SUPERVISOR/INSPECTOR AND/OR CVC RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.
- THE CONTRACTOR SHALL MONITOR WEATHER FORECASTS TO ENSURE THAT THE WORKS WILL BE CONDUCTED IN FAVOURABLE WEATHER. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING ALL CONSTRUCTION EQUIPMENT AND MATERIALS THAT WOULD HAVE POTENTIAL TO CAUSE A SPILL OR OBSTRUCTION (I.E. FUEL TANKS, PORTABLE TOILETS, MACHINERY, ETC.), FROM THE 100 YEAR\* FLOODPLAIN IN THE CASE OF A LARGE STORM EVENT. \* OR SITE-SPECIFIC STORM EVENT
- AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON-SITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

**BENCHMARK**  
 TABLET SET HORIZONTALLY IN THE NORTH FACE OF THE CONCRETE FOUNDATION OF A GREY BUILDING (GREENING DONALD CO. LTD.) ON THE EAST SIDE OF HWY. 24, 1.55 KM NORTH OF THE POST OFFICE AT ERIN, 0.30 KM SOUTH OF WELLINGTON CITY, RD. 23 AND 109.5 M EAST OF THE CENTERLINE OF HWY 24, 1.52 M WEST OF N.E. CORNER OF SAID BUILDING, 7 CM BELOW CONCRETE SIDING AND 7 CM ABOVE GROUND LEVEL.  
 ELEVATION = 394.056m  
 ID = 00819798463

No.	REVISION	DATE	BY
6			
5			
4			
3			
2			
1			

**COUNTY OF WELLINGTON**  
**TOWN OF ERIN**

APPROVED AS SHOWN

**PROFESSIONAL ENGINEER**  
 O.J. SOMERVILLE  
 100120186  
 OCT. 4, 2023  
 PROVINCE OF ONTARIO

Town of Erin Approved as Shown  
 This approval constitutes a general review and does not certify dimensional accuracy.  
 This approval is subject to further certification of the "as proposed" works by a Professional Engineer of the Province of Ontario.  
 Date: \_\_\_\_\_  
 Approved By: \_\_\_\_\_  
 Print Name: \_\_\_\_\_

COUNTY FILE: \_\_\_\_\_ PROJECT: 21-684 TOWN FILE: \_\_\_\_\_

**URBANTECH**  
 Urbantech Consulting  
 A Division of Leighton-Zac Ltd.  
 3750 14th Avenue, Suite 301,  
 Markham, ON L3R 3T7  
 TEL 905.946.9461 • urbantech.com

**EC (ERIN) GP INC. (EMPIRE)**  
 5525 8th LINE

**SITE ALTERATION - STAGE 1A**  
**TREE REMOVAL**

SURVEYED BY: R-PE DATE: APRIL 26, 2021 CONTRACT NO.  
 DRAWN BY: M.A.N. CHECKED BY: O.S. DRAWING NO.  
 DESIGNED BY: M.A.N. CHECKED BY: O.S.  
 SCALE: 1:1500 DATE: OCTOBER, 2023

**1001**

## **APPENDIX B**

### **DESIGN CALCULATIONS**

B1	Landuse Breakdown & Imperviousness Calculations
B2A	Storm Sewer Design Sheets (5-yr)
B2B	Storm Sewer Design Sheets (100-yr)
B3A	Cleanwater Collector System Sewer Design Sheets (5-yr)
B3B	Cleanwater Collector System Sewer Design Sheets (100-yr)
B4	VO Model Inputs
B5	VO Model Output
B6	Water Quality Sizing Calculations
B7	Sanitary Sewer Design Sheet
B8	North SWM Dry Pond Calculations
B9	North SWM Dry Pond Inlet Spillway and ROW Capacity
B10	Underground Storage Tank Calculations
B11	East SWM Dry Pond Calculations
B12	Swale Design



**SWM DESIGN CALCULATIONS**  
HYRDO-0: Contributing Drainage Area and Land Use

**Project Name:** Empire Erin, 5525 8<sup>th</sup> Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 18-Sep-22

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**SWM**

**Contributing Drainage Area**

SWM	Area [ha]	Runoff Coefficient	Imperviousness (Town of Erin Guidelines)	
			TIMP	XIMP
Drainage Area to North SWM Facility - Rear lots and ROW	7.89	0.65	64%	64%
Drainage Area to North SWM Facility - 8th Line	0.86	0.95	99%	99%
Drainage Area to North SWM Facility - North SWM Facility	0.57	0.65	64%	64%
<b>Drainage Area to North SWM Facility</b>	<b>9.32</b>	<b>0.68</b>	<b>68%</b>	<b>68%</b>
<b>Roof Drainage Area to North SWM Facility</b>	<b>3.26</b>	<b>0.95</b>	<b>99%</b>	<b>99%</b>
Total (North)	12.58	0.75	78%	78%
Drainage Area to East SWM Facility - lots ROW	0.15	0.65	64%	64%
Drainage Area to East SWM Facility - Gravel access route	0.14	0.6	99%	99%
Drainage Area to East SWM Facility - East SWM Facility	0.08	0.65	64%	64%
<b>Drainage Area to East SWM Facility</b>	<b>0.37</b>	<b>0.63</b>	<b>62%</b>	<b>62%</b>
<b>Roof Drainage Area to East SWM Facility</b>	<b>0.60</b>	<b>0.95</b>	<b>99%</b>	<b>99%</b>
Total (East)	0.97	0.83	90%	90%
<b>Total Controlled Drainage Area</b>	<b>13.55</b>	<b>0.75</b>	<b>79%</b>	<b>79%</b>
Uncontrolled Area - Park	0.89	0.25	7%	7%
Uncontrolled Area - Rear Lots	0.51	0.65	64%	64%
Uncontrolled Area - Open Space (East)	0.33	0.25	7%	7%
Uncontrolled Area - ROW (South)	0.33	0.65	64%	64%
<b>Total Uncontrolled Area</b>	<b>2.06</b>	<b>0.41</b>	<b>30%</b>	<b>30%</b>
<b>Total Site Drainage Area</b>	<b>15.61</b>	<b>0.71</b>	<b>73%</b>	<b>73%</b>

# B2A STORM SEWER DESIGN SHEETS (5-yr)

**STORM SEWER DESIGN SHEET**

**5 Year Storm**

**EMPIRE ERIN, 5525 8th LINE**

**Town of Erin**

**PROJECT DETAILS**

Project No: 21-684

Date: 1-Sep-23

Designed by: AL

Checked by: OS

**DESIGN CRITERIA**

Min. Diameter = 300 mm	Rainfall Intensity = $\frac{A}{(Tc+B)^c}$
Mannings 'n' = 0.013	A = 744
Starting Tc = 10 min	B = 1.76
Factor of Safety = 25 %	c = 0.729

**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 (%)
<b>DRAINAGE TO SWM POND</b>																				
STREET C	101	102	0.89	0.65	0.58	0.58	123.4	0.198			0.198	239.8	3.00	375	0.304	2.75	10.00	1.45	11.45	65%
STREET C	102	125				0.58	113.3	0.182			0.182	32.7	0.50	525	0.304	1.40	11.45	0.39	11.84	60%
STREET D	103	104	1.21	0.65	0.79	0.79	123.4	0.270			0.270	111.5	4.00	375	0.351	3.17	10.00	0.59	10.59	77%
STREET A	1040	104					123.4					61.8	1.00	300	0.097	1.37	10.00	0.75	10.75	
STREET D	104	105				0.79	117.9	0.258			0.258	94.9	3.00	450	0.494	3.10	10.75	0.51	11.26	52%
STREET D	105	124				0.79	114.5	0.250			0.250	32.6	0.50	600	0.434	1.54	11.26	0.35	11.62	58%
<b>EXISTING DEVELOPMENT</b>																				
STREET B	106-E	111	0.89	0.65	0.58	0.58														
STREET B	111	112	1.94	0.65	1.26	1.84	123.4	0.630			0.630	18.1	1.00	675	0.841	2.35	10.00	0.13	10.13	75%
STREET B	112	113				1.84	122.4	0.625			0.625	103.3	1.00	675	0.841	2.35	10.13	0.73	10.86	74%
STREET B	113	114				1.84	117.2	0.599			0.599	74.6	1.00	675	0.841	2.35	10.86	0.53	11.39	71%
STREET B	114	115				1.84	113.7	0.581			0.581	81.6	3.00	675	1.456	4.07	11.39	0.33	11.72	40%
STREET B	115	117				1.84	111.7	0.571			0.571	18.8	2.50	675	1.329	3.71	11.72	0.08	11.81	43%
STREET B	115	117				1.84	111.2	0.568			0.568	96.1	2.00	675	1.189	3.32	11.81	0.48	12.29	48%
STREET A	116	117					123.4					79.2	2.00	300	0.137	1.93	10.00	0.68	10.68	
STREET B	117	118				1.84	108.4	0.554			0.554	17.8	0.50	750	0.787	1.78	12.29	0.17	12.46	70%
STREET B	118	119				1.84	107.4	0.549			0.549	27.8	0.50	750	0.787	1.78	12.46	0.26	12.72	70%
STREET B	119	120	0.75	0.65	0.49	2.33	106.0	0.685			0.685	51.4	0.50	825	1.015	1.90	12.72	0.45	13.17	68%
STREET B	120	123				2.33	103.7	0.670			0.670	50.7	0.50	825	1.015	1.90	13.17	0.45	13.61	66%
STREET E	121	1210	1.07	0.65	0.70	0.70	123.4	0.238			0.238	105.4	3.50	375	0.328	2.97	10.00	0.59	10.59	73%
STREET A	1211	1210					123.4					61.8	1.50	300	0.118	1.68	10.00	0.61	10.61	
STREET E	1210	122				0.70	118.9	0.230			0.230	68.4	3.50	375	0.328	2.97	10.61	0.38	11.00	70%
STREET E	122	123				0.70	116.3	0.225			0.225	33.0	0.50	525	0.304	1.40	11.00	0.39	11.39	74%
STREET B	123	124				3.02	101.5	0.852			0.852	78.5	0.50	900	1.280	2.01	13.61	0.65	14.26	67%
STREET B	124	125				3.81	98.5	1.042			1.042	78.5	0.50	975	1.585	2.12	14.26	0.62	14.88	66%
STREET B	125	126				4.39	95.8	1.167			1.167	11.0	0.50	975	1.585	2.12	14.88	0.09	14.97	74%
STREET B	126	OGS 2				4.39	95.4	1.163			1.163	16.0	0.50	975	1.585	2.12	14.97	0.13	15.09	73%
STREET B	OGS 2	127				4.39	94.9	1.157			1.157	16.0	0.50	975	1.585	2.12	15.09	0.13	15.22	73%

**Urbantech Consulting, A Division of Leighton-Zec Ltd.**  
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[www.urbantech.com](http://www.urbantech.com)

**STORM SEWER DESIGN SHEET**

5 Year Storm

**EMPIRE ERIN, 5525 8th LINE**

Town of Erin

**PROJECT DETAILS**

Project No: 21-684

Date: 1-Sep-23

Designed by: AL

Checked by: OS

**DESIGN CRITERIA**

Min. Diameter = 300 mm

Mannings 'n' = 0.013

Starting Tc = 10 min

Factor of Safety = 25 %

Rainfall Intensity =  $\frac{A}{(Tc+B)^c}$

A = 744

B = 1.76

c = 0.729

**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 B	106-N	107	1.14	0.65	0.74	0.74	123.4	0.254			0.254	18.1	3.00	525	0.745	3.44	10.00	0.09	10.09	34%
STREET B	107	108				0.74	122.7	0.253			0.253	250.8	3.00	525	0.745	3.44	10.09	1.21	11.30	34%
STREET B	108	110				0.74	114.3	0.235			0.235	25.2	0.50	675	0.594	1.66	11.30	0.25	11.56	40%
STREET B	109	110	0.86	0.95	0.82	0.82	123.4	0.280			0.280	42.4	0.30	675	0.460	1.29	10.00	0.55	10.55	61%
STREET B	110	OGS 1				1.56	112.7	0.488			0.488	5.5	0.30	900	0.992	1.56	11.56	0.06	11.61	49%
STREET B	OGS 1	127				1.56	112.3	0.486			0.486	5.5	0.30	900	0.992	1.56	11.61	0.06	11.67	49%
STREET B	127	128				5.95	94.4	1.559			1.559	8.8	0.30	1350	2.923	2.04	15.22	0.07	15.29	53%
SWM POND	128	HW 1				5.95	94.1	1.554			1.554	7.6	0.30	1350	2.923	2.04	15.29	0.06	15.35	53%

**Urbantech Consulting, A Division of Leighton-Zec Ltd.**

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# B2B STORM SEWER DESIGN SHEETS (100-yr)

**STORM SEWER DESIGN SHEET**

**100 Year Storm**

**EMPIRE ERIN, 5525 8th LINE**

**Town of Erin**

**PROJECT DETAILS**

Project No: 21-684

Date: 1-Sep-23

Designed by: AL

Checked by: OS

**DESIGN CRITERIA**

Min. Diameter =	300	mm		Rainfall Intensity =	$\frac{A}{(Tc+B)^c}$
Mannings 'n' =	0.013			A =	1248
Starting Tc =	10	min		B =	1.83
Factor of Safety =	25	%		c =	0.732

**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 (%)
<b>DRAINAGE TO SWM POND</b>																				
STREET C	101	102	0.89	0.65	0.58	0.58	204.5	0.329			0.329	239.8	3.00	375	0.304	2.75	10.00	1.45	11.45	108%
STREET C	102	125				0.58	187.9	0.302			0.302	32.7	0.50	525	0.304	1.40	11.45	0.39	11.84	99%
STREET D	103	104	1.21	0.65	0.79	0.79	204.5	0.447			0.447	111.5	4.00	375	0.351	3.17	10.00	0.59	10.59	127%
STREET A	1040	104					204.5					61.8	1.00	300	0.097	1.37	10.00	0.75	10.75	
STREET D	104	105				0.79	195.5	0.427			0.427	94.9	3.00	450	0.494	3.10	10.75	0.51	11.26	86%
STREET D	105	124				0.79	189.9	0.415			0.415	32.6	0.50	600	0.434	1.54	11.26	0.35	11.62	96%
<b>EXISTING DEVELOPMENT</b>																				
STREET B	106-E	111	0.89	0.65	0.58	0.58	204.5	1.045			1.045	18.1	1.00	675	0.841	2.35	10.00	0.13	10.13	124%
STREET B	111	112	1.94	0.65	1.26	1.84	204.5	1.037			1.037	103.3	1.00	675	0.841	2.35	10.13	0.73	10.86	123%
STREET B	112	113				1.84	194.3	0.993			0.993	74.6	1.00	675	0.841	2.35	10.86	0.53	11.39	118%
STREET B	113	114				1.84	188.6	0.964			0.964	81.6	3.00	675	1.456	4.07	11.39	0.33	11.72	66%
STREET B	114	115				1.84	185.1	0.946			0.946	18.8	2.50	675	1.329	3.71	11.72	0.08	11.81	71%
STREET B	115	117				1.84	184.3	0.942			0.942	96.1	2.00	675	1.189	3.32	11.81	0.48	12.29	79%
STREET A	116	117					204.5					79.2	2.00	300	0.137	1.93	10.00	0.68	10.68	
STREET B	117	118				1.84	179.7	0.918			0.918	17.8	0.50	750	0.787	1.78	12.29	0.17	12.46	117%
STREET B	118	119				1.84	178.1	0.910			0.910	27.8	0.50	750	0.787	1.78	12.46	0.26	12.72	116%
STREET B	119	120	0.75	0.65	0.49	2.33	175.8	1.136			1.136	51.4	0.50	825	1.015	1.90	12.72	0.45	13.17	112%
STREET B	120	123				2.33	171.9	1.111			1.111	50.7	0.50	825	1.015	1.90	13.17	0.45	13.61	109%
STREET E	121	1210	1.07	0.65	0.70	0.70	204.5	0.395			0.395	105.4	3.50	375	0.328	2.97	10.00	0.59	10.59	120%
STREET A	1211	1210					204.5					61.8	1.50	300	0.118	1.68	10.00	0.61	10.61	
STREET E	1210	122				0.70	197.1	0.381			0.381	68.4	3.50	375	0.328	2.97	10.61	0.38	11.00	116%
STREET E	122	123				0.70	192.8	0.372			0.372	33.0	0.50	525	0.304	1.40	11.00	0.39	11.39	122%
STREET B	123	124				3.02	168.3	1.413			1.413	78.5	0.50	900	1.280	2.01	13.61	0.65	14.26	110%
STREET B	124	125				3.81	163.3	1.728			1.728	78.5	0.50	975	1.585	2.12	14.26	0.62	14.88	109%
STREET B	125	126				4.39	158.8	1.936			1.936	11.0	0.50	975	1.585	2.12	14.88	0.09	14.97	122%
STREET B	126	OGS 2				4.39	158.2	1.929			1.929	16.0	0.50	975	1.585	2.12	14.97	0.13	15.09	122%
STREET B	OGS 2	127				4.39	157.4	1.918			1.918	16.0	0.50	975	1.585	2.12	15.09	0.13	15.22	121%

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**STORM SEWER DESIGN SHEET**

**100 Year Storm**

**EMPIRE ERIN, 5525 8th LINE**

**Town of Erin**

**PROJECT DETAILS**

**Project No: 21-684**

**Date: 1-Sep-23**

**Designed by: AL**

**Checked by: OS**

**DESIGN CRITERIA**

**Min. Diameter = 300 mm**

**Mannings 'n' = 0.013**

**Starting Tc = 10 min**

**Factor of Safety = 25 %**

**Rainfall Intensity =  $\frac{A}{(Tc+B)^c}$**

**A = 1248**

**B = 1.83**

**c = 0.732**

**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 B	106-N	107	1.14	0.65	0.74	0.74	204.5	0.421			0.421	18.1	3.00	525	0.745	3.44	10.00	0.09	10.09	57%
STREET B	107	108				0.74	203.4	0.419			0.419	250.8	3.00	525	0.745	3.44	10.09	1.21	11.30	56%
STREET B	108	110				0.74	189.5	0.390			0.390	25.2	0.50	675	0.594	1.66	11.30	0.25	11.56	66%
STREET B	109	110	0.86	0.95	0.82	0.82	204.5	0.464			0.464	42.4	0.30	675	0.460	1.29	10.00	0.55	10.55	101%
STREET B	110	OGS 1				1.56	186.9	0.809			0.809	5.5	0.30	900	0.992	1.56	11.56	0.06	11.61	82%
STREET B	OGS 1	127				1.56	186.3	0.806			0.806	5.5	0.30	900	0.992	1.56	11.61	0.06	11.67	81%
STREET B	127	128				5.95	156.5	2.585			2.585	8.8	0.30	1350	2.923	2.04	15.22	0.07	15.29	88%
SWM POND	128	HW 1				5.95	156.1	2.577			2.577	7.6	0.30	1350	2.923	2.04	15.29	0.06	15.35	88%

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# B3A CLEANWATER COLLECTOR SYSTEM SEWER DESIGN SHEETS (5-yr)

**CLEANWATER COLLECTOR SEWER DESIGN SHEET**

**5 Year Storm**

**EMPIRE ERIN, 5525 8th LINE**

**Town of Erin**

**PROJECT DETAILS**

Project No: 21-684  
Date: 1-Sep-23  
Designed by: AL  
Checked by: OS

**DESIGN CRITERIA**

Min. Diameter =	300	mm		Rainfall Intensity =	$\frac{A}{(Tc+B)^c}$
Mannings 'n' =	0.013			A =	744
Starting Tc =	10	min		B =	1.76
Factor of Safety =	20	%		c =	0.729

**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 (%)
<b>TO EAST SWM FACILITY</b>																				
STREET B	304C	305C	0.60	0.95	0.57	0.57	123.4	0.195		0.195	0.195	75.8	3.00	375	0.304	2.75	10.00	0.46	10.46	64%
STREET B	305C	306C				0.57	120.0	0.190		0.190	0.190	17.7	2.50	450	0.451	2.83	10.46	0.10	10.56	42%
STREET B	306C	308C				0.57	119.2	0.189		0.189	0.189	92.4	2.00	450	0.403	2.54	10.56	0.61	11.17	47%
STREET A	307C	308C					123.4					77.1	2.00	375	0.248	2.25	10.00	0.57	10.57	
STREET B	308C	309C				0.57	115.1	0.182		0.182	0.182	11.3	0.50	600	0.434	1.54	11.17	0.12	11.29	42%
STREET B	309C	310C				0.57	114.3	0.181		0.181	0.181	31.7	0.50	600	0.434	1.54	11.29	0.34	11.64	42%
STREET B	310C	311C				0.57	112.2	0.178		0.178	0.178	51.3	0.50	600	0.434	1.54	11.64	0.56	12.19	41%
STREET B	311C	HW 1C				0.57	108.9	0.172		0.172	0.172	22.2	0.50	600	0.434	1.54	12.19	0.24	12.44	40%
<b>TO WEST SWM FACILITY</b>																				
STREET B	301C-E	302C	0.72	0.95	0.68	0.68	123.4	0.234		0.234	0.234	16.4	1.00	450	0.285	1.79	10.00	0.15	10.15	82%
STREET B	302C	303C				0.68	122.2	0.232		0.232	0.232	101.6	1.00	450	0.285	1.79	10.15	0.94	11.10	81%
STREET B	303C	316C				0.68	115.6	0.220		0.220	0.220	74.6	1.00	450	0.285	1.79	11.10	0.69	11.79	77%
STREET B	310C-N	312C	0.38	0.95	0.36	0.36	123.4	0.124		0.124	0.124	53.0	0.50	450	0.202	1.27	10.00	0.70	10.70	61%
STREET B	312C	315C				0.36	118.3	0.119		0.119	0.119	51.6	0.50	450	0.202	1.27	10.70	0.68	11.38	59%
STREET E	316C	3160C	0.38	0.95	0.36	1.05	111.3	0.323		0.323	0.323	114.9	3.50	450	0.533	3.35	11.79	0.57	12.36	61%
STREET A	3161C	3160C					123.4					59.8	1.50	450	0.349	2.20	10.00	0.45	10.45	
STREET E	3160C	314C				1.05	108.0	0.313		0.313	0.313	70.4	3.50	450	0.533	3.35	12.36	0.35	12.71	59%
STREET E	314C	315C				1.05	106.1	0.308		0.308	0.308	31.6	0.50	600	0.434	1.54	12.71	0.34	13.05	71%
STREET D	317C	3170C	0.46	0.95	0.44	0.44	123.4	0.150		0.150	0.150	109.4	3.00	450	0.494	3.10	10.00	0.59	10.59	30%
STREET A	3171C	3170C					123.4					59.8	1.00	450	0.285	1.79	10.00	0.56	10.56	
STREET D	3170C	318C				0.44	119.1	0.145		0.145	0.145	96.9	3.00	450	0.494	3.10	10.59	0.52	11.11	29%
STREET D	318C	319C				0.44	115.5	0.140		0.140	0.140	31.2	0.50	600	0.434	1.54	11.11	0.34	11.45	32%
STREET C	320C	321C	0.47	0.95	0.45	0.45	123.4	0.153		0.153	0.153	239.8	3.00	375	0.304	2.75	10.00	1.45	11.45	50%
STREET C	321C	322C				0.45	113.3	0.141		0.141	0.141	31.2	0.50	525	0.304	1.40	11.45	0.37	11.82	46%

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**CLEANWATER COLLECTOR SEWER DESIGN SHEET**

**5 Year Storm**  
**EMPIRE ERIN, 5525 8th LINE**  
 Town of Erin

**PROJECT DETAILS**

Project No: 21-684  
 Date: 1-Sep-23  
 Designed by: AL  
 Checked by: OS

**DESIGN CRITERIA**

Min. Diameter = 300 mm  
 Mannings 'n' = 0.013  
 Starting Tc = 10 min  
 Factor of Safety = 20 %

Rainfall Intensity =  $\frac{A}{(Tc+B)^c}$   
 A = 744  
 B = 1.76  
 c = 0.729

**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 B	315C	319C				1.41	104.3	0.407			0.407	78.5	0.50	675	0.594	1.66	13.05	0.79	13.84	69%
STREET B	319C	322C				1.84	100.4	0.514			0.514	78.4	0.50	825	1.015	1.90	13.84	0.69	14.53	51%
STREET B	322C	323C				2.29	97.3	0.619			0.619	9.0	0.50	825	1.015	1.90	14.53	0.08	14.61	61%
STREET B	323C	326C				2.29	96.9	0.617			0.617	41.1	0.50	825	1.015	1.90	14.61	0.36	14.97	61%
STREET B	301C-N	324C	0.85	0.95	0.81	0.81	123.4	0.277			0.277	16.4	3.00	450	0.494	3.10	10.00	0.09	10.09	56%
STREET B	324C	325C				0.81	122.7	0.275			0.275	250.7	3.00	450	0.494	3.10	10.09	1.35	11.43	56%
STREET B	325C	326C				0.81	113.5	0.254			0.254	23.2	0.50	600	0.434	1.54	11.43	0.25	11.69	59%
STREET B	326C	327C				3.10	95.4	0.821			0.821	15.2	1.00	825	1.435	2.69	14.97	0.09	15.06	57%
STREET B	327C	HW2C				3.10	95.0	0.818			0.818	31.1	1.00	825	1.435	2.69	15.06	0.19	15.26	57%

# B3B CLEANWATER COLLECTOR SYSTEM SEWER DESIGN SHEETS (100-yr)

**CLEANWATER COLLECTOR SEWER DESIGN SHEET**

**100 Year Storm**

**EMPIRE ERIN, 5525 8th LINE**

**Town of Erin**

**PROJECT DETAILS**

Project No: 21-684  
Date: 1-Sep-23  
Designed by: AL  
Checked by: OS

**DESIGN CRITERIA**

Min. Diameter = 300 mm	Rainfall Intensity = $\frac{A}{(Tc+B)^c}$
Mannings 'n' = 0.013	A = 1248
Starting Tc = 10 min	B = 1.83
Factor of Safety = 20 %	c = 0.732

**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 (%)
<b>TO EAST SWM FACILITY</b>																				
STREET B	304C	305C	0.60	0.95	0.57	0.57	204.5	0.324		0.324	75.8	3.00	375	0.304	2.75	10.00	0.46	10.46	107%	
STREET B	305C	306C				0.57	198.9	0.315		0.315	17.7	2.50	450	0.451	2.83	10.46	0.10	10.56	70%	
STREET B	306C	308C				0.57	197.7	0.313		0.313	92.4	2.00	450	0.403	2.54	10.56	0.61	11.17	78%	
STREET A	307C	308C					204.5				77.1	2.00	375	0.248	2.25	10.00	0.57	10.57		
STREET B	308C	309C				0.57	190.9	0.302		0.302	11.3	0.50	600	0.434	1.54	11.17	0.12	11.29	70%	
STREET B	309C	310C				0.57	189.6	0.300		0.300	31.7	0.50	600	0.434	1.54	11.29	0.34	11.64	69%	
STREET B	310C	311C				0.57	186.0	0.295		0.295	51.3	0.50	600	0.434	1.54	11.64	0.56	12.19	68%	
STREET B	311C	HW 1C				0.57	180.6	0.286		0.286	22.2	0.50	600	0.434	1.54	12.19	0.24	12.44	66%	
<b>TO WEST SWM FACILITY</b>																				
STREET B	301C-E	302C	0.72	0.95	0.68	0.68	204.5	0.389		0.389	16.4	1.00	450	0.285	1.79	10.00	0.15	10.15	136%	
STREET B	302C	303C				0.68	202.6	0.385		0.385	101.6	1.00	450	0.285	1.79	10.15	0.94	11.10	135%	
STREET B	303C	316C				0.68	191.7	0.364		0.364	74.6	1.00	450	0.285	1.79	11.10	0.69	11.79	128%	
STREET B	310C-N	312C	0.38	0.95	0.36	0.36	204.5	0.205		0.205	53.0	0.50	450	0.202	1.27	10.00	0.70	10.70	102%	
STREET B	312C	315C				0.36	196.2	0.197		0.197	51.6	0.50	450	0.202	1.27	10.70	0.68	11.38	98%	
STREET E	316C	3160C	0.38	0.95	0.36	1.05	184.5	0.536		0.536	114.9	3.50	450	0.533	3.35	11.79	0.57	12.36	100%	
STREET A	3161C	3160C					204.5				59.8	1.50	450	0.349	2.20	10.00	0.45	10.45		
STREET E	3160C	314C				1.05	179.0	0.520		0.520	70.4	3.50	450	0.533	3.35	12.36	0.35	12.71	97%	
STREET E	314C	315C				1.05	175.9	0.511		0.511	31.6	0.50	600	0.434	1.54	12.71	0.34	13.05	118%	
STREET D	317C	3170C	0.46	0.95	0.44	0.44	204.5	0.248		0.248	109.4	3.00	450	0.494	3.10	10.00	0.59	10.59	50%	
STREET A	3171C	3170C					204.5				59.8	1.00	450	0.285	1.79	10.00	0.56	10.56		
STREET D	3170C	318C				0.44	197.4	0.240		0.240	96.9	3.00	450	0.494	3.10	10.59	0.52	11.11	49%	
STREET D	318C	319C				0.44	191.6	0.233		0.233	31.2	0.50	600	0.434	1.54	11.11	0.34	11.45	54%	
STREET C	320C	321C	0.47	0.95	0.45	0.45	204.5	0.254		0.254	239.8	3.00	375	0.304	2.75	10.00	1.45	11.45	84%	
STREET C	321C	322C				0.45	187.9	0.233		0.233	31.2	0.50	525	0.304	1.40	11.45	0.37	11.82	77%	

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**CLEANWATER COLLECTOR SEWER DESIGN SHEET**

**100 Year Storm**  
**EMPIRE ERIN, 5525 8th LINE**  
 Town of Erin

**PROJECT DETAILS**

Project No: 21-684  
 Date: 1-Sep-23  
 Designed by: AL  
 Checked by: OS

**DESIGN CRITERIA**

Min. Diameter = 300 mm  
 Mannings 'n' = 0.013  
 Starting Tc = 10 min  
 Factor of Safety = 20 %

Rainfall Intensity =  $\frac{A}{(Tc+B)^c}$   
 A = 1248  
 B = 1.83  
 c = 0.732

**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 B	315C	319C				1.41	172.9	0.675			0.675	78.5	0.50	675	0.594	1.66	13.05	0.79	13.84	114%
STREET B	319C	322C				1.84	166.5	0.852			0.852	78.4	0.50	825	1.015	1.90	13.84	0.69	14.53	84%
STREET B	322C	323C				2.29	161.3	1.026			1.026	9.0	0.50	825	1.015	1.90	14.53	0.08	14.61	101%
STREET B	323C	326C				2.29	160.8	1.022			1.022	41.1	0.50	825	1.015	1.90	14.61	0.36	14.97	101%
STREET B	301C-N	324C	0.85	0.95	0.81	0.81	204.5	0.459			0.459	16.4	3.00	450	0.494	3.10	10.00	0.09	10.09	93%
STREET B	324C	325C				0.81	203.4	0.456			0.456	250.7	3.00	450	0.494	3.10	10.09	1.35	11.43	92%
STREET B	325C	326C				0.81	188.1	0.422			0.422	23.2	0.50	600	0.434	1.54	11.43	0.25	11.69	97%
STREET B	326C	327C				3.10	158.2	1.361			1.361	15.2	1.00	825	1.435	2.69	14.97	0.09	15.06	95%
STREET B	327C	HW2C				3.10	157.6	1.356			1.356	31.1	1.00	825	1.435	2.69	15.06	0.19	15.26	94%



## **TIME TO PEAK (AIRPORT METHOD) CALCULATIONS**

Project Name: Empire Erin, 5525 8th Line  
Municipality: Town of Erin  
Project No.: 21-684  
Date: 9/18/2022

Prepared by: M.B.  
Checked by: A.B.  
Submission: 2nd Submission

Parameter	Value	Description
<b>L =</b>	400	Catchment or watershed length (m)
<b>Upstream Elev. =</b>	429	Upstream Elevation (m)
<b>Downstream Elev. =</b>	402	Downstream Elevation (m)
<b>Sw =</b>	0.0675	Catchment or watershed slope (m/m)
<b>Tc =</b>	29.5	Airport Method Time of Concentration (min)
<b>Tp =</b>	0.328	Airport Method Time to Peak (min)



# URBANTECH®

## Town of Erin 24-hour SCS Type II Storms VO model Output

**Project Name:** Empire Erin, 5525 8<sup>th</sup> Line

**Prepared by:** M.B.

**Municipality:** Town of Erin

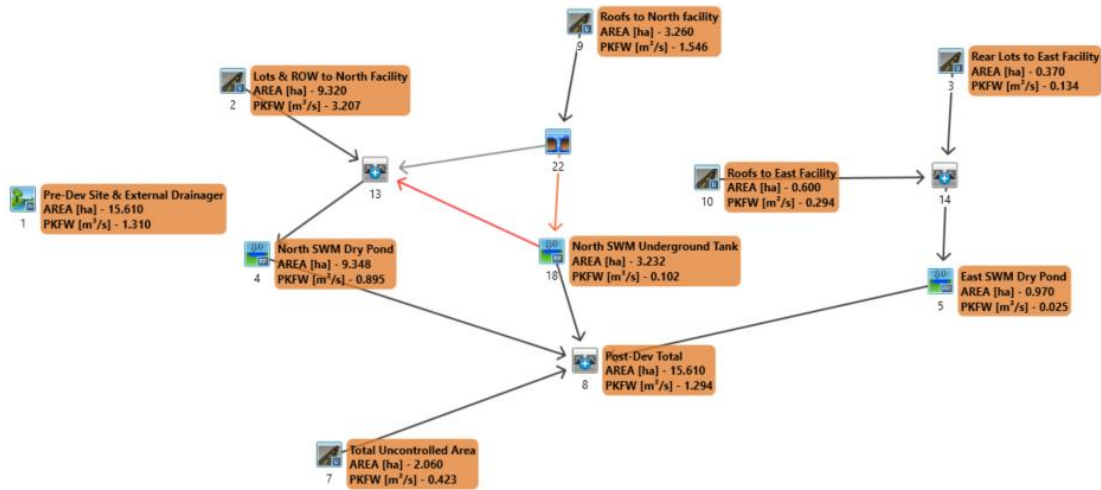
**Checked by:** A.B.

**Project No.:** 21-684

**Submission #:** 2nd Submission

**Date:** 18-Sep-2023

### VO model Schematic



=====

V V I SSSSS U U A L (v 6.2.2006)  
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

000 TTTTT TTTTT H H Y Y M M 000 TM  
O O T T H H Y Y MM MM O O  
O O T T H H Y M M O O  
000 T T H H Y M M 000

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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\V02\voin.dat

Output filename:

C:\Users\mberjis\AppData\Local\Civica\XH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\fed7  
19a7-9084-4d06-aba0-148d7bf602f2\scen

Summary filename:

C:\Users\mberjis\AppData\Local\Civica\XH5\188d7ced-da37-40bb-a4f8-77c1e2c88fc3\fed7  
19a7-9084-4d06-aba0-148d7bf602f2\scen

DATE: 08-31-2023

TIME: 09:16:45

USER:

COMMENTS: \_\_\_\_\_

-----

\*\*\*\*\*  
\*\* SIMULATION : 100yr 24hr 10min SCS Type II \*\*  
\*\*\*\*\*

-----  
| READ STORM |

Filename: C:\Users\mberjis\AppData\Local\Temp\

| Ptotal=145.92 mm |

4dc620f2-1a3a-40c9-b115-4cc194a01380\490513f  
 Comments: 100yr 24hr 10min SCS Type II

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.00	6.33	2.63	12.50	21.01	18.67	2.63
0.33	1.61	6.50	2.63	12.67	21.01	18.83	2.63
0.50	1.61	6.67	2.63	12.83	10.80	19.00	2.63
0.67	1.61	6.83	2.63	13.00	10.80	19.17	2.63
0.83	1.61	7.00	2.63	13.17	10.80	19.33	2.63
1.00	1.61	7.17	2.63	13.33	7.88	19.50	2.63
1.17	1.61	7.33	3.21	13.50	7.88	19.67	2.63
1.33	1.61	7.50	3.21	13.67	7.88	19.83	2.63
1.50	1.61	7.67	3.21	13.83	6.13	20.00	2.63
1.67	1.61	7.83	3.21	14.00	6.13	20.17	2.63
1.83	1.61	8.00	3.21	14.17	6.13	20.33	1.75
2.00	1.61	8.17	3.21	14.33	4.38	20.50	1.75
2.17	1.61	8.33	3.79	14.50	4.38	20.67	1.75
2.33	1.90	8.50	3.79	14.67	4.38	20.83	1.75
2.50	1.90	8.67	3.79	14.83	4.38	21.00	1.75
2.67	1.90	8.83	4.09	15.00	4.38	21.17	1.75
2.83	1.90	9.00	4.09	15.17	4.38	21.33	1.75
3.00	1.90	9.17	4.09	15.33	4.38	21.50	1.75
3.17	1.90	9.33	4.67	15.50	4.38	21.67	1.75
3.33	1.90	9.50	4.67	15.67	4.38	21.83	1.75
3.50	1.90	9.67	4.67	15.83	4.38	22.00	1.75
3.67	1.90	9.83	5.25	16.00	4.38	22.17	1.75
3.83	1.90	10.00	5.25	16.17	4.38	22.33	1.75
4.00	1.90	10.17	5.25	16.33	2.63	22.50	1.75
4.17	1.90	10.33	6.71	16.50	2.63	22.67	1.75
4.33	2.33	10.50	6.71	16.67	2.63	22.83	1.75
4.50	2.33	10.67	6.71	16.83	2.63	23.00	1.75
4.67	2.33	10.83	9.05	17.00	2.63	23.17	1.75
4.83	2.33	11.00	9.05	17.17	2.63	23.33	1.75
5.00	2.33	11.17	9.05	17.33	2.63	23.50	1.75
5.17	2.33	11.33	14.01	17.50	2.63	23.67	1.75
5.33	2.33	11.50	14.01	17.67	2.63	23.83	1.75
5.50	2.33	11.67	14.01	17.83	2.63	24.00	1.75
5.67	2.33	11.83	43.19	18.00	2.63	24.17	1.75
5.83	2.33	12.00	110.90	18.17	2.63		
6.00	2.33	12.17	178.61	18.33	2.63		
6.17	2.33	12.33	21.01	18.50	2.63		

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

Area (ha)= 9.32  
 Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.34	2.98
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	249.27	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75

3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 \*\*\*\*\*  
over (min) 6.00 12.00  
Storage Coeff. (min)= 3.50 (ii) 7.64 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.23 0.12

\*TOTALS\*  
PEAK FLOW (cms)= 2.91 0.42 3.207 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 114.22  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 0.78

\*\*\*\*\* 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)= 3.26  
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.23	0.03
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	147.42	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75

3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)=	178.61	60.90
over (min)	6.00	6.00
Storage Coeff. (min)=	2.56 (ii)	3.45 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00
Unit Hyd. peak (cms)=	0.26	0.23

\*TOTALS\*

PEAK FLOW (cms)=	1.54	0.01	1.546 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	144.92	49.00	143.96
TOTAL RAINFALL (mm)=	145.92	145.92	145.92
RUNOFF COEFFICIENT =	0.99	0.34	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.= 1.435|

```

| #of Inlets=      1|
| Total(cms)=     1.4|      AREA      QPEAK      TPEAK      R.V.
-----            (ha)       (cms)       (hrs)       (mm)
TOTAL HYD.(ID= 1):  3.26       1.55       12.10      143.96
=====
MAJOR SYS.(ID= 2):  0.03       0.11       12.10      143.96
MINOR SYS.(ID= 3):  3.23       1.43       12.10      143.96

```

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      |      0.0580       0.2641
0.0170           0.1556      |      0.0690       0.2900
0.0330           0.1985      |      0.1020       0.3040
0.0440           0.2269      |      0.0000       0.0000

```

```

                                AREA      QPEAK      TPEAK      R.V.
                                (ha)       (cms)       (hrs)       (mm)
INFLOW : ID= 2 ( 0022)         3.232       1.435       12.10      143.96
OUTFLOW: ID= 1 ( 0018)         3.232       0.102       12.80      143.24
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

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PEAK FLOW REDUCTION [Qout/Qin](%)= 7.09
TIME SHIFT OF PEAK FLOW (min)= 42.00
MAXIMUM STORAGE USED (ha.m.)= 0.3039

```

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-----
| 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):  9.32      3.207      12.10     114.22
=====
ID = 3 ( 0013):  9.32      3.207      12.10     114.22

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.



0.100	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75

5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 60.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.33 (ii) 5.93 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.28 0.18

\*TOTALS\*

PEAK FLOW (cms)= 0.11 0.02 0.134 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 108.46  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 0.74

\*\*\*\*\* 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)= 0.60  
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00  
-----

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.59	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	63.25	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63	
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63	
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63	
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63	
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63	
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63	
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63	
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63	
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63	
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63	
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63	
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63	
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63	
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63	
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63	
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63	
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63	
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63	
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33	
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75	
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75	
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75	
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75	
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75	
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75	
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75	
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75	
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75	
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75	
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75	
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75	
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75	
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75	
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75	
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75	
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75	
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75	
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75	
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75	
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75	
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75	
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75	
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75	
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75	
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75	
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75	
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75	
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75	
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75	

5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 60.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.54 (ii) 2.43 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.28 0.26

\*TOTALS\*

PEAK FLOW (cms)= 0.29 0.00 0.294 (iii)  
TIME TO PEAK (hrs)= 12.10 12.10 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 143.96  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 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.

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-----
| ADD HYD ( 0014) |
| 1 + 2 = 3 |
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	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 ( 0010):	0.60	0.294	12.10	143.96
+ ID2= 2 ( 0003):	0.37	0.134	12.10	108.46
=====				
ID = 3 ( 0014):	0.97	0.428	12.10	130.42

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 |
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OUTFLOW	STORAGE	OUTFLOW	STORAGE
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(cms)	(ha.m.)	(cms)	(ha.m.)
0.0000	0.0000	0.0200	0.0664
0.0080	0.0387	0.0240	0.0730
0.0120	0.0497	0.0250	0.0840
0.0150	0.0569	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0014)	0.970	0.428	12.10	130.42
OUTFLOW: ID= 1 ( 0005)	0.970	0.025	13.20	129.15

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.73  
 TIME SHIFT OF PEAK FLOW (min)= 66.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0787

CALIB			
STANDHYD ( 0007)	Area (ha)=	2.06	
ID= 1 DT= 6.0 min	Total Imp(%)=	30.00	Dir. Conn.(%)= 30.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.62	1.44
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	117.19	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63

1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)=	178.61	60.90
over (min)	6.00	12.00
Storage Coeff. (min)=	2.23 (ii)	10.83 (ii)
Unit Hyd. Tpeak (min)=	6.00	12.00

Unit Hyd. peak (cms)=	0.26	0.10	
			*TOTALS*
PEAK FLOW (cms)=	0.30	0.18	0.423 (iii)
TIME TO PEAK (hrs)=	12.10	12.20	12.10
RUNOFF VOLUME (mm)=	144.92	49.00	77.77
TOTAL RAINFALL (mm)=	145.92	145.92	145.92
RUNOFF COEFFICIENT =	0.99	0.34	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.

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-----
| ADD HYD ( 0008) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0018):  3.23    0.102    12.80    143.24
+ ID2= 2 ( 0004):  9.35    0.895    12.30    114.31
=====
ID = 3 ( 0008):  12.58    0.967    12.40    121.75

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| ADD HYD ( 0008) |
| 3 + 2 = 1 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 3 ( 0008):  12.58    0.967    12.40    121.75
+ ID2= 2 ( 0005):  0.97    0.025    13.20    129.15
=====
ID = 1 ( 0008):  13.55    0.991    12.40    122.28

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| ADD HYD ( 0008) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0008):  13.55    0.991    12.40    122.28
+ ID2= 2 ( 0007):  2.06    0.423    12.10    77.77
=====
ID = 3 ( 0008):  15.61    1.294    12.20    116.40

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| CALIB |
| NASHYD ( 0001) | Area (ha)= 15.61 Curve Number (CN)= 49.0
| ID= 1 DT= 6.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
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| U.H. Tp(hrs)= 0.33

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NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75

3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 1.310 (i)

TIME TO PEAK (hrs)= 12.400

RUNOFF VOLUME (mm)= 48.971

TOTAL RAINFALL (mm)= 145.920

RUNOFF COEFFICIENT = 0.336

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

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 FINISH  
 =====  
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 \*\* SIMULATION:100yr 24hr 10min SCS Type II \*\*  
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READ STORM	Filename: C:\Users\mberjis\AppData\Local\Temp\4dc620f2-1a3a-40c9-b115-4cc194a01380\490513f
Ptotal=145.92 mm	Comments: 100yr 24hr 10min SCS Type II

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	0.00	6.33	2.63	12.50	21.01	18.67	2.63
0.33	1.61	6.50	2.63	12.67	21.01	18.83	2.63
0.50	1.61	6.67	2.63	12.83	10.80	19.00	2.63
0.67	1.61	6.83	2.63	13.00	10.80	19.17	2.63
0.83	1.61	7.00	2.63	13.17	10.80	19.33	2.63
1.00	1.61	7.17	2.63	13.33	7.88	19.50	2.63
1.17	1.61	7.33	3.21	13.50	7.88	19.67	2.63
1.33	1.61	7.50	3.21	13.67	7.88	19.83	2.63
1.50	1.61	7.67	3.21	13.83	6.13	20.00	2.63
1.67	1.61	7.83	3.21	14.00	6.13	20.17	2.63
1.83	1.61	8.00	3.21	14.17	6.13	20.33	1.75
2.00	1.61	8.17	3.21	14.33	4.38	20.50	1.75
2.17	1.61	8.33	3.79	14.50	4.38	20.67	1.75
2.33	1.90	8.50	3.79	14.67	4.38	20.83	1.75
2.50	1.90	8.67	3.79	14.83	4.38	21.00	1.75
2.67	1.90	8.83	4.09	15.00	4.38	21.17	1.75
2.83	1.90	9.00	4.09	15.17	4.38	21.33	1.75
3.00	1.90	9.17	4.09	15.33	4.38	21.50	1.75
3.17	1.90	9.33	4.67	15.50	4.38	21.67	1.75
3.33	1.90	9.50	4.67	15.67	4.38	21.83	1.75
3.50	1.90	9.67	4.67	15.83	4.38	22.00	1.75
3.67	1.90	9.83	5.25	16.00	4.38	22.17	1.75
3.83	1.90	10.00	5.25	16.17	4.38	22.33	1.75
4.00	1.90	10.17	5.25	16.33	2.63	22.50	1.75
4.17	1.90	10.33	6.71	16.50	2.63	22.67	1.75
4.33	2.33	10.50	6.71	16.67	2.63	22.83	1.75
4.50	2.33	10.67	6.71	16.83	2.63	23.00	1.75
4.67	2.33	10.83	9.05	17.00	2.63	23.17	1.75
4.83	2.33	11.00	9.05	17.17	2.63	23.33	1.75
5.00	2.33	11.17	9.05	17.33	2.63	23.50	1.75
5.17	2.33	11.33	14.01	17.50	2.63	23.67	1.75
5.33	2.33	11.50	14.01	17.67	2.63	23.83	1.75
5.50	2.33	11.67	14.01	17.83	2.63	24.00	1.75
5.67	2.33	11.83	43.19	18.00	2.63	24.17	1.75
5.83	2.33	12.00	110.90	18.17	2.63		
6.00	2.33	12.17	178.61	18.33	2.63		
6.17	2.33	12.33	21.01	18.50	2.63		

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

Area (ha)= 9.32  
 Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.34	2.98
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	249.27	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75

3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 \*\*\*\*\*  
over (min) 6.00 12.00  
Storage Coeff. (min)= 3.50 (ii) 7.64 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.23 0.12

\*TOTALS\*

PEAK FLOW (cms)= 2.91 0.42 3.207 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 114.22  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 0.78

\*\*\*\*\* 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)=	3.26	
ID= 1 DT= 6.0 min	Total Imp(%)=	99.00	Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.23	0.03
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	147.42	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75

3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)=	178.61	60.90
over (min)	6.00	6.00
Storage Coeff. (min)=	2.56 (ii)	3.45 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00
Unit Hyd. peak (cms)=	0.26	0.23

			*TOTALS*
PEAK FLOW (cms)=	1.54	0.01	1.546 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	144.92	49.00	143.96
TOTAL RAINFALL (mm)=	145.92	145.92	145.92
RUNOFF COEFFICIENT =	0.99	0.34	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.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	3.26	1.55	12.10	143.96
=====				
MAJOR SYS.(ID= 2):	0.03	0.11	12.10	143.96
MINOR SYS.(ID= 3):	3.23	1.43	12.10	143.96

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR( 0018) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----

```

OVERFLOW IS ON

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0580	0.2641
0.0170	0.1556	0.0690	0.2900
0.0330	0.1985	0.1020	0.3040
0.0440	0.2269	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0022)	3.232	1.435	12.10	143.96
OUTFLOW: ID= 1 ( 0018)	3.232	0.102	12.80	143.24
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](%)= 7.09  
 TIME SHIFT OF PEAK FLOW (min)= 42.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.3039

```

-----
| ADD HYD ( 0013) |
| 1 + 2 = 3 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (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):    9.32  3.207  12.10  114.22
=====
ID = 3 ( 0013):    9.32  3.207  12.10  114.22

```

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):    9.32  3.207  12.10  114.22
+ ID2= 2 ( 0022):    0.03  0.111  12.10  143.96
=====
ID = 1 ( 0013):    9.35  3.318  12.10  114.31

```

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    |    0.7270    0.3690
                0.1930    0.2106    |    0.8750    0.4190
                0.4080    0.2705    |    0.8990    0.4420
                0.5200    0.3128    |    0.0000    0.0000

```

```

                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 ( 0013)    9.348    3.318    12.10    114.31
OUTFLOW: ID= 1 ( 0004)    9.348    0.895    12.30    114.31

```

```

PEAK FLOW REDUCTION [Qout/Qin](%)= 26.96
TIME SHIFT OF PEAK FLOW (min)= 12.00
MAXIMUM STORAGE USED (ha.m.)= 0.4412

```

```

-----
| CALIB |
| STANDHYD ( 0003) | Area (ha)= 0.37
| ID= 1 DT= 6.0 min | Total Imp(%)= 62.00 Dir. Conn.(%)= 62.00
-----

```

```

                IMPERVIOUS    PERVIOUS (i)
Surface Area (ha)= 0.23 0.14
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 49.67 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	0.00	6.200	2.43	12.300	21.01	18.40	2.63	
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63	
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63	
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63	
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63	
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63	
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63	
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63	
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63	
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63	
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63	
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63	
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63	
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63	
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63	
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63	
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63	
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63	
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33	
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75	
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75	
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75	
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75	
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75	
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75	
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75	
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75	
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75	
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75	
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75	
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75	
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75	
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75	
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75	
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75	
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75	
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75	
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75	
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75	
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75	
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75	
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75	
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75	

4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 60.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.33 (ii) 5.93 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.28 0.18

\*TOTALS\*  
PEAK FLOW (cms)= 0.11 0.02 0.134 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 108.46  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 0.74

\*\*\*\*\* 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) |  
ID= 1 DT= 6.0 min

Area (ha)= 0.60  
Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.59	0.01
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	63.25	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75

4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Max.Eff.Inten.(mm/hr)= 178.61 60.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.54 (ii) 2.43 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.28 0.26

\*TOTALS\*

PEAK FLOW (cms)= 0.29 0.00 0.294 (iii)  
TIME TO PEAK (hrs)= 12.10 12.10 12.10  
RUNOFF VOLUME (mm)= 144.92 49.00 143.96  
TOTAL RAINFALL (mm)= 145.92 145.92 145.92  
RUNOFF COEFFICIENT = 0.99 0.34 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):  0.60  0.294  12.10  143.96
+ ID2= 2 ( 0003):  0.37  0.134  12.10  108.46
=====
ID = 3 ( 0014):  0.97  0.428  12.10  130.42

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR( 0005)		OVERFLOW IS OFF							
IN= 2---> OUT= 1		OUTFLOW		STORAGE		OUTFLOW		STORAGE	
DT= 6.0 min		(cms)	(ha.m.)	(cms)	(ha.m.)	(cms)	(ha.m.)	(cms)	(ha.m.)
		0.0000	0.0000	0.0200	0.0664				
		0.0080	0.0387	0.0240	0.0730				
		0.0120	0.0497	0.0250	0.0840				
		0.0150	0.0569	0.0000	0.0000				
		AREA	QPEAK	TPEAK	R.V.				
		(ha)	(cms)	(hrs)	(mm)				
INFLOW :	ID= 2 ( 0014)	0.970	0.428	12.10	130.42				
OUTFLOW:	ID= 1 ( 0005)	0.970	0.025	13.20	129.15				

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.73  
 TIME SHIFT OF PEAK FLOW (min)= 66.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0787

CALIB		STANDHYD ( 0007)		
ID= 1 DT= 6.0 min		Area (ha)=	Total Imp(%)=	Dir. Conn.(%)=
		2.06	30.00	30.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.62	1.44
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	117.19	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	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63

1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75
2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17

6.000	2.33	12.100	178.61	18.200	2.63
6.100	2.33	12.200	126.06	18.300	2.63

Max.Eff.Inten.(mm/hr)=	178.61	60.90	
over (min)	6.00	12.00	
Storage Coeff. (min)=	2.23 (ii)	10.83 (ii)	
Unit Hyd. Tpeak (min)=	6.00	12.00	
Unit Hyd. peak (cms)=	0.26	0.10	
			*TOTALS*
PEAK FLOW (cms)=	0.30	0.18	0.423 (iii)
TIME TO PEAK (hrs)=	12.10	12.20	12.10
RUNOFF VOLUME (mm)=	144.92	49.00	77.77
TOTAL RAINFALL (mm)=	145.92	145.92	145.92
RUNOFF COEFFICIENT =	0.99	0.34	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.

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-----
| ADD HYD ( 0008) |
| 1 + 2 = 3      |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0018):  3.23  0.102  12.80  143.24
+ ID2= 2 ( 0004):  9.35  0.895  12.30  114.31
=====
ID = 3 ( 0008):  12.58  0.967  12.40  121.75

```

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):  12.58  0.967  12.40  121.75
+ ID2= 2 ( 0005):  0.97  0.025  13.20  129.15
=====
ID = 1 ( 0008):  13.55  0.991  12.40  122.28

```

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):  13.55  0.991  12.40  122.28
+ ID2= 2 ( 0007):   2.06  0.423  12.10   77.77
=====
ID = 3 ( 0008):  15.61  1.294  12.20  116.40

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| CALIB |
| NASHYD ( 0001) | Area (ha)= 15.61 Curve Number (CN)= 49.0
| ID= 1 DT= 6.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
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          U.H. Tp(hrs)= 0.33

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NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	2.43	12.300	21.01	18.40	2.63
0.200	0.54	6.300	2.63	12.400	21.01	18.50	2.63
0.300	1.61	6.400	2.63	12.500	21.01	18.60	2.63
0.400	1.61	6.500	2.63	12.600	21.01	18.70	2.63
0.500	1.61	6.600	2.63	12.700	17.61	18.80	2.63
0.600	1.61	6.700	2.63	12.800	10.80	18.90	2.63
0.700	1.61	6.800	2.63	12.900	10.80	19.00	2.63
0.800	1.61	6.900	2.63	13.000	10.80	19.10	2.63
0.900	1.61	7.000	2.63	13.100	10.80	19.20	2.63
1.000	1.61	7.100	2.63	13.200	9.82	19.30	2.63
1.100	1.61	7.200	2.82	13.300	7.88	19.40	2.63
1.200	1.61	7.300	3.21	13.400	7.88	19.50	2.63
1.300	1.61	7.400	3.21	13.500	7.88	19.60	2.63
1.400	1.61	7.500	3.21	13.600	7.88	19.70	2.63
1.500	1.61	7.600	3.21	13.700	7.30	19.80	2.63
1.600	1.61	7.700	3.21	13.800	6.13	19.90	2.63
1.700	1.61	7.800	3.21	13.900	6.13	20.00	2.63
1.800	1.61	7.900	3.21	14.000	6.13	20.10	2.63
1.900	1.61	8.000	3.21	14.100	6.13	20.20	2.33
2.000	1.61	8.100	3.21	14.200	5.54	20.30	1.75
2.100	1.61	8.200	3.40	14.300	4.38	20.40	1.75
2.200	1.70	8.300	3.79	14.400	4.38	20.50	1.75
2.300	1.90	8.400	3.79	14.500	4.38	20.60	1.75
2.400	1.90	8.500	3.79	14.600	4.38	20.70	1.75
2.500	1.90	8.600	3.79	14.700	4.38	20.80	1.75
2.600	1.90	8.700	3.89	14.800	4.38	20.90	1.75
2.700	1.90	8.800	4.09	14.900	4.38	21.00	1.75
2.800	1.90	8.900	4.09	15.000	4.38	21.10	1.75

2.900	1.90	9.000	4.09	15.100	4.38	21.20	1.75
3.000	1.90	9.100	4.09	15.200	4.38	21.30	1.75
3.100	1.90	9.200	4.28	15.300	4.38	21.40	1.75
3.200	1.90	9.300	4.67	15.400	4.38	21.50	1.75
3.300	1.90	9.400	4.67	15.500	4.38	21.60	1.75
3.400	1.90	9.500	4.67	15.600	4.38	21.70	1.75
3.500	1.90	9.600	4.67	15.700	4.38	21.80	1.75
3.600	1.90	9.700	4.86	15.800	4.38	21.90	1.75
3.700	1.90	9.800	5.25	15.900	4.38	22.00	1.75
3.800	1.90	9.900	5.25	16.000	4.38	22.10	1.75
3.900	1.90	10.000	5.25	16.100	4.38	22.20	1.75
4.000	1.90	10.100	5.25	16.200	3.79	22.30	1.75
4.100	1.90	10.200	5.74	16.300	2.63	22.40	1.75
4.200	2.04	10.300	6.71	16.400	2.63	22.50	1.75
4.300	2.33	10.400	6.71	16.500	2.63	22.60	1.75
4.400	2.33	10.500	6.71	16.600	2.63	22.70	1.75
4.500	2.33	10.600	6.71	16.700	2.63	22.80	1.75
4.600	2.33	10.700	7.49	16.800	2.63	22.90	1.75
4.700	2.33	10.800	9.05	16.900	2.63	23.00	1.75
4.800	2.33	10.900	9.05	17.000	2.63	23.10	1.75
4.900	2.33	11.000	9.05	17.100	2.63	23.20	1.75
5.000	2.33	11.100	9.05	17.200	2.63	23.30	1.75
5.100	2.33	11.200	10.70	17.300	2.63	23.40	1.75
5.200	2.33	11.300	14.01	17.400	2.63	23.50	1.75
5.300	2.33	11.400	14.01	17.500	2.63	23.60	1.75
5.400	2.33	11.500	14.01	17.600	2.63	23.70	1.75
5.500	2.33	11.600	14.01	17.700	2.63	23.80	1.75
5.600	2.33	11.700	23.74	17.800	2.63	23.90	1.75
5.700	2.33	11.800	43.19	17.900	2.63	24.00	1.75
5.800	2.33	11.900	88.34	18.000	2.63	24.10	1.75
5.900	2.33	12.000	110.91	18.100	2.63	24.20	1.17
6.000	2.33	12.100	178.61	18.200	2.63		
6.100	2.33	12.200	126.06	18.300	2.63		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 1.310 (i)

TIME TO PEAK (hrs)= 12.400

RUNOFF VOLUME (mm)= 48.971

TOTAL RAINFALL (mm)= 145.920

RUNOFF COEFFICIENT = 0.336

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

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 \*\*\*\*\*  
 \*\* SIMULATION:10yr 24hr 10min SCS Type II \*\*  
 \*\*\*\*\*  
 -----

READ STORM  
 Ptotal=103.09 mm

Filename: C:\Users\mberjis\AppData\Local\Temp\4dc620f2-1a3a-40c9-b115-4cc194a01380\446d0956  
 Comments: 10yr 24hr 10min SCS Type II

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.00	6.33	1.86	12.50	14.84	18.67	1.86
0.33	1.13	6.50	1.86	12.67	14.84	18.83	1.86
0.50	1.13	6.67	1.86	12.83	7.63	19.00	1.86
0.67	1.13	6.83	1.86	13.00	7.63	19.17	1.86
0.83	1.13	7.00	1.86	13.17	7.63	19.33	1.86
1.00	1.13	7.17	1.86	13.33	5.57	19.50	1.86
1.17	1.13	7.33	2.27	13.50	5.57	19.67	1.86
1.33	1.13	7.50	2.27	13.67	5.57	19.83	1.86
1.50	1.13	7.67	2.27	13.83	4.33	20.00	1.86
1.67	1.13	7.83	2.27	14.00	4.33	20.17	1.86
1.83	1.13	8.00	2.27	14.17	4.33	20.33	1.24
2.00	1.13	8.17	2.27	14.33	3.09	20.50	1.24
2.17	1.13	8.33	2.68	14.50	3.09	20.67	1.24
2.33	1.34	8.50	2.68	14.67	3.09	20.83	1.24
2.50	1.34	8.67	2.68	14.83	3.09	21.00	1.24
2.67	1.34	8.83	2.89	15.00	3.09	21.17	1.24
2.83	1.34	9.00	2.89	15.17	3.09	21.33	1.24
3.00	1.34	9.17	2.89	15.33	3.09	21.50	1.24
3.17	1.34	9.33	3.30	15.50	3.09	21.67	1.24
3.33	1.34	9.50	3.30	15.67	3.09	21.83	1.24
3.50	1.34	9.67	3.30	15.83	3.09	22.00	1.24
3.67	1.34	9.83	3.71	16.00	3.09	22.17	1.24
3.83	1.34	10.00	3.71	16.17	3.09	22.33	1.24
4.00	1.34	10.17	3.71	16.33	1.86	22.50	1.24
4.17	1.34	10.33	4.74	16.50	1.86	22.67	1.24
4.33	1.65	10.50	4.74	16.67	1.86	22.83	1.24
4.50	1.65	10.67	4.74	16.83	1.86	23.00	1.24
4.67	1.65	10.83	6.39	17.00	1.86	23.17	1.24
4.83	1.65	11.00	6.39	17.17	1.86	23.33	1.24
5.00	1.65	11.17	6.39	17.33	1.86	23.50	1.24
5.17	1.65	11.33	9.90	17.50	1.86	23.67	1.24
5.33	1.65	11.50	9.90	17.67	1.86	23.83	1.24
5.50	1.65	11.67	9.90	17.83	1.86	24.00	1.24
5.67	1.65	11.83	30.51	18.00	1.86	24.17	1.24
5.83	1.65	12.00	78.35	18.17	1.86		
6.00	1.65	12.17	126.18	18.33	1.86		
6.17	1.65	12.33	14.84	18.50	1.86		

CALIB  
 STANDHYD ( 0002)

Area (ha)= 9.32

|ID= 1 DT= 6.0 min | Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.34	2.98
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	249.27	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	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86
1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24
3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24
3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24

3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24
4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24
4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Max.Eff.Inten.(mm/hr)= 126.18 \*\*\*\*\*  
over (min) 6.00 12.00  
Storage Coeff. (min)= 4.03 (ii) 8.78 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.22 0.11

\*TOTALS\*

PEAK FLOW (cms)= 2.01 0.21 2.158 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 102.09 26.55 77.92  
TOTAL RAINFALL (mm)= 103.09 103.09 103.09  
RUNOFF COEFFICIENT = 0.99 0.26 0.76

\*\*\*\*\* 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.

| STANDHYD ( 0009) | Area (ha)= 3.26  
 | ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	3.23	0.03
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	147.42	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	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86
1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24
3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24

3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24
3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24
4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24
4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Max.Eff.Inten.(mm/hr)= 126.18 32.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 2.94 (ii) 3.96 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.25 0.22

\*TOTALS\*

PEAK FLOW (cms)= 1.07 0.00 1.075 (iii)  
TIME TO PEAK (hrs)= 12.10 12.10 12.10  
RUNOFF VOLUME (mm)= 102.09 26.55 101.33  
TOTAL RAINFALL (mm)= 103.09 103.09 103.09  
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.

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| DUHYD ( 0022)|
| Inlet Cap.= 1.435|
| #of Inlets= 1|
| Total(cms)= 1.4|
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	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	3.26	1.08	12.10	101.33
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.26	1.08	12.10	101.33

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
```

OVERFLOW IS ON

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0580	0.2641
0.0170	0.1556	0.0690	0.2900
0.0330	0.1985	0.1020	0.3040
0.0440	0.2269	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0022)	3.260	1.075	12.10	101.33
OUTFLOW: ID= 1 ( 0018)	3.260	0.044	13.70	100.62
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](%)= 4.09  
 TIME SHIFT OF PEAK FLOW (min)= 96.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.2270

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-----
| ADD HYD ( 0013)|
| 1 + 2 = 3 |
```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (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):	9.32	2.158	12.10	77.92
=====				
ID = 3 ( 0013):	9.32	2.158	12.10	77.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| 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):   9.32   2.158   12.10   77.92
      + ID2= 2 ( 0022):   0.00   0.000   0.00   0.00
      =====
      ID = 1 ( 0013):   9.32   2.158   12.10   77.92
  
```

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      0.7270      0.3690
          0.1930      0.2106      0.8750      0.4190
          0.4080      0.2705      0.8990      0.4420
          0.5200      0.3128      0.0000      0.0000

          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
INFLOW : ID= 2 ( 0013)  9.320      2.158      12.10      77.92
OUTFLOW: ID= 1 ( 0004)  9.320      0.517      12.40      77.92
  
```

PEAK FLOW REDUCTION [Qout/Qin](%)= 23.94  
 TIME SHIFT OF PEAK FLOW (min)= 18.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.3127

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-----
| CALIB |
| STANDHYD ( 0003) |
| ID= 1 DT= 6.0 min |
-----
          Area (ha)= 0.37
          Total Imp(%)= 62.00   Dir. Conn.(%)= 62.00

          IMPERVIOUS      PERVIOUS (i)
          Surface Area (ha)= 0.23      0.14
          Dep. Storage (mm)= 1.00      5.00
          Average Slope (%)= 1.00      2.00
          Length (m)= 49.67      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	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86
1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24
3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24
3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24
3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24
4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24

4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Max.Eff.Inten.(mm/hr)= 126.18 32.90  
over (min) 6.00 12.00  
Storage Coeff. (min)= 1.53 (ii) 6.82 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.28 0.13

\*TOTALS\*

PEAK FLOW (cms)= 0.08 0.01 0.087 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 102.09 26.55 73.37  
TOTAL RAINFALL (mm)= 103.09 103.09 103.09  
RUNOFF COEFFICIENT = 0.99 0.26 0.71

\*\*\*\*\* 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)= 0.60  
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00  
-----

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.59	0.01
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	63.25	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	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86
1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24
3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24
3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24
3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24

4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24
4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Max.Eff.Inten.(mm/hr)= 126.18 32.90  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.77 (ii) 2.79 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.27 0.25

\*TOTALS\*

PEAK FLOW (cms)= 0.21 0.00 0.206 (iii)  
TIME TO PEAK (hrs)= 12.10 12.10 12.10  
RUNOFF VOLUME (mm)= 102.09 26.55 101.33  
TOTAL RAINFALL (mm)= 103.09 103.09 103.09  
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 (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 ( 0010):	0.60	0.206	12.10	101.33
+ ID2= 2 ( 0003):	0.37	0.087	12.10	73.37
=====				
ID = 3 ( 0014):	0.97	0.293	12.10	90.67

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0200	0.0664
0.0080	0.0387	0.0240	0.0730
0.0120	0.0497	0.0250	0.0840
0.0150	0.0569	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0014)	0.970	0.293	12.10	90.67
OUTFLOW: ID= 1 ( 0005)	0.970	0.015	13.30	89.40

PEAK FLOW REDUCTION [Qout/Qin](%)= 4.99  
 TIME SHIFT OF PEAK FLOW (min)= 72.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0560

```

-----
| CALIB          |
| STANDHYD ( 0007) |
| ID= 1 DT= 6.0 min |
-----

```

Area (ha)= 2.06  
 Total Imp(%)= 30.00 Dir. Conn.(%)= 30.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.62	1.44
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	117.19	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	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86

1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24
3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24
3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24
3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24
4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24
4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Max.Eff.Inten.(mm/hr)=	126.18	32.90	
over (min)	6.00	18.00	
Storage Coeff. (min)=	2.56 (ii)	13.57 (ii)	
Unit Hyd. Tpeak (min)=	6.00	18.00	
Unit Hyd. peak (cms)=	0.26	0.07	
			*TOTALS*
PEAK FLOW (cms)=	0.21	0.08	0.253 (iii)
TIME TO PEAK (hrs)=	12.10	12.30	12.10
RUNOFF VOLUME (mm)=	102.09	26.55	49.21
TOTAL RAINFALL (mm)=	103.09	103.09	103.09
RUNOFF COEFFICIENT =	0.99	0.26	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):  3.26  0.044  13.70  100.62
+ ID2= 2 ( 0004):  9.32  0.517  12.40  77.92
=====
ID = 3 ( 0008):  12.58  0.554  12.40  83.80

```

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):  12.58  0.554  12.40  83.80
+ ID2= 2 ( 0005):  0.97  0.015  13.30  89.40
=====
ID = 1 ( 0008):  13.55  0.567  12.40  84.20

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0008) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)

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```

ID1= 1 ( 0008):    13.55    0.567    12.40    84.20
+ ID2= 2 ( 0007):     2.06    0.253    12.10    49.21
=====
ID = 3 ( 0008):    15.61    0.691    12.20    79.58

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| CALIB |
| NASHYD ( 0001) | Area (ha)= 15.61 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)= 0.33

```

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	1.72	12.300	14.84	18.40	1.86
0.200	0.38	6.300	1.86	12.400	14.85	18.50	1.86
0.300	1.13	6.400	1.86	12.500	14.85	18.60	1.86
0.400	1.13	6.500	1.86	12.600	14.84	18.70	1.86
0.500	1.13	6.600	1.86	12.700	12.44	18.80	1.86
0.600	1.13	6.700	1.86	12.800	7.63	18.90	1.86
0.700	1.13	6.800	1.86	12.900	7.63	19.00	1.86
0.800	1.13	6.900	1.86	13.000	7.63	19.10	1.86
0.900	1.13	7.000	1.86	13.100	7.63	19.20	1.86
1.000	1.13	7.100	1.86	13.200	6.94	19.30	1.86
1.100	1.13	7.200	1.99	13.300	5.57	19.40	1.86
1.200	1.13	7.300	2.27	13.400	5.57	19.50	1.86
1.300	1.13	7.400	2.27	13.500	5.57	19.60	1.86
1.400	1.13	7.500	2.27	13.600	5.57	19.70	1.86
1.500	1.13	7.600	2.27	13.700	5.15	19.80	1.86
1.600	1.13	7.700	2.27	13.800	4.33	19.90	1.86
1.700	1.13	7.800	2.27	13.900	4.33	20.00	1.86
1.800	1.13	7.900	2.27	14.000	4.33	20.10	1.86
1.900	1.13	8.000	2.27	14.100	4.33	20.20	1.65
2.000	1.13	8.100	2.27	14.200	3.92	20.30	1.24
2.100	1.13	8.200	2.41	14.300	3.09	20.40	1.24
2.200	1.20	8.300	2.68	14.400	3.09	20.50	1.24
2.300	1.34	8.400	2.68	14.500	3.09	20.60	1.24
2.400	1.34	8.500	2.68	14.600	3.09	20.70	1.24
2.500	1.34	8.600	2.68	14.700	3.09	20.80	1.24
2.600	1.34	8.700	2.75	14.800	3.09	20.90	1.24
2.700	1.34	8.800	2.89	14.900	3.09	21.00	1.24
2.800	1.34	8.900	2.89	15.000	3.09	21.10	1.24
2.900	1.34	9.000	2.89	15.100	3.09	21.20	1.24
3.000	1.34	9.100	2.89	15.200	3.09	21.30	1.24
3.100	1.34	9.200	3.02	15.300	3.09	21.40	1.24

3.200	1.34	9.300	3.30	15.400	3.09	21.50	1.24
3.300	1.34	9.400	3.30	15.500	3.09	21.60	1.24
3.400	1.34	9.500	3.30	15.600	3.09	21.70	1.24
3.500	1.34	9.600	3.30	15.700	3.09	21.80	1.24
3.600	1.34	9.700	3.44	15.800	3.09	21.90	1.24
3.700	1.34	9.800	3.71	15.900	3.09	22.00	1.24
3.800	1.34	9.900	3.71	16.000	3.09	22.10	1.24
3.900	1.34	10.000	3.71	16.100	3.09	22.20	1.24
4.000	1.34	10.100	3.71	16.200	2.68	22.30	1.24
4.100	1.34	10.200	4.05	16.300	1.86	22.40	1.24
4.200	1.44	10.300	4.74	16.400	1.86	22.50	1.24
4.300	1.65	10.400	4.74	16.500	1.86	22.60	1.24
4.400	1.65	10.500	4.74	16.600	1.86	22.70	1.24
4.500	1.65	10.600	4.74	16.700	1.86	22.80	1.24
4.600	1.65	10.700	5.29	16.800	1.86	22.90	1.24
4.700	1.65	10.800	6.39	16.900	1.86	23.00	1.24
4.800	1.65	10.900	6.39	17.000	1.86	23.10	1.24
4.900	1.65	11.000	6.39	17.100	1.86	23.20	1.24
5.000	1.65	11.100	6.39	17.200	1.86	23.30	1.24
5.100	1.65	11.200	7.56	17.300	1.86	23.40	1.24
5.200	1.65	11.300	9.90	17.400	1.86	23.50	1.24
5.300	1.65	11.400	9.90	17.500	1.86	23.60	1.24
5.400	1.65	11.500	9.90	17.600	1.86	23.70	1.24
5.500	1.65	11.600	9.90	17.700	1.86	23.80	1.24
5.600	1.65	11.700	16.77	17.800	1.86	23.90	1.24
5.700	1.65	11.800	30.51	17.900	1.86	24.00	1.24
5.800	1.65	11.900	62.41	18.000	1.86	24.10	1.24
5.900	1.65	12.000	78.35	18.100	1.86	24.20	0.82
6.000	1.65	12.100	126.18	18.200	1.86		
6.100	1.65	12.200	89.06	18.300	1.86		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 0.700 (i)

TIME TO PEAK (hrs)= 12.400

RUNOFF VOLUME (mm)= 26.531

TOTAL RAINFALL (mm)= 103.090

RUNOFF COEFFICIENT = 0.257

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

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

-----  
 | CHICAGO STORM |  
Ptotal= 78.03 mm

IDF curve parameters: A=1770.000  
 B= 4.000  
 C= 0.820

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	4.34	1.17	38.21	2.17	10.60	3.17	5.19
0.33	5.00	1.33	203.31	2.33	8.96	3.33	4.81
0.50	5.92	1.50	50.96	2.50	7.78	3.50	4.48
0.67	7.33	1.67	25.51	2.67	6.90	3.67	4.20
0.83	9.77	1.83	17.18	2.83	6.21	3.83	3.96
1.00	15.10	2.00	13.06	3.00	5.65	4.00	3.74

-----  
MODIFY STORM

MODIFYING PARAMETERS

Time shift (min) = 0.00

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.167	1.39	1.167	12.24	2.167	3.40	3.17	1.66
0.333	1.60	1.333	65.14	2.333	2.87	3.33	1.54
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.667	2.35	1.667	8.17	2.667	2.21	3.67	1.35
0.833	3.13	1.833	5.51	2.833	1.99	3.83	1.27
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

-----  
CALIB

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

Area (ha)= 9.32

Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	6.34	2.98
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	249.27	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	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62

0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54
0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Max.Eff.Inten.(mm/hr)= 65.14 1.24  
over (min) 6.00 48.00  
Storage Coeff. (min)= 5.25 (ii) 46.07 (ii)  
Unit Hyd. Tpeak (min)= 6.00 48.00  
Unit Hyd. peak (cms)= 0.19 0.02

\*TOTALS\*

PEAK FLOW (cms)= 0.91 0.01 0.913 (iii)  
TIME TO PEAK (hrs)= 1.30 2.20 1.30  
RUNOFF VOLUME (mm)= 24.00 1.41 16.77  
TOTAL RAINFALL (mm)= 25.00 25.00 25.00  
RUNOFF COEFFICIENT = 0.96 0.06 0.67

\*\*\*\*\* 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)= 3.26  
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00  
-----

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	3.23	0.03
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	147.42	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	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62

0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54
0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Max.Eff.Inten.(mm/hr)= 65.14 80.55  
over (min) 6.00 6.00  
Storage Coeff. (min)= 3.83 (ii) 5.16 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.22 0.19

\*TOTALS\*

PEAK FLOW (cms)= 0.51 0.00 0.511 (iii)  
TIME TO PEAK (hrs)= 1.30 1.40 1.30  
RUNOFF VOLUME (mm)= 24.00 1.41 23.77  
TOTAL RAINFALL (mm)= 25.00 25.00 25.00  
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.

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-----
| DUHYD ( 0022) |
| Inlet Cap.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
-----

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	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	3.26	0.51	1.30	23.77
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.26	0.51	1.30	23.77

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| RESERVOIR( 0018) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
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OVERFLOW IS ON	
OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000
OUTFLOW (cms)	STORAGE (ha.m.)
0.0580	0.2641

0.0170	0.1556		0.0690	0.2900
0.0330	0.1985		0.1020	0.3040
0.0440	0.2269		0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0022)	3.260	0.511	1.30	23.77
OUTFLOW: ID= 1 ( 0018)	3.260	0.008	4.00	23.06
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](%)= 1.50  
 TIME SHIFT OF PEAK FLOW (min)=162.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0703

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ADD HYD ( 0013)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
*** 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):	9.32	0.913	1.30	16.77
=====				
ID = 3 ( 0013):	9.32	0.913	1.30	16.77

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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ADD HYD ( 0013)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
*** 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):	9.32	0.913	1.30	16.77
+ ID2= 2 ( 0022):	0.00	0.000	0.00	0.00
=====				
ID = 1 ( 0013):	9.32	0.913	1.30	16.77

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 (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.7270	0.3690
	0.1930	0.2106	0.8750	0.4190
	0.4080	0.2705	0.8990	0.4420
	0.5200	0.3128	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0013)	9.320	0.913	1.30	16.77
OUTFLOW: ID= 1 ( 0004)	9.320	0.094	1.90	16.77

PEAK FLOW REDUCTION [Qout/Qin](%)= 10.28  
 TIME SHIFT OF PEAK FLOW (min)= 36.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.1025

CALIB	STANDHYD ( 0003)	Area (ha)=	Total Imp(%)=	Dir. Conn.(%)=
ID= 1 DT= 6.0 min		0.37	62.00	62.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.23	0.14
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	49.67	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	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62
0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54
0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Max.Eff.Inten.(mm/hr)=	65.14	1.24
over (min)	6.00	48.00
Storage Coeff. (min)=	1.99 (ii)	42.82 (ii)
Unit Hyd. Tpeak (min)=	6.00	48.00

Unit Hyd. peak (cms)=	0.27	0.03	
			*TOTALS*
PEAK FLOW (cms)=	0.04	0.00	0.040 (iii)
TIME TO PEAK (hrs)=	1.30	2.20	1.30
RUNOFF VOLUME (mm)=	24.00	1.41	15.33
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.96	0.06	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 ( 0010) | Area (ha)= 0.60
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00
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		IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=		0.59	0.01
Dep. Storage (mm)=		1.00	5.00
Average Slope (%)=		1.00	2.00
Length (m)=		63.25	40.00
Mannings n =		0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62
0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54
0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Max.Eff.Inten.(mm/hr)=	65.14	80.55
over (min)	6.00	6.00
Storage Coeff. (min)=	2.30 (ii)	3.64 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00

Unit Hyd. peak (cms)=	0.26	0.23	
			*TOTALS*
PEAK FLOW (cms)=	0.10	0.00	0.103 (iii)
TIME TO PEAK (hrs)=	1.30	1.40	1.30
RUNOFF VOLUME (mm)=	24.00	1.41	23.77
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
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.

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-----
| ADD HYD ( 0014) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0010):  0.60    0.103    1.30    23.77
+ ID2= 2 ( 0003):  0.37    0.040    1.30    15.33
=====
ID = 3 ( 0014):  0.97    0.143    1.30    20.55

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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    0.0200    0.0664
          0.0080    0.0387    0.0240    0.0730
          0.0120    0.0497    0.0250    0.0840
          0.0150    0.0569    0.0000    0.0000

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0014)	0.970	0.143	1.30	20.55
OUTFLOW: ID= 1 ( 0005)	0.970	0.003	3.50	19.29

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.41  
TIME SHIFT OF PEAK FLOW (min)=132.00  
MAXIMUM STORAGE USED (ha.m.)= 0.0167

CALIB			
STANDHYD ( 0007)		Area (ha)= 2.06	
ID= 1 DT= 6.0 min		Total Imp(%)= 30.00	Dir. Conn.(%)= 30.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.62	1.44
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	117.19	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	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62
0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54
0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Max.Eff.Inten.(mm/hr)=	65.14	1.24
over (min)	6.00	48.00
Storage Coeff. (min)=	3.34 (ii)	44.16 (ii)
Unit Hyd. Tpeak (min)=	6.00	48.00
Unit Hyd. peak (cms)=	0.24	0.02

			*TOTALS*
PEAK FLOW (cms)=	0.10	0.00	0.101 (iii)
TIME TO PEAK (hrs)=	1.30	2.20	1.30
RUNOFF VOLUME (mm)=	24.00	1.41	8.17
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.96	0.06	0.33

\*\*\*\*\* 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):		3.26	0.008	4.00	23.06
+ ID2= 2 ( 0004):		9.32	0.094	1.90	16.77
=====					
ID = 3 ( 0008):		12.58	0.101	2.00	18.40

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):		12.58	0.101	2.00	18.40
+ ID2= 2 ( 0005):		0.97	0.003	3.50	19.29
=====					
ID = 1 ( 0008):		13.55	0.104	2.00	18.46

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):		13.55	0.104	2.00	18.46
+ ID2= 2 ( 0007):		2.06	0.101	1.30	8.17
=====					
ID = 3 ( 0008):		15.61	0.145	1.30	17.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB		Area	(ha)=	Curve Number	(CN)=
NASHYD ( 0001)		15.61		49.0	
ID= 1 DT= 6.0 min		Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
		U.H. Tp(hrs)=	0.33		

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	1.39	1.100	12.24	2.100	3.40	3.10	1.66
0.200	1.46	1.200	29.87	2.200	3.22	3.20	1.62
0.300	1.60	1.300	65.14	2.300	2.87	3.30	1.54

0.400	1.80	1.400	32.60	2.400	2.62	3.40	1.47
0.500	1.90	1.500	16.33	2.500	2.49	3.50	1.44
0.600	2.35	1.600	8.17	2.600	2.21	3.60	1.35
0.700	2.61	1.700	7.28	2.700	2.14	3.70	1.32
0.800	3.13	1.800	5.51	2.800	1.99	3.80	1.27
0.900	4.27	1.900	4.63	2.900	1.87	3.90	1.22
1.000	4.84	2.000	4.18	3.000	1.81	4.00	1.20

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 0.047 (i)  
 TIME TO PEAK (hrs)= 1.700  
 RUNOFF VOLUME (mm)= 1.406  
 TOTAL RAINFALL (mm)= 25.000  
 RUNOFF COEFFICIENT = 0.056

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

\*\*\*\*\*  
 \*\* SIMULATION:25yr 24hr 10min SCS Type II \*\*  
 \*\*\*\*\*

READ STORM	Filename: C:\Users\mberjis\AppData\Local\Temp\4dc620f2-1a3a-40c9-b115-4cc194a01380\d8314f4c
Ptotal=121.70 mm	Comments: 25yr 24hr 10min SCS Type II

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	0.00	6.33	2.19	12.50	17.52	18.67	2.19
0.33	1.34	6.50	2.19	12.67	17.52	18.83	2.19
0.50	1.34	6.67	2.19	12.83	9.01	19.00	2.19
0.67	1.34	6.83	2.19	13.00	9.01	19.17	2.19
0.83	1.34	7.00	2.19	13.17	9.01	19.33	2.19
1.00	1.34	7.17	2.19	13.33	6.57	19.50	2.19
1.17	1.34	7.33	2.68	13.50	6.57	19.67	2.19
1.33	1.34	7.50	2.68	13.67	6.57	19.83	2.19
1.50	1.34	7.67	2.68	13.83	5.11	20.00	2.19
1.67	1.34	7.83	2.68	14.00	5.11	20.17	2.19
1.83	1.34	8.00	2.68	14.17	5.11	20.33	1.46
2.00	1.34	8.17	2.68	14.33	3.65	20.50	1.46
2.17	1.34	8.33	3.16	14.50	3.65	20.67	1.46
2.33	1.58	8.50	3.16	14.67	3.65	20.83	1.46
2.50	1.58	8.67	3.16	14.83	3.65	21.00	1.46
2.67	1.58	8.83	3.41	15.00	3.65	21.17	1.46
2.83	1.58	9.00	3.41	15.17	3.65	21.33	1.46
3.00	1.58	9.17	3.41	15.33	3.65	21.50	1.46
3.17	1.58	9.33	3.89	15.50	3.65	21.67	1.46

3.33	1.58	9.50	3.89	15.67	3.65	21.83	1.46
3.50	1.58	9.67	3.89	15.83	3.65	22.00	1.46
3.67	1.58	9.83	4.38	16.00	3.65	22.17	1.46
3.83	1.58	10.00	4.38	16.17	3.65	22.33	1.46
4.00	1.58	10.17	4.38	16.33	2.19	22.50	1.46
4.17	1.58	10.33	5.60	16.50	2.19	22.67	1.46
4.33	1.95	10.50	5.60	16.67	2.19	22.83	1.46
4.50	1.95	10.67	5.60	16.83	2.19	23.00	1.46
4.67	1.95	10.83	7.55	17.00	2.19	23.17	1.46
4.83	1.95	11.00	7.55	17.17	2.19	23.33	1.46
5.00	1.95	11.17	7.55	17.33	2.19	23.50	1.46
5.17	1.95	11.33	11.68	17.50	2.19	23.67	1.46
5.33	1.95	11.50	11.68	17.67	2.19	23.83	1.46
5.50	1.95	11.67	11.68	17.83	2.19	24.00	1.46
5.67	1.95	11.83	36.02	18.00	2.19	24.17	1.46
5.83	1.95	12.00	92.49	18.17	2.19		
6.00	1.95	12.17	148.96	18.33	2.19		
6.17	1.95	12.33	17.52	18.50	2.19		

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

Area (ha)= 9.32  
 Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.34	2.98
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	249.27	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	0.00	6.200	2.03	12.300	17.52	18.40	2.19
0.200	0.45	6.300	2.19	12.400	17.52	18.50	2.19
0.300	1.34	6.400	2.19	12.500	17.52	18.60	2.19
0.400	1.34	6.500	2.19	12.600	17.52	18.70	2.19
0.500	1.34	6.600	2.19	12.700	14.68	18.80	2.19
0.600	1.34	6.700	2.19	12.800	9.01	18.90	2.19
0.700	1.34	6.800	2.19	12.900	9.01	19.00	2.19
0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19
1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19

1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46
2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46
2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46
3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46
5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		
6.100	1.95	12.200	105.14	18.300	2.19		

Max.Eff.Inten.(mm/hr)=	148.96	*****	
over (min)	6.00	12.00	
Storage Coeff. (min)=	3.77 (ii)	8.22 (ii)	
Unit Hyd. Tpeak (min)=	6.00	12.00	
Unit Hyd. peak (cms)=	0.23	0.12	
			*TOTALS*
PEAK FLOW (cms)=	2.40	0.29	2.607 (iii)
TIME TO PEAK (hrs)=	12.10	12.20	12.10
RUNOFF VOLUME (mm)=	120.70	35.74	93.51
TOTAL RAINFALL (mm)=	121.70	121.70	121.70
RUNOFF COEFFICIENT =	0.99	0.29	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.

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CALIB	
STANDHYD ( 0009)	Area (ha)= 3.26
ID= 1 DT= 6.0 min	Total Imp(%)= 99.00   Dir. Conn.(%)= 99.00

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		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.23	0.03
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	147.42	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	0.00	6.200	2.03	12.300	17.52	18.40	2.19
0.200	0.45	6.300	2.19	12.400	17.52	18.50	2.19
0.300	1.34	6.400	2.19	12.500	17.52	18.60	2.19
0.400	1.34	6.500	2.19	12.600	17.52	18.70	2.19
0.500	1.34	6.600	2.19	12.700	14.68	18.80	2.19
0.600	1.34	6.700	2.19	12.800	9.01	18.90	2.19
0.700	1.34	6.800	2.19	12.900	9.01	19.00	2.19
0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19

1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19
1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46
2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46
2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46
3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46
5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		

6.100 1.95 | 12.200 105.14 | 18.300 2.19 |

Max.Eff.Inten.(mm/hr)=	148.96	44.36	
over (min)	6.00	6.00	
Storage Coeff. (min)=	2.75 (ii)	3.71 (ii)	
Unit Hyd. Tpeak (min)=	6.00	6.00	
Unit Hyd. peak (cms)=	0.25	0.23	
			*TOTALS*
PEAK FLOW (cms)=	1.28	0.00	1.280 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	120.70	35.74	119.85
TOTAL RAINFALL (mm)=	121.70	121.70	121.70
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.

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-----
| DUHYD ( 0022) |
| Inlet Cap.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
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	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
TOTAL HYD.(ID= 1):	3.26	1.28	12.10	119.85
=====				
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.26	1.28	12.10	119.85

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| RESERVOIR( 0018) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
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OVERFLOW IS ON

	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0580	0.2641
	0.0170	0.1556	0.0690	0.2900
	0.0330	0.1985	0.1020	0.3040
	0.0440	0.2269	0.0000	0.0000

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 ( 0022)	3.260	1.280	12.10	119.85

OUTFLOW: ID= 1 ( 0018)      3.260      0.058      13.60      119.14  
 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](%)= 4.54  
 TIME SHIFT OF PEAK FLOW (min)= 90.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.2643

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-----
| 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):    9.32    2.607    12.10    93.51
    =====
    ID = 3 ( 0013):    9.32    2.607    12.10    93.51
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| 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):    9.32    2.607    12.10    93.51
    + ID2= 2 ( 0022):    0.00    0.000    0.00    0.00
    =====
    ID = 1 ( 0013):    9.32    2.607    12.10    93.51
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| RESERVOIR( 0004) |
| IN= 2---> OUT= 1 |
| DT= 6.0 min |
-----
                OVERFLOW IS OFF
                OUTFLOW    STORAGE    |    OUTFLOW    STORAGE
                (cms)    (ha.m.)    |    (cms)    (ha.m.)
                0.0000    0.0000    |    0.7270    0.3690
                0.1930    0.2106    |    0.8750    0.4190
                0.4080    0.2705    |    0.8990    0.4420
                0.5200    0.3128    |    0.0000    0.0000
  
```

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 ( 0013)	9.320	2.607	12.10	93.51
OUTFLOW: ID= 1 ( 0004)	9.320	0.704	12.40	93.51

PEAK FLOW REDUCTION [Qout/Qin](%)= 27.01  
 TIME SHIFT OF PEAK FLOW (min)= 18.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.3659

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 | CALIB |  
 | STANDHYD ( 0003) | Area (ha)= 0.37  
 | ID= 1 DT= 6.0 min | Total Imp(%)= 62.00 Dir. Conn.(%)= 62.00  
 -----

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.23	0.14
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	49.67	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	0.00	6.200	2.03	12.300	17.52	18.40	2.19
0.200	0.45	6.300	2.19	12.400	17.52	18.50	2.19
0.300	1.34	6.400	2.19	12.500	17.52	18.60	2.19
0.400	1.34	6.500	2.19	12.600	17.52	18.70	2.19
0.500	1.34	6.600	2.19	12.700	14.68	18.80	2.19
0.600	1.34	6.700	2.19	12.800	9.01	18.90	2.19
0.700	1.34	6.800	2.19	12.900	9.01	19.00	2.19
0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19
1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19
1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46
2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46

2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46
3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46
5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		
6.100	1.95	12.200	105.14	18.300	2.19		

Max.Eff.Inten.(mm/hr)=	148.96	44.36
over (min)	6.00	12.00
Storage Coeff. (min)=	1.43 (ii)	6.38 (ii)
Unit Hyd. Tpeak (min)=	6.00	12.00
Unit Hyd. peak (cms)=	0.28	0.13

\*TOTALS\*

PEAK FLOW (cms)=	0.09	0.01	0.105 (iii)
TIME TO PEAK (hrs)=	12.10	12.20	12.10
RUNOFF VOLUME (mm)=	120.70	35.74	88.40
TOTAL RAINFALL (mm)=	121.70	121.70	121.70

RUNOFF COEFFICIENT = 0.99 0.29 0.73

\*\*\*\*\* 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)= 0.60
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00
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		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.59	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	63.25	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	2.03	12.300	17.52	18.40	2.19
0.200	0.45	6.300	2.19	12.400	17.52	18.50	2.19
0.300	1.34	6.400	2.19	12.500	17.52	18.60	2.19
0.400	1.34	6.500	2.19	12.600	17.52	18.70	2.19
0.500	1.34	6.600	2.19	12.700	14.68	18.80	2.19
0.600	1.34	6.700	2.19	12.800	9.01	18.90	2.19
0.700	1.34	6.800	2.19	12.900	9.01	19.00	2.19
0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19
1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19
1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46

2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46
2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46
3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46
5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		
6.100	1.95	12.200	105.14	18.300	2.19		

Max.Eff.Inten.(mm/hr)=	148.96	44.36
over (min)	6.00	6.00
Storage Coeff. (min)=	1.65 (ii)	2.61 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00
Unit Hyd. peak (cms)=	0.28	0.25

\*TOTALS\*

PEAK FLOW (cms)=	0.24	0.00	0.244 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	120.70	35.74	119.85

TOTAL RAINFALL (mm)= 121.70 121.70 121.70  
 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.

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-----
| ADD HYD ( 0014) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0010):  0.60  0.244  12.10  119.85
+ ID2= 2 ( 0003):  0.37  0.105  12.10   88.40
=====
ID = 3 ( 0014):  0.97  0.349  12.10  107.85
  
```

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    0.0200    0.0664
          0.0080    0.0387    0.0240    0.0730
          0.0120    0.0497    0.0250    0.0840
          0.0150    0.0569    0.0000    0.0000
  
```

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          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 ( 0014)  0.970    0.349    12.10    107.85
OUTFLOW: ID= 1 ( 0005)  0.970    0.020    13.20    106.59
  
```

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.62  
 TIME SHIFT OF PEAK FLOW (min)= 66.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0657

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-----
| CALIB |
| STANDHYD ( 0007) | Area (ha)= 2.06
| ID= 1 DT= 6.0 min | Total Imp(%)= 30.00 Dir. Conn.(%)= 30.00
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```

IMPERVIOUS PERVIOUS (i)

Surface Area	(ha)=	0.62	1.44
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	117.19	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	0.00	6.200	2.03	12.300	17.52	18.40	2.19
0.200	0.45	6.300	2.19	12.400	17.52	18.50	2.19
0.300	1.34	6.400	2.19	12.500	17.52	18.60	2.19
0.400	1.34	6.500	2.19	12.600	17.52	18.70	2.19
0.500	1.34	6.600	2.19	12.700	14.68	18.80	2.19
0.600	1.34	6.700	2.19	12.800	9.01	18.90	2.19
0.700	1.34	6.800	2.19	12.900	9.01	19.00	2.19
0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19
1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19
1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46
2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46
2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46

3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46
5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		
6.100	1.95	12.200	105.14	18.300	2.19		

Max.Eff.Inten.(mm/hr)= 148.96 44.36  
over (min) 6.00 18.00  
Storage Coeff. (min)= 2.40 (ii) 12.17 (ii)  
Unit Hyd. Tpeak (min)= 6.00 18.00  
Unit Hyd. peak (cms)= 0.26 0.08

\*TOTALS\*

PEAK FLOW (cms)= 0.25 0.11 0.312 (iii)  
TIME TO PEAK (hrs)= 12.10 12.30 12.10  
RUNOFF VOLUME (mm)= 120.70 35.74 61.22  
TOTAL RAINFALL (mm)= 121.70 121.70 121.70  
RUNOFF COEFFICIENT = 0.99 0.29 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.

-----  
| ADD HYD ( 0008) |  
1 + 2 = 3

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

```

ID1= 1 ( 0018):    3.26  0.058  13.60  119.14
+ ID2= 2 ( 0004):    9.32  0.704  12.40  93.51
=====
ID = 3 ( 0008):    12.58  0.756  12.40  100.15

```

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):    12.58  0.756  12.40  100.15
+ ID2= 2 ( 0005):    0.97  0.020  13.20  106.59
=====
ID = 1 ( 0008):    13.55  0.774  12.40  100.61

```

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):    13.55  0.774  12.40  100.61
+ ID2= 2 ( 0007):    2.06  0.312  12.10  61.22
=====
ID = 3 ( 0008):    15.61  0.927  12.30  95.42

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| CALIB |
| NASHYD ( 0001) | Area (ha)= 15.61 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)= 0.33

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NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
0.100 0.00 | 6.200 2.03 | 12.300 17.52 | 18.40 2.19
0.200 0.45 | 6.300 2.19 | 12.400 17.52 | 18.50 2.19
0.300 1.34 | 6.400 2.19 | 12.500 17.52 | 18.60 2.19
0.400 1.34 | 6.500 2.19 | 12.600 17.52 | 18.70 2.19
0.500 1.34 | 6.600 2.19 | 12.700 14.68 | 18.80 2.19
0.600 1.34 | 6.700 2.19 | 12.800 9.01 | 18.90 2.19
0.700 1.34 | 6.800 2.19 | 12.900 9.01 | 19.00 2.19

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0.800	1.34	6.900	2.19	13.000	9.01	19.10	2.19
0.900	1.34	7.000	2.19	13.100	9.01	19.20	2.19
1.000	1.34	7.100	2.19	13.200	8.19	19.30	2.19
1.100	1.34	7.200	2.35	13.300	6.57	19.40	2.19
1.200	1.34	7.300	2.68	13.400	6.57	19.50	2.19
1.300	1.34	7.400	2.68	13.500	6.57	19.60	2.19
1.400	1.34	7.500	2.68	13.600	6.57	19.70	2.19
1.500	1.34	7.600	2.68	13.700	6.08	19.80	2.19
1.600	1.34	7.700	2.68	13.800	5.11	19.90	2.19
1.700	1.34	7.800	2.68	13.900	5.11	20.00	2.19
1.800	1.34	7.900	2.68	14.000	5.11	20.10	2.19
1.900	1.34	8.000	2.68	14.100	5.11	20.20	1.95
2.000	1.34	8.100	2.68	14.200	4.62	20.30	1.46
2.100	1.34	8.200	2.84	14.300	3.65	20.40	1.46
2.200	1.42	8.300	3.16	14.400	3.65	20.50	1.46
2.300	1.58	8.400	3.16	14.500	3.65	20.60	1.46
2.400	1.58	8.500	3.16	14.600	3.65	20.70	1.46
2.500	1.58	8.600	3.16	14.700	3.65	20.80	1.46
2.600	1.58	8.700	3.25	14.800	3.65	20.90	1.46
2.700	1.58	8.800	3.41	14.900	3.65	21.00	1.46
2.800	1.58	8.900	3.41	15.000	3.65	21.10	1.46
2.900	1.58	9.000	3.41	15.100	3.65	21.20	1.46
3.000	1.58	9.100	3.41	15.200	3.65	21.30	1.46
3.100	1.58	9.200	3.57	15.300	3.65	21.40	1.46
3.200	1.58	9.300	3.89	15.400	3.65	21.50	1.46
3.300	1.58	9.400	3.89	15.500	3.65	21.60	1.46
3.400	1.58	9.500	3.89	15.600	3.65	21.70	1.46
3.500	1.58	9.600	3.89	15.700	3.65	21.80	1.46
3.600	1.58	9.700	4.06	15.800	3.65	21.90	1.46
3.700	1.58	9.800	4.38	15.900	3.65	22.00	1.46
3.800	1.58	9.900	4.38	16.000	3.65	22.10	1.46
3.900	1.58	10.000	4.38	16.100	3.65	22.20	1.46
4.000	1.58	10.100	4.38	16.200	3.16	22.30	1.46
4.100	1.58	10.200	4.79	16.300	2.19	22.40	1.46
4.200	1.70	10.300	5.60	16.400	2.19	22.50	1.46
4.300	1.95	10.400	5.60	16.500	2.19	22.60	1.46
4.400	1.95	10.500	5.60	16.600	2.19	22.70	1.46
4.500	1.95	10.600	5.60	16.700	2.19	22.80	1.46
4.600	1.95	10.700	6.25	16.800	2.19	22.90	1.46
4.700	1.95	10.800	7.55	16.900	2.19	23.00	1.46
4.800	1.95	10.900	7.55	17.000	2.19	23.10	1.46
4.900	1.95	11.000	7.55	17.100	2.19	23.20	1.46
5.000	1.95	11.100	7.55	17.200	2.19	23.30	1.46
5.100	1.95	11.200	8.92	17.300	2.19	23.40	1.46
5.200	1.95	11.300	11.68	17.400	2.19	23.50	1.46
5.300	1.95	11.400	11.68	17.500	2.19	23.60	1.46
5.400	1.95	11.500	11.68	17.600	2.19	23.70	1.46
5.500	1.95	11.600	11.68	17.700	2.19	23.80	1.46
5.600	1.95	11.700	19.80	17.800	2.19	23.90	1.46
5.700	1.95	11.800	36.02	17.900	2.19	24.00	1.46

5.800	1.95	11.900	73.67	18.000	2.19	24.10	1.46
5.900	1.95	12.000	92.50	18.100	2.19	24.20	0.97
6.000	1.95	12.100	148.96	18.200	2.19		
6.100	1.95	12.200	105.14	18.300	2.19		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 0.949 (i)  
 TIME TO PEAK (hrs)= 12.400  
 RUNOFF VOLUME (mm)= 35.719  
 TOTAL RAINFALL (mm)= 121.700  
 RUNOFF COEFFICIENT = 0.293

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

\*\*\*\*\*  
 \*\* SIMULATION:2yr 24hr 10min SCS Type II \*\*  
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 | READ STORM |  
Ptotal= 67.15 mm

Filename: C:\Users\mberjis\AppData  
 Local\Temp\  
 4dc620f2-1a3a-40c9-b115-4cc194a01380\0f4eaa17  
 Comments: 2yr 24hr 10min SCS Type II

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	0.00	6.33	1.21	12.50	9.67	18.67	1.21
0.33	0.74	6.50	1.21	12.67	9.67	18.83	1.21
0.50	0.74	6.67	1.21	12.83	4.97	19.00	1.21
0.67	0.74	6.83	1.21	13.00	4.97	19.17	1.21
0.83	0.74	7.00	1.21	13.17	4.97	19.33	1.21
1.00	0.74	7.17	1.21	13.33	3.63	19.50	1.21
1.17	0.74	7.33	1.48	13.50	3.63	19.67	1.21
1.33	0.74	7.50	1.48	13.67	3.63	19.83	1.21
1.50	0.74	7.67	1.48	13.83	2.82	20.00	1.21
1.67	0.74	7.83	1.48	14.00	2.82	20.17	1.21
1.83	0.74	8.00	1.48	14.17	2.82	20.33	0.81
2.00	0.74	8.17	1.48	14.33	2.01	20.50	0.81
2.17	0.74	8.33	1.75	14.50	2.01	20.67	0.81
2.33	0.87	8.50	1.75	14.67	2.01	20.83	0.81
2.50	0.87	8.67	1.75	14.83	2.01	21.00	0.81
2.67	0.87	8.83	1.88	15.00	2.01	21.17	0.81
2.83	0.87	9.00	1.88	15.17	2.01	21.33	0.81
3.00	0.87	9.17	1.88	15.33	2.01	21.50	0.81
3.17	0.87	9.33	2.15	15.50	2.01	21.67	0.81
3.33	0.87	9.50	2.15	15.67	2.01	21.83	0.81
3.50	0.87	9.67	2.15	15.83	2.01	22.00	0.81
3.67	0.87	9.83	2.42	16.00	2.01	22.17	0.81

3.83	0.87	10.00	2.42	16.17	2.01	22.33	0.81
4.00	0.87	10.17	2.42	16.33	1.21	22.50	0.81
4.17	0.87	10.33	3.09	16.50	1.21	22.67	0.81
4.33	1.07	10.50	3.09	16.67	1.21	22.83	0.81
4.50	1.07	10.67	3.09	16.83	1.21	23.00	0.81
4.67	1.07	10.83	4.16	17.00	1.21	23.17	0.81
4.83	1.07	11.00	4.16	17.17	1.21	23.33	0.81
5.00	1.07	11.17	4.16	17.33	1.21	23.50	0.81
5.17	1.07	11.33	6.45	17.50	1.21	23.67	0.81
5.33	1.07	11.50	6.45	17.67	1.21	23.83	0.81
5.50	1.07	11.67	6.45	17.83	1.21	24.00	0.81
5.67	1.07	11.83	19.88	18.00	1.21	24.17	0.81
5.83	1.07	12.00	51.03	18.17	1.21		
6.00	1.07	12.17	82.19	18.33	1.21		
6.17	1.07	12.33	9.67	18.50	1.21		

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

Area (ha)= 9.32  
 Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	6.34	2.98
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	249.27	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	0.00	6.200	1.12	12.300	9.67	18.40	1.21
0.200	0.25	6.300	1.21	12.400	9.67	18.50	1.21
0.300	0.74	6.400	1.21	12.500	9.67	18.60	1.21
0.400	0.74	6.500	1.21	12.600	9.67	18.70	1.21
0.500	0.74	6.600	1.21	12.700	8.10	18.80	1.21
0.600	0.74	6.700	1.21	12.800	4.97	18.90	1.21
0.700	0.74	6.800	1.21	12.900	4.97	19.00	1.21
0.800	0.74	6.900	1.21	13.000	4.97	19.10	1.21
0.900	0.74	7.000	1.21	13.100	4.97	19.20	1.21
1.000	0.74	7.100	1.21	13.200	4.52	19.30	1.21
1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21
1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21

1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81
2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81
2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81
4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		
6.100	1.07	12.200	58.01	18.300	1.21		

Max.Eff.Inten.(mm/hr)= 82.19  
over (min) 6.00

\*\*\*\*\*  
12.00

Storage Coeff. (min)=	4.78 (ii)	10.43 (ii)	
Unit Hyd. Tpeak (min)=	6.00	12.00	
Unit Hyd. peak (cms)=	0.20	0.10	
			*TOTALS*
PEAK FLOW (cms)=	1.27	0.09	1.325 (iii)
TIME TO PEAK (hrs)=	12.10	12.20	12.10
RUNOFF VOLUME (mm)=	66.15	11.83	48.77
TOTAL RAINFALL (mm)=	67.15	67.15	67.15
RUNOFF COEFFICIENT =	0.99	0.18	0.73

\*\*\*\*\* 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) |
| ID= 1 DT= 6.0 min |
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Area (ha)= 3.26
Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

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	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	3.23	0.03
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	147.42	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	1.12	12.300	9.67	18.40	1.21
0.200	0.25	6.300	1.21	12.400	9.67	18.50	1.21
0.300	0.74	6.400	1.21	12.500	9.67	18.60	1.21
0.400	0.74	6.500	1.21	12.600	9.67	18.70	1.21
0.500	0.74	6.600	1.21	12.700	8.10	18.80	1.21
0.600	0.74	6.700	1.21	12.800	4.97	18.90	1.21
0.700	0.74	6.800	1.21	12.900	4.97	19.00	1.21
0.800	0.74	6.900	1.21	13.000	4.97	19.10	1.21
0.900	0.74	7.000	1.21	13.100	4.97	19.20	1.21
1.000	0.74	7.100	1.21	13.200	4.52	19.30	1.21
1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21

1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21
1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81
2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81
2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81
4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		
6.100	1.07	12.200	58.01	18.300	1.21		

Max. Eff. Inten. (mm/hr)= 82.19

14.60

over (min)	6.00	6.00	
Storage Coeff. (min)=	3.49 (ii)	4.70 (ii)	
Unit Hyd. Tpeak (min)=	6.00	6.00	
Unit Hyd. peak (cms)=	0.23	0.20	
			*TOTALS*
PEAK FLOW (cms)=	0.68	0.00	0.684 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	66.15	11.83	65.61
TOTAL RAINFALL (mm)=	67.15	67.15	67.15
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.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	3.26	0.68	12.10	65.61
=====				
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.26	0.68	12.10	65.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR( 0018) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----

```

OVERFLOW IS ON

	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0580	0.2641
	0.0170	0.1556	0.0690	0.2900
	0.0330	0.1985	0.1020	0.3040
	0.0440	0.2269	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0022)	3.260	0.684	12.10	65.61
OUTFLOW: ID= 1 ( 0018)	3.260	0.017	16.20	64.89
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](%)= 2.48  
 TIME SHIFT OF PEAK FLOW (min)=246.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.1555

```

-----
| 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):    9.32    1.325    12.10    48.77
  =====
    ID = 3 ( 0013):    9.32    1.325    12.10    48.77
  
```

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):    9.32    1.325    12.10    48.77
  + ID2= 2 ( 0022):    0.00    0.000    0.00    0.00
  =====
    ID = 1 ( 0013):    9.32    1.325    12.10    48.77
  
```

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    |    0.7270    0.3690
                0.1930    0.2106    |    0.8750    0.4190
                0.4080    0.2705    |    0.8990    0.4420
                0.5200    0.3128    |    0.0000    0.0000
  
```

```

                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 ( 0013)    9.320    1.325    12.10    48.77
  
```

OUTFLOW: ID= 1 ( 0004)      9.320      0.193      12.70      48.77

PEAK FLOW REDUCTION [Qout/Qin](%)= 14.55  
 TIME SHIFT OF PEAK FLOW (min)= 36.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.2106

-----  
 -----  
 | CALIB |  
 | STANDHYD ( 0003) | Area (ha)= 0.37  
 | ID= 1 DT= 6.0 min | Total Imp(%)= 62.00 Dir. Conn.(%)= 62.00  
 -----

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.23	0.14
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	49.67	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	0.00	6.200	1.12	12.300	9.67	18.40	1.21
0.200	0.25	6.300	1.21	12.400	9.67	18.50	1.21
0.300	0.74	6.400	1.21	12.500	9.67	18.60	1.21
0.400	0.74	6.500	1.21	12.600	9.67	18.70	1.21
0.500	0.74	6.600	1.21	12.700	8.10	18.80	1.21
0.600	0.74	6.700	1.21	12.800	4.97	18.90	1.21
0.700	0.74	6.800	1.21	12.900	4.97	19.00	1.21
0.800	0.74	6.900	1.21	13.000	4.97	19.10	1.21
0.900	0.74	7.000	1.21	13.100	4.97	19.20	1.21
1.000	0.74	7.100	1.21	13.200	4.52	19.30	1.21
1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21
1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21
1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81
2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81

2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81
4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		
6.100	1.07	12.200	58.01	18.300	1.21		

Max.Eff.Inten.(mm/hr)=	82.19	12.38
over (min)	6.00	24.00
Storage Coeff. (min)=	1.82 (ii)	18.10 (ii)
Unit Hyd. Tpeak (min)=	6.00	24.00
Unit Hyd. peak (cms)=	0.27	0.06

			*TOTALS*
PEAK FLOW (cms)=	0.05	0.00	0.053 (iii)
TIME TO PEAK (hrs)=	12.10	12.40	12.10
RUNOFF VOLUME (mm)=	66.15	11.83	45.48
TOTAL RAINFALL (mm)=	67.15	67.15	67.15
RUNOFF COEFFICIENT =	0.99	0.18	0.68

\*\*\*\*\* 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)= 0.60
ID= 1 DT= 6.0 min	Total Imp(%)= 99.00    Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.59	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	63.25	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	0.00	6.200	1.12	12.300	9.67	18.40	1.21
0.200	0.25	6.300	1.21	12.400	9.67	18.50	1.21
0.300	0.74	6.400	1.21	12.500	9.67	18.60	1.21
0.400	0.74	6.500	1.21	12.600	9.67	18.70	1.21
0.500	0.74	6.600	1.21	12.700	8.10	18.80	1.21
0.600	0.74	6.700	1.21	12.800	4.97	18.90	1.21
0.700	0.74	6.800	1.21	12.900	4.97	19.00	1.21
0.800	0.74	6.900	1.21	13.000	4.97	19.10	1.21
0.900	0.74	7.000	1.21	13.100	4.97	19.20	1.21
1.000	0.74	7.100	1.21	13.200	4.52	19.30	1.21
1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21
1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21
1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81

2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81
2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81
4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		
6.100	1.07	12.200	58.01	18.300	1.21		

Max.Eff.Inten.(mm/hr)=	82.19	14.60
over (min)	6.00	6.00
Storage Coeff. (min)=	2.10 (ii)	3.31 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00
Unit Hyd. peak (cms)=	0.27	0.24

\*TOTALS\*

PEAK FLOW (cms)=	0.13	0.00	0.133 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	66.15	11.83	65.60
TOTAL RAINFALL (mm)=	67.15	67.15	67.15
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)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 ( 0010):	0.60	0.133	12.10	65.60
+ ID2= 2 ( 0003):	0.37	0.053	12.10	45.48
=====				
ID = 3 ( 0014):	0.97	0.186	12.10	57.93

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR( 0005)	OVERFLOW IS OFF			
IN= 2---> OUT= 1	OUTFLOW	STORAGE	OUTFLOW	STORAGE
DT= 6.0 min	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0200	0.0664
	0.0080	0.0387	0.0240	0.0730
	0.0120	0.0497	0.0250	0.0840
	0.0150	0.0569	0.0000	0.0000

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 ( 0014)	0.970	0.186	12.10	57.93
OUTFLOW: ID= 1 ( 0005)	0.970	0.008	13.80	56.67

PEAK FLOW REDUCTION [Qout/Qin](%)= 4.09  
 TIME SHIFT OF PEAK FLOW (min)=102.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0367

CALIB	Area	(ha)=	2.06
STANDHYD ( 0007)	Total Imp(%)=	30.00	Dir. Conn.(%)= 30.00
ID= 1 DT= 6.0 min			
	IMPERVIOUS		PERVIOUS (i)
Surface Area	(ha)=	0.62	1.44
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00

Length (m)= 117.19 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	0.00	6.200	1.12	12.300	9.67	18.40	1.21
0.200	0.25	6.300	1.21	12.400	9.67	18.50	1.21
0.300	0.74	6.400	1.21	12.500	9.67	18.60	1.21
0.400	0.74	6.500	1.21	12.600	9.67	18.70	1.21
0.500	0.74	6.600	1.21	12.700	8.10	18.80	1.21
0.600	0.74	6.700	1.21	12.800	4.97	18.90	1.21
0.700	0.74	6.800	1.21	12.900	4.97	19.00	1.21
0.800	0.74	6.900	1.21	13.000	4.97	19.10	1.21
0.900	0.74	7.000	1.21	13.100	4.97	19.20	1.21
1.000	0.74	7.100	1.21	13.200	4.52	19.30	1.21
1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21
1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21
1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81
2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81
2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81

4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		
6.100	1.07	12.200	58.01	18.300	1.21		

Max.Eff.Inten.(mm/hr)= 82.19 12.38  
over (min) 6.00 24.00  
Storage Coeff. (min)= 3.04 (ii) 19.32 (ii)  
Unit Hyd. Tpeak (min)= 6.00 24.00  
Unit Hyd. peak (cms)= 0.24 0.05

\*TOTALS\*

PEAK FLOW (cms)= 0.13 0.03 0.145 (iii)  
TIME TO PEAK (hrs)= 12.10 12.40 12.10  
RUNOFF VOLUME (mm)= 66.15 11.83 28.12  
TOTAL RAINFALL (mm)= 67.15 67.15 67.15  
RUNOFF COEFFICIENT = 0.99 0.18 0.42

\*\*\*\*\* 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):  3.26  0.017  16.20  64.89
+ ID2= 2 ( 0004):  9.32  0.193  12.70  48.77
=====

```

ID = 3 ( 0008): 12.58 0.208 12.70 52.95

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):  12.58  0.208  12.70  52.95
+ ID2= 2 ( 0005):  0.97  0.008  13.80  56.67
=====
ID = 1 ( 0008):  13.55  0.216  12.70  53.21

```

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):  13.55  0.216  12.70  53.21
+ ID2= 2 ( 0007):  2.06  0.145  12.10  28.12
=====
ID = 3 ( 0008):  15.61  0.303  12.20  49.90

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| CALIB |
| NASHYD ( 0001) | Area (ha)= 15.61 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)= 0.33

```

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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-----
          ----- TRANSFORMED HYETOGRAPH -----
          TIME      RAIN | TIME      RAIN | TIME      RAIN | TIME      RAIN
          hrs      mm/hr | hrs      mm/hr | hrs      mm/hr | hrs      mm/hr
0.100  0.00 | 6.200  1.12 | 12.300  9.67 | 18.40  1.21
0.200  0.25 | 6.300  1.21 | 12.400  9.67 | 18.50  1.21
0.300  0.74 | 6.400  1.21 | 12.500  9.67 | 18.60  1.21
0.400  0.74 | 6.500  1.21 | 12.600  9.67 | 18.70  1.21
0.500  0.74 | 6.600  1.21 | 12.700  8.10 | 18.80  1.21
0.600  0.74 | 6.700  1.21 | 12.800  4.97 | 18.90  1.21
0.700  0.74 | 6.800  1.21 | 12.900  4.97 | 19.00  1.21
0.800  0.74 | 6.900  1.21 | 13.000  4.97 | 19.10  1.21
0.900  0.74 | 7.000  1.21 | 13.100  4.97 | 19.20  1.21
1.000  0.74 | 7.100  1.21 | 13.200  4.52 | 19.30  1.21

```

1.100	0.74	7.200	1.30	13.300	3.63	19.40	1.21
1.200	0.74	7.300	1.48	13.400	3.63	19.50	1.21
1.300	0.74	7.400	1.48	13.500	3.63	19.60	1.21
1.400	0.74	7.500	1.48	13.600	3.63	19.70	1.21
1.500	0.74	7.600	1.48	13.700	3.36	19.80	1.21
1.600	0.74	7.700	1.48	13.800	2.82	19.90	1.21
1.700	0.74	7.800	1.48	13.900	2.82	20.00	1.21
1.800	0.74	7.900	1.48	14.000	2.82	20.10	1.21
1.900	0.74	8.000	1.48	14.100	2.82	20.20	1.07
2.000	0.74	8.100	1.48	14.200	2.55	20.30	0.81
2.100	0.74	8.200	1.57	14.300	2.01	20.40	0.81
2.200	0.78	8.300	1.75	14.400	2.01	20.50	0.81
2.300	0.87	8.400	1.75	14.500	2.01	20.60	0.81
2.400	0.87	8.500	1.75	14.600	2.01	20.70	0.81
2.500	0.87	8.600	1.75	14.700	2.01	20.80	0.81
2.600	0.87	8.700	1.79	14.800	2.01	20.90	0.81
2.700	0.87	8.800	1.88	14.900	2.01	21.00	0.81
2.800	0.87	8.900	1.88	15.000	2.01	21.10	0.81
2.900	0.87	9.000	1.88	15.100	2.01	21.20	0.81
3.000	0.87	9.100	1.88	15.200	2.01	21.30	0.81
3.100	0.87	9.200	1.97	15.300	2.01	21.40	0.81
3.200	0.87	9.300	2.15	15.400	2.01	21.50	0.81
3.300	0.87	9.400	2.15	15.500	2.01	21.60	0.81
3.400	0.87	9.500	2.15	15.600	2.01	21.70	0.81
3.500	0.87	9.600	2.15	15.700	2.01	21.80	0.81
3.600	0.87	9.700	2.24	15.800	2.01	21.90	0.81
3.700	0.87	9.800	2.42	15.900	2.01	22.00	0.81
3.800	0.87	9.900	2.42	16.000	2.01	22.10	0.81
3.900	0.87	10.000	2.42	16.100	2.01	22.20	0.81
4.000	0.87	10.100	2.42	16.200	1.75	22.30	0.81
4.100	0.87	10.200	2.64	16.300	1.21	22.40	0.81
4.200	0.94	10.300	3.09	16.400	1.21	22.50	0.81
4.300	1.07	10.400	3.09	16.500	1.21	22.60	0.81
4.400	1.07	10.500	3.09	16.600	1.21	22.70	0.81
4.500	1.07	10.600	3.09	16.700	1.21	22.80	0.81
4.600	1.07	10.700	3.45	16.800	1.21	22.90	0.81
4.700	1.07	10.800	4.16	16.900	1.21	23.00	0.81
4.800	1.07	10.900	4.16	17.000	1.21	23.10	0.81
4.900	1.07	11.000	4.16	17.100	1.21	23.20	0.81
5.000	1.07	11.100	4.16	17.200	1.21	23.30	0.81
5.100	1.07	11.200	4.92	17.300	1.21	23.40	0.81
5.200	1.07	11.300	6.45	17.400	1.21	23.50	0.81
5.300	1.07	11.400	6.45	17.500	1.21	23.60	0.81
5.400	1.07	11.500	6.45	17.600	1.21	23.70	0.81
5.500	1.07	11.600	6.45	17.700	1.21	23.80	0.81
5.600	1.07	11.700	10.92	17.800	1.21	23.90	0.81
5.700	1.07	11.800	19.88	17.900	1.21	24.00	0.81
5.800	1.07	11.900	40.65	18.000	1.21	24.10	0.81
5.900	1.07	12.000	51.04	18.100	1.21	24.20	0.54
6.000	1.07	12.100	82.19	18.200	1.21		

6.100 1.07 | 12.200 58.01 | 18.300 1.21 |

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 0.306 (i)  
 TIME TO PEAK (hrs)= 12.400  
 RUNOFF VOLUME (mm)= 11.823  
 TOTAL RAINFALL (mm)= 67.150  
 RUNOFF COEFFICIENT = 0.176

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

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 \*\*\*\*\*  
 \*\* SIMULATION:50yr 24hr 10min SCS Type II \*\*  
 \*\*\*\*\*

READ STORM	Filename: C:\Users\mberjis\AppData\Local\Temp\4dc620f2-1a3a-40c9-b115-4cc194a01380\4424f10c
Ptotal=134.56 mm	Comments: 50yr 24hr 10min SCS Type II

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.00	6.33	2.42	12.50	19.38	18.67	2.42
0.33	1.48	6.50	2.42	12.67	19.38	18.83	2.42
0.50	1.48	6.67	2.42	12.83	9.96	19.00	2.42
0.67	1.48	6.83	2.42	13.00	9.96	19.17	2.42
0.83	1.48	7.00	2.42	13.17	9.96	19.33	2.42
1.00	1.48	7.17	2.42	13.33	7.27	19.50	2.42
1.17	1.48	7.33	2.96	13.50	7.27	19.67	2.42
1.33	1.48	7.50	2.96	13.67	7.27	19.83	2.42
1.50	1.48	7.67	2.96	13.83	5.65	20.00	2.42
1.67	1.48	7.83	2.96	14.00	5.65	20.17	2.42
1.83	1.48	8.00	2.96	14.17	5.65	20.33	1.61
2.00	1.48	8.17	2.96	14.33	4.04	20.50	1.61
2.17	1.48	8.33	3.50	14.50	4.04	20.67	1.61
2.33	1.75	8.50	3.50	14.67	4.04	20.83	1.61
2.50	1.75	8.67	3.50	14.83	4.04	21.00	1.61
2.67	1.75	8.83	3.77	15.00	4.04	21.17	1.61
2.83	1.75	9.00	3.77	15.17	4.04	21.33	1.61
3.00	1.75	9.17	3.77	15.33	4.04	21.50	1.61
3.17	1.75	9.33	4.31	15.50	4.04	21.67	1.61
3.33	1.75	9.50	4.31	15.67	4.04	21.83	1.61
3.50	1.75	9.67	4.31	15.83	4.04	22.00	1.61
3.67	1.75	9.83	4.84	16.00	4.04	22.17	1.61
3.83	1.75	10.00	4.84	16.17	4.04	22.33	1.61
4.00	1.75	10.17	4.84	16.33	2.42	22.50	1.61
4.17	1.75	10.33	6.19	16.50	2.42	22.67	1.61

4.33	2.15	10.50	6.19	16.67	2.42	22.83	1.61
4.50	2.15	10.67	6.19	16.83	2.42	23.00	1.61
4.67	2.15	10.83	8.34	17.00	2.42	23.17	1.61
4.83	2.15	11.00	8.34	17.17	2.42	23.33	1.61
5.00	2.15	11.17	8.34	17.33	2.42	23.50	1.61
5.17	2.15	11.33	12.92	17.50	2.42	23.67	1.61
5.33	2.15	11.50	12.92	17.67	2.42	23.83	1.61
5.50	2.15	11.67	12.92	17.83	2.42	24.00	1.61
5.67	2.15	11.83	39.83	18.00	2.42	24.17	1.61
5.83	2.15	12.00	102.27	18.17	2.42		
6.00	2.15	12.17	164.70	18.33	2.42		
6.17	2.15	12.33	19.38	18.50	2.42		

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

Area (ha)= 9.32  
 Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	6.34	2.98
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	249.27	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	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42
1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42
1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42

1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61
2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61
2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61
4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Max.Eff.Inten.(mm/hr)= 164.70 \*\*\*\*\*  
 over (min) 6.00 12.00  
 Storage Coeff. (min)= 3.62 (ii) 7.90 (ii)  
 Unit Hyd. Tpeak (min)= 6.00 12.00  
 Unit Hyd. peak (cms)= 0.23 0.12

				*TOTALS*
PEAK FLOW	(cms)=	2.67	0.36	2.923 (iii)
TIME TO PEAK	(hrs)=	12.10	12.20	12.10
RUNOFF VOLUME	(mm)=	133.56	42.61	104.46
TOTAL RAINFALL	(mm)=	134.56	134.56	134.56
RUNOFF COEFFICIENT	=	0.99	0.32	0.78

\*\*\*\*\* 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)= 3.26
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00
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		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.23	0.03
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	147.42	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42
1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42

1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42
1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61
2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61
2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61
4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Max.Eff.Inten.(mm/hr)=	164.70	52.93
over (min)	6.00	6.00
Storage Coeff. (min)=	2.64 (ii)	3.56 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00

Unit Hyd. peak (cms)=	0.25	0.23	
			*TOTALS*
PEAK FLOW (cms)=	1.42	0.00	1.421 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	133.56	42.61	132.65
TOTAL RAINFALL (mm)=	134.56	134.56	134.56
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.

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-----
| DUHYD ( 0022) |
| Inlet Cap.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
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	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	3.26	1.42	12.10	132.65
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	3.26	1.42	12.10	132.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| RESERVOIR( 0018) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----

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OVERFLOW IS ON

	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0580	0.2641
	0.0170	0.1556	0.0690	0.2900
	0.0330	0.1985	0.1020	0.3040
	0.0440	0.2269	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0022)	3.260	1.421	12.10	132.65
OUTFLOW: ID= 1 ( 0018)	3.260	0.069	13.30	131.94
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](%)= 4.87  
 TIME SHIFT OF PEAK FLOW (min)= 72.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.2901

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-----
| 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):    9.32    2.923    12.10    104.46
    =====
    ID = 3 ( 0013):    9.32    2.923    12.10    104.46
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| 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):    9.32    2.923    12.10    104.46
    + ID2= 2 ( 0022):    0.00    0.000    0.00    0.00
    =====
    ID = 1 ( 0013):    9.32    2.923    12.10    104.46
  
```

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    |    0.7270    0.3690
                0.1930    0.2106    |    0.8750    0.4190
                0.4080    0.2705    |    0.8990    0.4420
                0.5200    0.3128    |    0.0000    0.0000
  
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                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 ( 0013)    9.320    2.923    12.10    104.46
OUTFLOW: ID= 1 ( 0004)    9.320    0.820    12.30    104.46
  
```

PEAK FLOW REDUCTION [Qout/Qin](%)= 28.03

TIME SHIFT OF PEAK FLOW (min)= 12.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.4035

CALIB			
STANDHYD ( 0003)	Area (ha)=	0.37	
ID= 1 DT= 6.0 min	Total Imp(%)=	62.00	Dir. Conn.(%)= 62.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.23	0.14
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	49.67	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	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42
1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42
1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42
1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61
2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61

2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61
4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Max.Eff.Inten.(mm/hr)= 164.70 52.93  
over (min) 6.00 12.00  
Storage Coeff. (min)= 1.38 (ii) 6.13 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.28 0.13

\*TOTALS\*

PEAK FLOW (cms)= 0.10 0.02 0.117 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 133.56 42.61 98.99  
TOTAL RAINFALL (mm)= 134.56 134.56 134.56  
RUNOFF COEFFICIENT = 0.99 0.32 0.74

\*\*\*\*\* 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)= 0.60
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00
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		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.59	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	63.25	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42
1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42
1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42
1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61

2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61
2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61
4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Max.Eff.Inten.(mm/hr)= 164.70 52.93  
over (min) 6.00 6.00  
Storage Coeff. (min)= 1.59 (ii) 2.51 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.28 0.26

\*TOTALS\*

PEAK FLOW (cms)= 0.27 0.00 0.270 (iii)  
TIME TO PEAK (hrs)= 12.10 12.10 12.10  
RUNOFF VOLUME (mm)= 133.56 42.61 132.65  
TOTAL RAINFALL (mm)= 134.56 134.56 134.56  
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)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 ( 0010):	0.60	0.270	12.10	132.65
+ ID2= 2 ( 0003):	0.37	0.117	12.10	98.99
=====				
ID = 3 ( 0014):	0.97	0.388	12.10	119.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR( 0005)	OVERFLOW IS OFF			
IN= 2---> OUT= 1	OUTFLOW	STORAGE	OUTFLOW	STORAGE
DT= 6.0 min	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0200	0.0664
	0.0080	0.0387	0.0240	0.0730
	0.0120	0.0497	0.0250	0.0840
	0.0150	0.0569	0.0000	0.0000

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 ( 0014)	0.970	0.388	12.10	119.81
OUTFLOW: ID= 1 ( 0005)	0.970	0.024	13.20	118.55

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.07  
 TIME SHIFT OF PEAK FLOW (min)= 66.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0723

CALIB	Area	(ha)=	2.06
STANDHYD ( 0007)	Total Imp(%)=	30.00	Dir. Conn.(%)= 30.00
ID= 1 DT= 6.0 min			

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.62	1.44
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	117.19	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	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42
1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42
1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42
1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61
2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61
2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61

4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Max.Eff.Inten.(mm/hr)= 164.70 52.93  
over (min) 6.00 12.00  
Storage Coeff. (min)= 2.30 (ii) 11.40 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.26 0.10

\*TOTALS\*

PEAK FLOW (cms)= 0.27 0.15 0.380 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 133.56 42.61 69.89  
TOTAL RAINFALL (mm)= 134.56 134.56 134.56  
RUNOFF COEFFICIENT = 0.99 0.32 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 |
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	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 ( 0018):	3.26	0.069	13.30	131.94
+ ID2= 2 ( 0004):	9.32	0.820	12.30	104.46
=====				
ID = 3 ( 0008):	12.58	0.879	12.30	111.58

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):	12.58	0.879	12.30	111.58
+ ID2= 2 ( 0005):	0.97	0.024	13.20	118.55
=====				
ID = 1 ( 0008):	13.55	0.900	12.40	112.08

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):	13.55	0.900	12.40	112.08
+ ID2= 2 ( 0007):	2.06	0.380	12.10	69.89
=====				
ID = 3 ( 0008):	15.61	1.134	12.20	106.51

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD ( 0001)				
ID= 1 DT= 6.0 min				
Area	(ha)=	15.61	Curve Number	(CN)= 49.0
Ia	(mm)=	5.00	# of Linear Res.(N)=	3.00
U.H. Tp	(hrs)=	0.33		

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	0.00	6.200	2.24	12.300	19.38	18.40	2.42
0.200	0.49	6.300	2.42	12.400	19.38	18.50	2.42
0.300	1.48	6.400	2.42	12.500	19.38	18.60	2.42
0.400	1.48	6.500	2.42	12.600	19.38	18.70	2.42
0.500	1.48	6.600	2.42	12.700	16.24	18.80	2.42
0.600	1.48	6.700	2.42	12.800	9.96	18.90	2.42
0.700	1.48	6.800	2.42	12.900	9.96	19.00	2.42
0.800	1.48	6.900	2.42	13.000	9.96	19.10	2.42
0.900	1.48	7.000	2.42	13.100	9.96	19.20	2.42
1.000	1.48	7.100	2.42	13.200	9.06	19.30	2.42
1.100	1.48	7.200	2.60	13.300	7.27	19.40	2.42
1.200	1.48	7.300	2.96	13.400	7.27	19.50	2.42
1.300	1.48	7.400	2.96	13.500	7.27	19.60	2.42

1.400	1.48	7.500	2.96	13.600	7.27	19.70	2.42
1.500	1.48	7.600	2.96	13.700	6.73	19.80	2.42
1.600	1.48	7.700	2.96	13.800	5.65	19.90	2.42
1.700	1.48	7.800	2.96	13.900	5.65	20.00	2.42
1.800	1.48	7.900	2.96	14.000	5.65	20.10	2.42
1.900	1.48	8.000	2.96	14.100	5.65	20.20	2.15
2.000	1.48	8.100	2.96	14.200	5.11	20.30	1.61
2.100	1.48	8.200	3.14	14.300	4.04	20.40	1.61
2.200	1.57	8.300	3.50	14.400	4.04	20.50	1.61
2.300	1.75	8.400	3.50	14.500	4.04	20.60	1.61
2.400	1.75	8.500	3.50	14.600	4.04	20.70	1.61
2.500	1.75	8.600	3.50	14.700	4.04	20.80	1.61
2.600	1.75	8.700	3.59	14.800	4.04	20.90	1.61
2.700	1.75	8.800	3.77	14.900	4.04	21.00	1.61
2.800	1.75	8.900	3.77	15.000	4.04	21.10	1.61
2.900	1.75	9.000	3.77	15.100	4.04	21.20	1.61
3.000	1.75	9.100	3.77	15.200	4.04	21.30	1.61
3.100	1.75	9.200	3.95	15.300	4.04	21.40	1.61
3.200	1.75	9.300	4.31	15.400	4.04	21.50	1.61
3.300	1.75	9.400	4.31	15.500	4.04	21.60	1.61
3.400	1.75	9.500	4.31	15.600	4.04	21.70	1.61
3.500	1.75	9.600	4.31	15.700	4.04	21.80	1.61
3.600	1.75	9.700	4.49	15.800	4.04	21.90	1.61
3.700	1.75	9.800	4.84	15.900	4.04	22.00	1.61
3.800	1.75	9.900	4.84	16.000	4.04	22.10	1.61
3.900	1.75	10.000	4.84	16.100	4.04	22.20	1.61
4.000	1.75	10.100	4.84	16.200	3.50	22.30	1.61
4.100	1.75	10.200	5.29	16.300	2.42	22.40	1.61
4.200	1.88	10.300	6.19	16.400	2.42	22.50	1.61
4.300	2.15	10.400	6.19	16.500	2.42	22.60	1.61
4.400	2.15	10.500	6.19	16.600	2.42	22.70	1.61
4.500	2.15	10.600	6.19	16.700	2.42	22.80	1.61
4.600	2.15	10.700	6.91	16.800	2.42	22.90	1.61
4.700	2.15	10.800	8.34	16.900	2.42	23.00	1.61
4.800	2.15	10.900	8.34	17.000	2.42	23.10	1.61
4.900	2.15	11.000	8.34	17.100	2.42	23.20	1.61
5.000	2.15	11.100	8.34	17.200	2.42	23.30	1.61
5.100	2.15	11.200	9.87	17.300	2.42	23.40	1.61
5.200	2.15	11.300	12.92	17.400	2.42	23.50	1.61
5.300	2.15	11.400	12.92	17.500	2.42	23.60	1.61
5.400	2.15	11.500	12.92	17.600	2.42	23.70	1.61
5.500	2.15	11.600	12.92	17.700	2.42	23.80	1.61
5.600	2.15	11.700	21.89	17.800	2.42	23.90	1.61
5.700	2.15	11.800	39.83	17.900	2.42	24.00	1.61
5.800	2.15	11.900	81.46	18.000	2.42	24.10	1.61
5.900	2.15	12.000	102.27	18.100	2.42	24.20	1.08
6.000	2.15	12.100	164.70	18.200	2.42		
6.100	2.15	12.200	116.25	18.300	2.42		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 1.136 (i)  
 TIME TO PEAK (hrs)= 12.400  
 RUNOFF VOLUME (mm)= 42.587  
 TOTAL RAINFALL (mm)= 134.560  
 RUNOFF COEFFICIENT = 0.316

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

\*\*\*\*\*  
 \*\* SIMULATION:5yr 24hr 10min SCS Type II \*\*  
 \*\*\*\*\*

READ STORM  Ptotal= 88.91 mm	Filename: C:\Users\mberjis\AppData\Local\Temp\4dc620f2-1a3a-40c9-b115-4cc194a01380\cbe854b2 Comments: 5yr 24hr 10min SCS Type II
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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	0.00	6.33	1.60	12.50	12.80	18.67	1.60
0.33	0.98	6.50	1.60	12.67	12.80	18.83	1.60
0.50	0.98	6.67	1.60	12.83	6.58	19.00	1.60
0.67	0.98	6.83	1.60	13.00	6.58	19.17	1.60
0.83	0.98	7.00	1.60	13.17	6.58	19.33	1.60
1.00	0.98	7.17	1.60	13.33	4.80	19.50	1.60
1.17	0.98	7.33	1.96	13.50	4.80	19.67	1.60
1.33	0.98	7.50	1.96	13.67	4.80	19.83	1.60
1.50	0.98	7.67	1.96	13.83	3.73	20.00	1.60
1.67	0.98	7.83	1.96	14.00	3.73	20.17	1.60
1.83	0.98	8.00	1.96	14.17	3.73	20.33	1.07
2.00	0.98	8.17	1.96	14.33	2.67	20.50	1.07
2.17	0.98	8.33	2.31	14.50	2.67	20.67	1.07
2.33	1.16	8.50	2.31	14.67	2.67	20.83	1.07
2.50	1.16	8.67	2.31	14.83	2.67	21.00	1.07
2.67	1.16	8.83	2.49	15.00	2.67	21.17	1.07
2.83	1.16	9.00	2.49	15.17	2.67	21.33	1.07
3.00	1.16	9.17	2.49	15.33	2.67	21.50	1.07
3.17	1.16	9.33	2.85	15.50	2.67	21.67	1.07
3.33	1.16	9.50	2.85	15.67	2.67	21.83	1.07
3.50	1.16	9.67	2.85	15.83	2.67	22.00	1.07
3.67	1.16	9.83	3.20	16.00	2.67	22.17	1.07
3.83	1.16	10.00	3.20	16.17	2.67	22.33	1.07
4.00	1.16	10.17	3.20	16.33	1.60	22.50	1.07
4.17	1.16	10.33	4.09	16.50	1.60	22.67	1.07
4.33	1.42	10.50	4.09	16.67	1.60	22.83	1.07
4.50	1.42	10.67	4.09	16.83	1.60	23.00	1.07
4.67	1.42	10.83	5.51	17.00	1.60	23.17	1.07

4.83	1.42	11.00	5.51	17.17	1.60	23.33	1.07
5.00	1.42	11.17	5.51	17.33	1.60	23.50	1.07
5.17	1.42	11.33	8.54	17.50	1.60	23.67	1.07
5.33	1.42	11.50	8.54	17.67	1.60	23.83	1.07
5.50	1.42	11.67	8.54	17.83	1.60	24.00	1.07
5.67	1.42	11.83	26.32	18.00	1.60	24.17	1.07
5.83	1.42	12.00	67.57	18.17	1.60		
6.00	1.42	12.17	108.83	18.33	1.60		
6.17	1.42	12.33	12.80	18.50	1.60		

CALIB	
STANDHYD ( 0002)	Area (ha)= 9.32
ID= 1 DT= 6.0 min	Total Imp(%)= 68.00 Dir. Conn.(%)= 68.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	6.34	2.98
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	249.27	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	0.00	6.200	1.48	12.300	12.80	18.40	1.60
0.200	0.33	6.300	1.60	12.400	12.80	18.50	1.60
0.300	0.98	6.400	1.60	12.500	12.80	18.60	1.60
0.400	0.98	6.500	1.60	12.600	12.80	18.70	1.60
0.500	0.98	6.600	1.60	12.700	10.73	18.80	1.60
0.600	0.98	6.700	1.60	12.800	6.58	18.90	1.60
0.700	0.98	6.800	1.60	12.900	6.58	19.00	1.60
0.800	0.98	6.900	1.60	13.000	6.58	19.10	1.60
0.900	0.98	7.000	1.60	13.100	6.58	19.20	1.60
1.000	0.98	7.100	1.60	13.200	5.99	19.30	1.60
1.100	0.98	7.200	1.72	13.300	4.80	19.40	1.60
1.200	0.98	7.300	1.96	13.400	4.80	19.50	1.60
1.300	0.98	7.400	1.96	13.500	4.80	19.60	1.60
1.400	0.98	7.500	1.96	13.600	4.80	19.70	1.60
1.500	0.98	7.600	1.96	13.700	4.45	19.80	1.60
1.600	0.98	7.700	1.96	13.800	3.73	19.90	1.60
1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42
2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07

2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07
3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07
3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07
4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Max.Eff.Inten.(mm/hr)= 108.83 \*\*\*\*\*  
over (min) 6.00 12.00  
Storage Coeff. (min)= 4.27 (ii) 9.32 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.21 0.11

\*TOTALS\*

PEAK FLOW (cms)= 1.71 0.16 1.823 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10

RUNOFF VOLUME (mm)=	87.91	20.22	66.25
TOTAL RAINFALL (mm)=	88.91	88.91	88.91
RUNOFF COEFFICIENT =	0.99	0.23	0.75

\*\*\*\*\* 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)= 3.26
| ID= 1 DT= 6.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00
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	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	3.23	0.03
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	147.42	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.100	0.00	6.200	1.48	12.300	12.80	18.40	1.60
0.200	0.33	6.300	1.60	12.400	12.80	18.50	1.60
0.300	0.98	6.400	1.60	12.500	12.80	18.60	1.60
0.400	0.98	6.500	1.60	12.600	12.80	18.70	1.60
0.500	0.98	6.600	1.60	12.700	10.73	18.80	1.60
0.600	0.98	6.700	1.60	12.800	6.58	18.90	1.60
0.700	0.98	6.800	1.60	12.900	6.58	19.00	1.60
0.800	0.98	6.900	1.60	13.000	6.58	19.10	1.60
0.900	0.98	7.000	1.60	13.100	6.58	19.20	1.60
1.000	0.98	7.100	1.60	13.200	5.99	19.30	1.60
1.100	0.98	7.200	1.72	13.300	4.80	19.40	1.60
1.200	0.98	7.300	1.96	13.400	4.80	19.50	1.60
1.300	0.98	7.400	1.96	13.500	4.80	19.60	1.60
1.400	0.98	7.500	1.96	13.600	4.80	19.70	1.60
1.500	0.98	7.600	1.96	13.700	4.45	19.80	1.60
1.600	0.98	7.700	1.96	13.800	3.73	19.90	1.60
1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42

2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07
2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07
3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07
3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07
4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Max.Eff.Inten.(mm/hr)= 108.83 25.02  
over (min) 6.00 6.00  
Storage Coeff. (min)= 3.12 (ii) 4.20 (ii)  
Unit Hyd. Tpeak (min)= 6.00 6.00  
Unit Hyd. peak (cms)= 0.24 0.22

PEAK FLOW (cms)= 0.92 0.00 \*TOTALS\* 0.920 (iii)

TIME TO PEAK	(hrs)=	12.10	12.10	12.10
RUNOFF VOLUME	(mm)=	87.91	20.22	87.23
TOTAL RAINFALL	(mm)=	88.91	88.91	88.91
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.

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-----
| DUHYD ( 0022) |
| Inlet Cap.= 1.435 |
| #of Inlets= 1 |
| Total(cms)= 1.4 |
-----
| AREA      QPEAK      TPEAK      R.V.
| (ha)      (cms)      (hrs)      (mm)
-----
TOTAL HYD.(ID= 1):  3.26      0.92      12.10      87.23
=====
MAJOR SYS.(ID= 2):  0.00      0.00      0.00      0.00
MINOR SYS.(ID= 3):  3.26      0.92      12.10      87.23

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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   | 0.0580    0.2641
| 0.0170    0.1556   | 0.0690    0.2900
| 0.0330    0.1985   | 0.1020    0.3040
| 0.0440    0.2269   | 0.0000    0.0000
-----
| AREA      QPEAK      TPEAK      R.V.
| (ha)      (cms)      (hrs)      (mm)
-----
INFLOW : ID= 2 ( 0022)  3.260      0.920      12.10      87.23
OUTFLOW: ID= 1 ( 0018)  3.260      0.033      14.10      86.52
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](%)= 3.59  
TIME SHIFT OF PEAK FLOW (min)=120.00

MAXIMUM STORAGE USED (ha.m.)= 0.1986

-----  
-----  
| 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): 9.32 1.823 12.10 66.25  
=====

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): 9.32 1.823 12.10 66.25  
+ ID2= 2 ( 0022): 0.00 0.000 0.00 0.00  
=====

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 | 0.7270 0.3690  
0.1930 0.2106 | 0.8750 0.4190  
0.4080 0.2705 | 0.8990 0.4420  
0.5200 0.3128 | 0.0000 0.0000

AREA QPEAK TPEAK R.V.  
(ha) (cms) (hrs) (mm)  
INFLOW : ID= 2 ( 0013) 9.320 1.823 12.10 66.25  
OUTFLOW: ID= 1 ( 0004) 9.320 0.407 12.40 66.25

PEAK FLOW REDUCTION [Qout/Qin](%)= 22.31  
TIME SHIFT OF PEAK FLOW (min)= 18.00  
MAXIMUM STORAGE USED (ha.m.)= 0.2705

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 -----  
 | CALIB |  
 | STANDHYD ( 0003) |  
ID= 1 DT= 6.0 min

Area (ha)= 0.37  
 Total Imp(%)= 62.00 Dir. Conn.(%)= 62.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.23	0.14
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	49.67	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	0.00	6.200	1.48	12.300	12.80	18.40	1.60
0.200	0.33	6.300	1.60	12.400	12.80	18.50	1.60
0.300	0.98	6.400	1.60	12.500	12.80	18.60	1.60
0.400	0.98	6.500	1.60	12.600	12.80	18.70	1.60
0.500	0.98	6.600	1.60	12.700	10.73	18.80	1.60
0.600	0.98	6.700	1.60	12.800	6.58	18.90	1.60
0.700	0.98	6.800	1.60	12.900	6.58	19.00	1.60
0.800	0.98	6.900	1.60	13.000	6.58	19.10	1.60
0.900	0.98	7.000	1.60	13.100	6.58	19.20	1.60
1.000	0.98	7.100	1.60	13.200	5.99	19.30	1.60
1.100	0.98	7.200	1.72	13.300	4.80	19.40	1.60
1.200	0.98	7.300	1.96	13.400	4.80	19.50	1.60
1.300	0.98	7.400	1.96	13.500	4.80	19.60	1.60
1.400	0.98	7.500	1.96	13.600	4.80	19.70	1.60
1.500	0.98	7.600	1.96	13.700	4.45	19.80	1.60
1.600	0.98	7.700	1.96	13.800	3.73	19.90	1.60
1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42
2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07
2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07
3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07

3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07
4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Max.Eff.Inten.(mm/hr)= 108.83 25.02  
over (min) 6.00 12.00  
Storage Coeff. (min)= 1.62 (ii) 7.23 (ii)  
Unit Hyd. Tpeak (min)= 6.00 12.00  
Unit Hyd. peak (cms)= 0.28 0.12

\*TOTALS\*

PEAK FLOW (cms)= 0.07 0.01 0.074 (iii)  
TIME TO PEAK (hrs)= 12.10 12.20 12.10  
RUNOFF VOLUME (mm)= 87.91 20.22 62.18  
TOTAL RAINFALL (mm)= 88.91 88.91 88.91  
RUNOFF COEFFICIENT = 0.99 0.23 0.70

\*\*\*\*\* 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) |  
ID= 1 DT= 6.0 min

Area (ha)= 0.60  
 Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.59	0.01
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	63.25	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	0.00	6.200	1.48	12.300	12.80	18.40	1.60
0.200	0.33	6.300	1.60	12.400	12.80	18.50	1.60
0.300	0.98	6.400	1.60	12.500	12.80	18.60	1.60
0.400	0.98	6.500	1.60	12.600	12.80	18.70	1.60
0.500	0.98	6.600	1.60	12.700	10.73	18.80	1.60
0.600	0.98	6.700	1.60	12.800	6.58	18.90	1.60
0.700	0.98	6.800	1.60	12.900	6.58	19.00	1.60
0.800	0.98	6.900	1.60	13.000	6.58	19.10	1.60
0.900	0.98	7.000	1.60	13.100	6.58	19.20	1.60
1.000	0.98	7.100	1.60	13.200	5.99	19.30	1.60
1.100	0.98	7.200	1.72	13.300	4.80	19.40	1.60
1.200	0.98	7.300	1.96	13.400	4.80	19.50	1.60
1.300	0.98	7.400	1.96	13.500	4.80	19.60	1.60
1.400	0.98	7.500	1.96	13.600	4.80	19.70	1.60
1.500	0.98	7.600	1.96	13.700	4.45	19.80	1.60
1.600	0.98	7.700	1.96	13.800	3.73	19.90	1.60
1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42
2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07
2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07

3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07
3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07
4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Max.Eff.Inten.(mm/hr)=	108.83	25.02
over (min)	6.00	6.00
Storage Coeff. (min)=	1.88 (ii)	2.96 (ii)
Unit Hyd. Tpeak (min)=	6.00	6.00
Unit Hyd. peak (cms)=	0.27	0.25

			*TOTALS*
PEAK FLOW (cms)=	0.18	0.00	0.177 (iii)
TIME TO PEAK (hrs)=	12.10	12.10	12.10
RUNOFF VOLUME (mm)=	87.91	20.22	87.23
TOTAL RAINFALL (mm)=	88.91	88.91	88.91
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)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0010):	0.60	0.177	12.10	87.23
+ ID2= 2 ( 0003):	0.37	0.074	12.10	62.18
=====				
ID = 3 ( 0014):	0.97	0.251	12.10	77.67

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR( 0005)	OVERFLOW IS OFF			
IN= 2---> OUT= 1	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
DT= 6.0 min	0.0000	0.0000	0.0200	0.0664
	0.0080	0.0387	0.0240	0.0730
	0.0120	0.0497	0.0250	0.0840
	0.0150	0.0569	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0014)	0.970	0.251	12.10	77.67
OUTFLOW: ID= 1 ( 0005)	0.970	0.012	13.60	76.42

PEAK FLOW REDUCTION [Qout/Qin](%)= 4.59  
 TIME SHIFT OF PEAK FLOW (min)= 90.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.0485

CALIB	Area (ha)=	2.06
STANDHYD ( 0007)	Total Imp(%)=	30.00
ID= 1 DT= 6.0 min	Dir. Conn.(%)=	30.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.62	1.44
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	117.19	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	0.00	6.200	1.48	12.300	12.80	18.40	1.60
0.200	0.33	6.300	1.60	12.400	12.80	18.50	1.60
0.300	0.98	6.400	1.60	12.500	12.80	18.60	1.60
0.400	0.98	6.500	1.60	12.600	12.80	18.70	1.60
0.500	0.98	6.600	1.60	12.700	10.73	18.80	1.60
0.600	0.98	6.700	1.60	12.800	6.58	18.90	1.60
0.700	0.98	6.800	1.60	12.900	6.58	19.00	1.60
0.800	0.98	6.900	1.60	13.000	6.58	19.10	1.60
0.900	0.98	7.000	1.60	13.100	6.58	19.20	1.60
1.000	0.98	7.100	1.60	13.200	5.99	19.30	1.60
1.100	0.98	7.200	1.72	13.300	4.80	19.40	1.60
1.200	0.98	7.300	1.96	13.400	4.80	19.50	1.60
1.300	0.98	7.400	1.96	13.500	4.80	19.60	1.60
1.400	0.98	7.500	1.96	13.600	4.80	19.70	1.60
1.500	0.98	7.600	1.96	13.700	4.45	19.80	1.60
1.600	0.98	7.700	1.96	13.800	3.73	19.90	1.60
1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42
2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07
2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07
3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07
3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07

4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Max.Eff.Inten.(mm/hr)= 108.83 21.33  
over (min) 6.00 18.00  
Storage Coeff. (min)= 2.72 (ii) 15.81 (ii)  
Unit Hyd. Tpeak (min)= 6.00 18.00  
Unit Hyd. peak (cms)= 0.25 0.07

\*TOTALS\*

PEAK FLOW (cms)= 0.18 0.06 0.210 (iii)  
TIME TO PEAK (hrs)= 12.10 12.30 12.10  
RUNOFF VOLUME (mm)= 87.91 20.22 40.52  
TOTAL RAINFALL (mm)= 88.91 88.91 88.91  
RUNOFF COEFFICIENT = 0.99 0.23 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)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 ( 0018):	3.26	0.033	14.10	86.52
+ ID2= 2 ( 0004):	9.32	0.407	12.40	66.25
=====				
ID = 3 ( 0008):	12.58	0.433	12.40	71.50

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD ( 0008) |
| 3 + 2 = 1 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 3 ( 0008):  12.55  0.433  12.40  71.50
+ ID2= 2 ( 0005):   0.97  0.012  13.60  76.42
=====
ID = 1 ( 0008):  13.55  0.443  12.40  71.85

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| ADD HYD ( 0008) |
| 1 + 2 = 3 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 1 ( 0008):  13.55  0.443  12.40  71.85
+ ID2= 2 ( 0007):   2.06  0.210  12.10  40.52
=====
ID = 3 ( 0008):  15.61  0.521  12.40  67.72

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| CALIB
| NASHYD ( 0001) |
| ID= 1 DT= 6.0 min |
-----
Area      (ha)= 15.61  Curve Number (CN)= 49.0
Ia        (mm)= 5.00   # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.33

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NOTE: RAINFALL WAS TRANSFORMED TO 6.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
  hrs   mm/hr |  hrs   mm/hr |  hrs   mm/hr |  hrs   mm/hr
0.100  0.00 | 6.200  1.48 | 12.300  12.80 | 18.40  1.60
0.200  0.33 | 6.300  1.60 | 12.400  12.80 | 18.50  1.60
0.300  0.98 | 6.400  1.60 | 12.500  12.80 | 18.60  1.60
0.400  0.98 | 6.500  1.60 | 12.600  12.80 | 18.70  1.60
0.500  0.98 | 6.600  1.60 | 12.700  10.73 | 18.80  1.60
0.600  0.98 | 6.700  1.60 | 12.800   6.58 | 18.90  1.60
0.700  0.98 | 6.800  1.60 | 12.900   6.58 | 19.00  1.60
0.800  0.98 | 6.900  1.60 | 13.000   6.58 | 19.10  1.60
0.900  0.98 | 7.000  1.60 | 13.100   6.58 | 19.20  1.60
1.000  0.98 | 7.100  1.60 | 13.200   5.99 | 19.30  1.60
1.100  0.98 | 7.200  1.72 | 13.300   4.80 | 19.40  1.60
1.200  0.98 | 7.300  1.96 | 13.400   4.80 | 19.50  1.60
1.300  0.98 | 7.400  1.96 | 13.500   4.80 | 19.60  1.60
1.400  0.98 | 7.500  1.96 | 13.600   4.80 | 19.70  1.60
1.500  0.98 | 7.600  1.96 | 13.700   4.45 | 19.80  1.60
1.600  0.98 | 7.700  1.96 | 13.800   3.73 | 19.90  1.60

```

1.700	0.98	7.800	1.96	13.900	3.73	20.00	1.60
1.800	0.98	7.900	1.96	14.000	3.73	20.10	1.60
1.900	0.98	8.000	1.96	14.100	3.73	20.20	1.42
2.000	0.98	8.100	1.96	14.200	3.38	20.30	1.07
2.100	0.98	8.200	2.07	14.300	2.67	20.40	1.07
2.200	1.04	8.300	2.31	14.400	2.67	20.50	1.07
2.300	1.16	8.400	2.31	14.500	2.67	20.60	1.07
2.400	1.16	8.500	2.31	14.600	2.67	20.70	1.07
2.500	1.16	8.600	2.31	14.700	2.67	20.80	1.07
2.600	1.16	8.700	2.37	14.800	2.67	20.90	1.07
2.700	1.16	8.800	2.49	14.900	2.67	21.00	1.07
2.800	1.16	8.900	2.49	15.000	2.67	21.10	1.07
2.900	1.16	9.000	2.49	15.100	2.67	21.20	1.07
3.000	1.16	9.100	2.49	15.200	2.67	21.30	1.07
3.100	1.16	9.200	2.61	15.300	2.67	21.40	1.07
3.200	1.16	9.300	2.85	15.400	2.67	21.50	1.07
3.300	1.16	9.400	2.85	15.500	2.67	21.60	1.07
3.400	1.16	9.500	2.85	15.600	2.67	21.70	1.07
3.500	1.16	9.600	2.85	15.700	2.67	21.80	1.07
3.600	1.16	9.700	2.96	15.800	2.67	21.90	1.07
3.700	1.16	9.800	3.20	15.900	2.67	22.00	1.07
3.800	1.16	9.900	3.20	16.000	2.67	22.10	1.07
3.900	1.16	10.000	3.20	16.100	2.67	22.20	1.07
4.000	1.16	10.100	3.20	16.200	2.31	22.30	1.07
4.100	1.16	10.200	3.50	16.300	1.60	22.40	1.07
4.200	1.24	10.300	4.09	16.400	1.60	22.50	1.07
4.300	1.42	10.400	4.09	16.500	1.60	22.60	1.07
4.400	1.42	10.500	4.09	16.600	1.60	22.70	1.07
4.500	1.42	10.600	4.09	16.700	1.60	22.80	1.07
4.600	1.42	10.700	4.56	16.800	1.60	22.90	1.07
4.700	1.42	10.800	5.51	16.900	1.60	23.00	1.07
4.800	1.42	10.900	5.51	17.000	1.60	23.10	1.07
4.900	1.42	11.000	5.51	17.100	1.60	23.20	1.07
5.000	1.42	11.100	5.51	17.200	1.60	23.30	1.07
5.100	1.42	11.200	6.52	17.300	1.60	23.40	1.07
5.200	1.42	11.300	8.54	17.400	1.60	23.50	1.07
5.300	1.42	11.400	8.54	17.500	1.60	23.60	1.07
5.400	1.42	11.500	8.54	17.600	1.60	23.70	1.07
5.500	1.42	11.600	8.54	17.700	1.60	23.80	1.07
5.600	1.42	11.700	14.46	17.800	1.60	23.90	1.07
5.700	1.42	11.800	26.32	17.900	1.60	24.00	1.07
5.800	1.42	11.900	53.82	18.000	1.60	24.10	1.07
5.900	1.42	12.000	67.58	18.100	1.60	24.20	0.71
6.000	1.42	12.100	108.83	18.200	1.60		
6.100	1.42	12.200	76.81	18.300	1.60		

Unit Hyd Qpeak (cms)= 1.818

PEAK FLOW (cms)= 0.530 (i)

TIME TO PEAK (hrs)= 12.400

RUNOFF VOLUME (mm)= 20.205  
TOTAL RAINFALL (mm)= 88.910  
RUNOFF COEFFICIENT = 0.227

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

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# B6 WATER QUALITY SIZING CALCULATIONS

## SWM DESIGN CALCULATIONS

### Water Quality Calculations

**Project Name:** Empire Erin, 5525 8<sup>th</sup> Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 28-Aug-22

**Prepared by:** M.B.  
**Checked by:** A.B.  
**Submission #** 2nd Submission

#### North SWM Facility

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Roof Drainage Area to North SWM Facility	Roof drainage from the cleanwater collector system being discharged to the North SWM facility (inherently clean runoff)	100%	3.26	26%	26%
Lots and ROW & External Road Drainage (8th Line)	SWM Dry Pond facility + 2 Proposed OGS units*	80%	9.32	74%	59%
Total			12.58	100%	<b>85%</b>

\* based on Treatment Train Approach, effective TSS Removal for the combination of north dry pond (with TSS removal= 60%) and OGS (with TSS removal= 50%) would be 80%

#### East SWM Facility

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Roof Drainage Area to East SWM Facility	Roof drainage from the cleanwater collector system being discharged to the East SWM facility (inherently clean runoff)	100%	0.60	62%	62%
Lots and ROW & Gravel Access Route	Proposed infiltration media at the east SWM facility (Enhanced Level Treatment)	80%	0.37	38%	31%
Total			0.97	100%	<b>92%</b>

#### Uncontrolled Drainage Area Discharge to Watercourse

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Park and Open Space	Inherent	80%	1.22	59%	47%
Rear Lots and Roofs	Roof drainage discharge (inherently clean runoff )	100%	0.84	41%	41%
Total			2.06	100%	<b>88%</b>

#### Total Site

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Total			15.61	100%	<b>86%</b>

#### Treatment Train Approach:

$$R = A + B - [(A \times B) / 100] \quad (\text{Equation 4-1})$$

Where:

R = Total TSS Removal Rate

A = TSS Removal Rate of the First or Upstream BMP

B = TSS Removal Rate of the Second or Downstream BMP

\*As per 'New Jersey Stormwater Best Management Practices Manual'  
Equation 4-1 (February 2004)

	Treatment Train TSS Removal:		
North Dry Pond (Basic level treatment with providing water treatment through settling contaminants)	=	60	%
OGS	=	50	%

Storm Outlet 1 - North SWM Pond

Removal at Infiltration:

$$R_{inf} = \text{Rate 1} + \text{Rate 2} - [(\text{Rate 1} \times \text{Rate 2})/100]$$

$$R_{inf} = 80.0 \quad \%$$

Treatment Train TSS Removal:

East SWM facility - infiltration, enhanced level treatment	=	80	%
OGS	=	0	%

Storm Outlet 2 - East SWM Pond

Removal at Infiltration:

$$R_{inf} = \text{Rate 1} + \text{Rate 2} - [(\text{Rate 1} \times \text{Rate 2})/100]$$

$$R_{inf} = 80.0 \quad \%$$

## WATER QUALITY STORAGE REQUIREMENTS - SWM NORTH

**Project Name:** 5525 8th Line (Empire, Erin)  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2023

**Prepared by:** M.B.  
**Checked by:** A.B.  
**Submission:** 2

### PERMANENT POOL SIZING

**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 <sup>3</sup> /ha	Extended Detention m <sup>3</sup> /ha	Infiltration m <sup>3</sup> /ha
35%	90	40	50
55%	150	40	110
70%	200	40	160
85%	240	40	200

**Interpolated Storage Requirement**

<b>68%</b>	190	40	<b>150</b>
------------	-----	----	------------

	Area [ha]	IMP%
<b>Total Contributing Area</b>	9.32	68%
<b>Quantity Control Only</b>	9.32	68%
<b>Quality Control Only</b>	9.32	68%

**Total WQ Vol Required =** 1775 m<sup>3</sup>  
**Total Ext Det Vol Required =** 373 m<sup>3</sup>  
**Total Dry Pond Vol Required =** **1402** m<sup>3</sup>

## WATER QUALITY STORAGE REQUIREMENTS - SWM EAST

**Project Name:** 5525 8th Line (Empire, Erin)  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2023

**Prepared by:** M.B.  
**Checked by:** A.B.  
**Submission:** 2

### Enhanced Level - 80% TSS Removal

**Infiltration** (REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)

Impervious Level (%)	Water Quality Storage Vol m <sup>3</sup> /ha	Extended Detention m <sup>3</sup> /ha	Infiltration m <sup>3</sup> /ha
35%	25	0	25
55%	30	0	30
70%	35	0	35
85%	40	0	40

### Interpolated Storage Requirement

<b>62%</b>	33	0	<b>33</b>
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	Area [ha]	IMP%
Total Contributing Area	0.37	62%
Quantity Control Only	0.37	62%
Quality Control Only	0.37	62%

Total WQ Vol Required =	12	m <sup>3</sup>
Total Ext Det Vol Required =	0	m <sup>3</sup>
Total Perm Pool Vol Required =	12	m <sup>3</sup>
Total Filtration Media Volume =	30	m <sup>3</sup>
Total Filtration Media Footprint =	333	m <sup>2</sup>
Total Filtration Media Min. Depth =	0.09	m

# B7 SANITARY SEWER DESIGN SHEET

<b>SANITARY SEWER DESIGN SHEET</b>  <b>EMPIRE ERIN, 5525 8th LINE</b>  <b>TOWN OF ERIN</b>	<b>PROJECT DETAILS</b>  Project No: 21-684 Date: 1-Sep-23 Designed by: AL Checked by: OS	<b>DESIGN CRITERIA</b>  Min Diameter = 200 mm      Avg. Domestic Flow = 290.0 l/c/d Mannings 'n' = 0.013      Infiltration = 0.290 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 %
<b>NOMINAL PIPE SIZE USED</b>		

STREET	FROM MH	TO MH	RESIDENTIAL						COMMERCIAL/INDUSTRIAL/INSTITUTIONAL						FLOW CALCULATIONS						PIPE DATA								
			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 B	201A	202A	2.24	2.24	46		2.8	129	129								0.6	129	4.00	1.7			2.4	1.00	200	32.8	1.0	0.6	7%
STREET B	202A	203A		2.24					129								0.6	129	4.00	1.7			2.4	1.00	200	32.8	1.0	0.6	7%
STREET B	203A	204A		2.24					129								0.6	129	4.00	1.7			2.4	1.00	200	32.8	1.0	0.6	7%
EX. ERIN HEIGHTS	227A	204A	20.60	20.60	100		2.8	280	280								6.0	280	4.00	3.8			9.7	4.00	200	65.6	2.1	1.5	15%
STREET B	204A	205A		22.84					409								6.6	409	4.00	5.5			12.1	3.00	200	56.8	1.8	1.4	21%
STREET B	205A	206A	2.86	25.70	45		2.8	126	535								7.5	535	3.96	7.1			14.6	2.50	200	51.9	1.7	1.4	28%
STREET B	206A	208A		25.70					535								7.5	535	3.96	7.1			14.6	2.00	200	46.4	1.5	1.3	31%
STREET A	207A	208A	0.47	0.47	15		2.8	42	42								0.1	42	4.00	0.6			0.7	2.00	200	46.4	1.5	0.5	2%
STREET B	208A	209A		26.17					577								7.6	577	3.94	7.6			15.2	0.50	200	23.2	0.7	0.8	66%
STREET B	209A	210A		26.17					577								7.6	577	3.94	7.6			15.2	0.50	200	23.2	0.7	0.8	66%
STREET B	210A	211A		26.17					577								7.6	577	3.94	7.6			15.2	0.50	200	23.2	0.7	0.8	66%
STREET B	211A	214A		26.17					577								7.6	577	3.94	7.6			15.2	0.50	200	23.2	0.7	0.8	66%
STREET E	212A	2120A	1.14	1.14	35		2.8	98	98								0.3	98	4.00	1.3			1.6	3.50	200	61.4	2.0	0.8	3%
STREET A	2121A	2120A	0.27	0.27	7		2.8	20	20								0.1	20	4.00	0.3			0.3	1.50	200	40.2	1.3	0.3	1%
STREET E	2120A	213A		1.41					118								0.4	118	4.00	1.6			2.0	3.50	200	61.4	2.0	0.9	3%
STREET E	213A	214A		1.41					118								0.4	118	4.00	1.6			2.0	0.50	200	23.2	0.7	0.5	9%
STREET B	214A	218A		27.58					695								8.0	695	3.90	9.1			17.1	0.50	200	23.2	0.7	0.8	74%
STREET D	215A	216A	1.32	1.32	43		2.8	121	121								0.4	121	4.00	1.6			2.0	3.00	200	56.8	1.8	0.9	4%
STREET A	2160A	216A	0.27	0.27	7		2.8	20	20								0.1	20	4.00	0.3			0.3	1.00	200	32.8	1.0	0.3	1%
STREET D	216A	217A		1.59					141								0.5	141	4.00	1.9			2.4	3.00	200	56.8	1.8	0.9	4%
STREET D	217A	218A		1.59					141								0.5	141	4.00	1.9			2.4	0.50	200	23.2	0.7	0.5	10%
STREET B	218A	221A		29.17					836								8.5	836	3.85	10.8			19.3	0.50	200	23.2	0.7	0.8	83%
STREET C	219A	220A	1.42	1.42	53		2.8	149	149								0.4	149	4.00	2.0			2.4	3.00	200	56.8	1.8	0.9	4%
STREET C	220A	221A		1.42					149								0.4	149	4.00	2.0			2.4	0.50	200	23.2	0.7	0.5	10%
STREET B	221A	222A		30.59					985								8.9	985	3.80	12.6			21.4	0.50	250	42.0	0.9	0.9	51%
STREET B	222A	225A		30.59					985								8.9	985	3.80	12.6			21.4	0.50	250	42.0	0.9	0.9	51%
STREET B	201A	223A	1.90	1.90	55		2.8	154	154								0.6	154	4.00	2.1			2.6	3.00	200	56.8	1.8	0.9	5%
STREET B	223A	224A		1.90					154								0.6	154	4.00	2.1			2.6	3.00	200	56.8	1.8	0.9	5%
STREET B	224A	225A		1.90					154								0.6	154	4.00	2.1			2.6	0.50	200	23.2	0.7	0.5	11%
STREET B	225A	226A		32.49					1139								9.4	1139	3.76	14.4			23.8	0.50	250	42.0	0.9	0.9	57%

**SWM POND DESIGN CALCULATION  
SWMF-1 TARGET SUMMARY - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**North Dry Pond**

Headwall(s)		
<b>Number of Headwalls:</b>	1	
<b>Drainage Area to HW:</b>	9.32	ha
<b>Minor System Flows @ HW:</b>	1.554	m <sup>3</sup> /s

Elevation	Storm Event	Surface Area (m <sup>2</sup> )	Incr. Volume (m <sup>3</sup> )	Cumulative Volume (m <sup>3</sup> )
406.45	BOTTOM Dry Pond	2388		0
406.50	--	2459	362	362
406.55	--	2527	124	486
406.60	--	2597	128	613
406.65	--	2667	131	744
406.70	--	2738	135	879
406.75	--	2809	138	1017
406.80	--	2882	142	1159
406.85	--	2955	145	1304
406.90	--	3028	149	1453
406.95	EXT DET	3103	153	1606
407.00	--	3178	156	1762
407.05	--	3237	160	1922
407.10	--	3294	163	2085
407.15	2-YR	3351	166	2250
407.20	--	3408	168	2419
407.25	--	3465	171	2590
407.30	5-YR	3523	174	2764
407.35	--	3582	177	2941
407.40	--	3641	180	3122
407.45	10-YR	3700	183	3305
407.50	--	3759	186	3491
407.55	--	3819	189	3680
407.60	25-YR	3880	192	3871
407.65	--	3940	195	4066
407.70	50-YR	4002	198	4265
407.75	100-YR	4063	155	4420

Note: Surface area and storage volume are generated from AutoCAD

**SWM POND DESIGN CALCULATION  
SWMF-1 TARGET SUMMARY - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**North Dry Pond**

**Design Target**

Event	Pre-Development Discharge Target Flow	Uncontrolled Flow	SWM (Total) Target Flow	SWM (North) Target Flow	SWM (North - Roof) Target Flow	
EXT DET						
2 YR	0.306	0.145	0.161	<b>0.193</b>	0.017	m <sup>3</sup> /s
5 YR	0.530	0.210	0.320	<b>0.408</b>	0.033	m <sup>3</sup> /s
10 YR	0.700	0.253	0.447	<b>0.520</b>	0.044	m <sup>3</sup> /s
25 YR	0.949	0.312	0.637	<b>0.727</b>	0.058	m <sup>3</sup> /s
50 YR	1.136	0.380	0.756	<b>0.875</b>	0.069	m <sup>3</sup> /s
100 YR	1.310	0.423	0.887	<b>0.899</b>	0.102	m <sup>3</sup> /s

**\*\* Quantity storage targets include extended detention storage.**

**Dry Pond Basic 60% long-term S.S. removal**

Impervious Level (%)	Water Quality Storage Vol m <sup>3</sup> /ha	Extended Detention m <sup>3</sup> /ha	Permanent Pool m <sup>3</sup> /ha
35%	90	40	-
55%	150	40	-
70%	200	40	-
85%	240	40	-

(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)

**Interpolated Storage Requirement**

<b>68%</b>	191	<b>40</b>	<b>151</b>
------------	-----	-----------	------------

	Area [ha]	IMP%
<b>Total Contributing Area</b>	9.32	68%
<b>Quantity Control Only</b>	9.32	68%
<b>Quality Control Only</b>	9.32	68%

Extended Detention Runoff Volume = **16.77** mm (From Visual Otthymo)

Ext. Det. Volume = Runoff Volume x Area  
 Ext. Det. Volume = **1563** m<sup>3</sup>

Duration = **48** hours  
 Qpeak = Ext. Det Volume / Duration  
 Qpeak(48h) = **0.009** m<sup>3</sup>/s

Return Period	Stage (m)	Target Discharge (m <sup>3</sup> /s)	Required VO6 Volume to control to Targets (m <sup>3</sup> )	Provided Volume (m <sup>3</sup> )	Design Discharge Rate From Outlet Structure (m <sup>3</sup> /s)
BOTTOM DRY POND	406.45	-	-	-	-
EXT DET (25mm over 48 hours)	406.95	0.009	1563	1606	0.009
2-YR	407.15	0.193	2106	2250	0.193
5-YR	407.30	0.408	2705	2764	0.410
10-YR	407.45	0.520	3128	3305	0.532
25-YR	407.60	0.727	3690	3871	0.730
50-YR	407.70	0.875	4190	4265	0.849
100-YR	407.75	0.899	4420	4420	0.899
EMERGENCY	407.75	2.577	-	4420	2.953

	SWM design sheet 100-Year Uncontrolled Flow (m <sup>3</sup> /s)	Emergency Flow (m <sup>3</sup> /s)
<b>HW1</b>	<b>2.577</b>	2.577

5-YR Uncontrolled Flow = **1.554** m<sup>3</sup>/s  
 100-YR Uncontrolled Flow = **2.577** m<sup>3</sup>/s

**SWM POND DESIGN CALCULATIONS**  
**SWMF-2: SWM Facility Drawdown Time - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission Number:** 2nd Submission

**North Dry Pond**

**Detention Time Calculations**

$$t = (0.66C_2h^{1.5} + 2C_3h^{0.5}) / 2.75A_0 \quad (\text{MOECC Eq'n 4.11})$$

**t= 255669**  
**t= 71.0**

*Drawdown time in seconds*  
*Drawdown time in hours*

**d= 0.080**  
**A<sub>0</sub>= 0.0050**  
**h= 0.460**

*Diameter of the orifice (m)*  
*Cross-sectional area of the orifice (m<sup>2</sup>)*  
*Maximum water elevation above orifice (m)*

**Q<sub>ext det</sub>= 0.009**  
**Q<sub>target</sub>= 0.009**

*Proposed extended detention release rate (m<sup>3</sup>/s)*  
*DCHU Extended Detention Target Release Rate*

**C<sub>2</sub>= 1429.17**  
**C<sub>3</sub>= 2388**

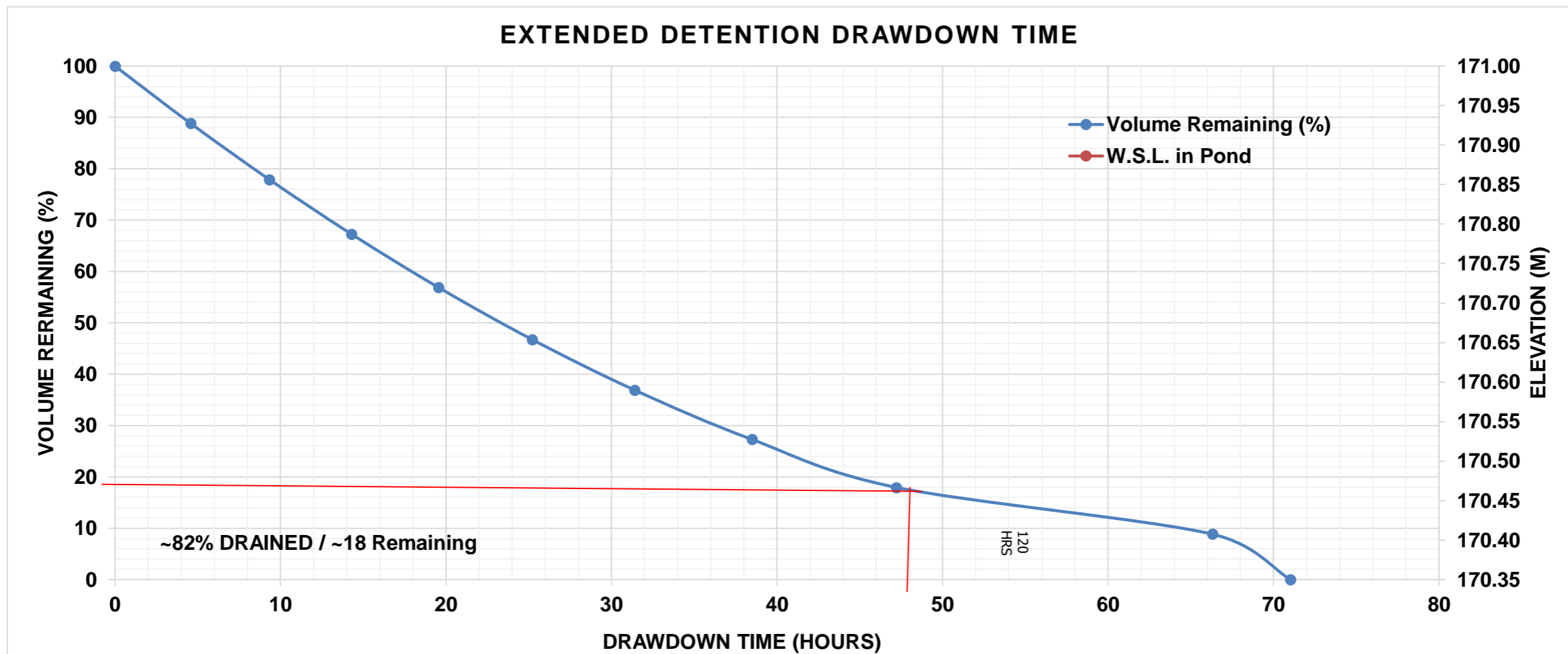
*Slope coefficient from the area-depth linear regression*  
*Intercept from the area-depth linear regression*

**Pond area-depth relationship:**

	Elevation (m)	Area (m <sup>2</sup> )	Depth (m)
<b>BOTTOM Dry Pond</b>	406.45	2388	0.00
<b>EXT DET</b>	406.95	3103	0.50

**The drawdown time for North Dry Pond is 71 hours (3 days)**  
**The drawdown time is greater than the target of 48 hours.**

From the graph below, after 48 hours, approximately 82% of the SWM Facility has drained.



**SWM POND DESIGN CALCULATIONS**  
**SWMF-3: Outlet Structure Calculation - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

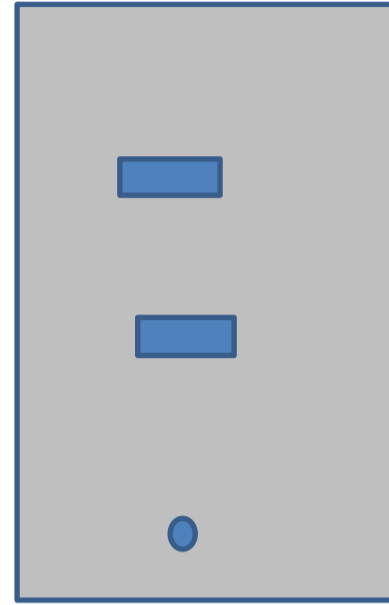
**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**North Dry Pond**  
**OUTLET STRUCTURE CALCULATIONS**

Return Period	Elevation	Q <sub>TARGET</sub>	H <sub>EXT DET ORIFICE</sub>	H <sub>WEIR_1</sub>	H <sub>WEIR_2</sub>	Q <sub>EXT DET</sub>	Q <sub>WEIR_1</sub>	Q <sub>ORIFICE_1</sub>	Q <sub>WEIR_2</sub>	Q <sub>ORIFICE_2</sub>			Q <sub>TOTAL_PROVIDED VIA OPENINGS</sub>	Q <sub>TOTAL_PROVIDED</sub>
	[m]	[m <sup>3</sup> /s]	[m]	[m]	[m]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]			[m <sup>3</sup> /s]	[m <sup>3</sup> /s]
<b>BOTTOM Dry Pond</b>	<b>406.45</b>													
--	406.50		0.010			0.001							0.001	0.001
--	406.55		0.060			0.003							0.003	0.003
--	406.60		0.110			0.004							0.004	0.004
--	406.65		0.160			0.005							0.005	0.005
--	406.70		0.210			0.006							0.006	0.006
--	406.75		0.260			0.007							0.007	0.007
--	406.80		0.310			0.007							0.007	0.007
--	406.85		0.360			0.008							0.008	0.008
--	406.90		0.410			0.009							0.009	0.009
<b>EXT DET</b>	<b>406.95</b>	<b>0.009</b>	0.460			0.009							0.009	0.009
--	407.00		0.510	0.000		0.010	0.00						0.010	0.010
--	407.05		0.560	0.050		0.010	0.04						0.045	0.045
--	407.10		0.610	0.100		0.010	0.10						0.110	0.110
<b>2-YR</b>	<b>407.15</b>	<b>0.193</b>	0.660	0.150		0.011	0.18						0.193	0.193
--	407.20		0.710	0.200		0.011	0.29						0.302	0.302
--	407.25		0.760	0.250		0.012	0.35						0.360	0.360
<b>5-YR</b>	<b>407.30</b>	<b>0.408</b>	0.810	0.300		0.012	0.40						0.410	0.410
--	407.35		0.860	0.350		0.012	0.44						0.454	0.454
--	407.40		0.910	0.400		0.013	0.48						0.495	0.495
<b>10-YR</b>	<b>407.45</b>	<b>0.520</b>	0.960	0.450		0.013	0.52						0.532	0.532
--	407.50		1.010	0.500	0.000	0.013	0.55	0.00					0.566	0.566
--	407.55		1.060	0.550	0.050	0.014	0.59	0.04					0.636	0.636
<b>25-YR</b>	<b>407.60</b>	<b>0.727</b>	1.110	0.600	0.100	0.014	0.62		0.10				0.730	0.730
--	407.65		1.160	0.650	0.150	0.014	0.65		0.13				0.793	0.793
<b>50-YR</b>	<b>407.70</b>	<b>0.875</b>	1.210	0.700	0.200	0.015	0.67		0.16				0.849	0.849
<b>100-YR</b>	<b>407.75</b>	<b>0.899</b>	1.260	0.750	0.250	0.015	0.70		0.18				0.899	0.899

Rectangular Weir/Orifice-1	
Width(m):	Height(m):
1.90	0.17
INV.:	407.00m

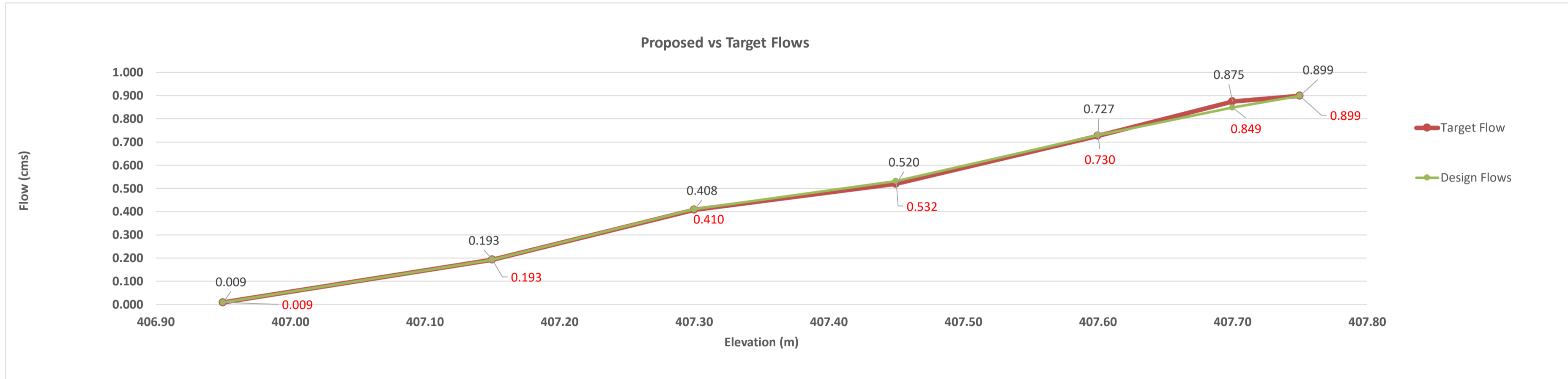
Rectangular Weir/Orifice-2	
Width(m):	Height(m):
2.00	0.08
INV.:	407.50m



**Extended Detention Orifice Plate**

Diameter (mm)	80
INV.:	406.45m

<b>Weir equation:</b>	$Q = BxC_d \times H^{3/2}$	$Q = BxC_d \times H^{3/2}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 1.65$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$b = \text{width of the weir (m)}$	$b = \text{width of the weir (m)}$	$C_d = \text{coefficient of discharge}$
<b>Orifice equation:</b>	$Q = C_d \times A \times (2gH)^{0.5}$	$Q = C_d \times A \times (2gH)^{0.5}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 0.6, A = (1/4 \times \pi \times D^2)$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$a = \text{area of orifice (m}^2\text{)}$	$a = \text{area of orifice (m}^2\text{)}$	$C_d = \text{coefficient of discharge}$



**SWM POND DESIGN CALCULATIONS**  
**SWMF-4: SWM Facility Overland Flow Inlet Spillway - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #** 2nd Submission

**North Dry Pond**  
**SWM Inlet Spillway**

[See Hydrowexpress Report and Result](#)

**Input Parameters:**

Side Slope, $z_1$	<b>3.0</b>	:1
Side Slope, $z_2$	<b>3.0</b>	:1
Minimum Flow Depth, $y$	<b>0.10</b>	m
Bottom Width, $b$ :	<b>3.00</b>	m
Manning Roughness, $n$	<b>0.013</b>	
Spillway Slope, $S$	<b>6.00</b>	%

**Computed Values:**

Top Width, $T$	3.60	m
Channel Area, $A$	0.33	$m^2$
Channel Wetted Perimeter, $P$	3.632	m
Hydraulic Radius, $R$	0.091	m
Velocity, $V$	3.807	m/s

<b>Capacity, <math>Q</math></b>	<b>1.256</b>	$m^3/s$
5-Year Uncontrolled Flow	<b>1.554</b>	$m^3/s$
100-Year Uncontrolled Flow	<b>2.577</b>	$m^3/s$
<b>Target, Q100-Q5 Year Uncontrolled Flow</b>	<b>1.023</b>	$m^3/s$

**The proposed inlet spillway provides sufficient capacity.**



**SWM POND DESIGN CALCULATIONS**  
**SWMF-5 EMERGENCY SPILLWAY WEIR - North Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Last Revised:** 2nd Submission

**North Dry Pond**

**Input Parameters:**

Side Slope, S <sub>1</sub>	3	:1
Side Slope, S <sub>2</sub>	3	:1
Weir Invert	407.75	m
Water Level	408.00	m
Flow Depth, H	0.25	m
Bottom Width, B:	15.00	m

**Weir equation:**  $Q = BxC_d \times H^{3/2} + SxC_d \times H^{5/2}$

$C_d = 1.5$

where:  $Q = \text{flow rate (m}^3/\text{s)}$

$H = \text{head on the weir (m)}$

$B = \text{width of the weir (m)}$

$S = \text{side slopes of weir (H:V)}$

**Computed Values:**

			<b>Depth (m)</b>
Capacity, Q at 407.8m =	0.25	m <sup>3</sup> /s	0.05
Capacity, Q at 407.85m =	0.73	m <sup>3</sup> /s	0.10
Capacity, Q at 407.9m =	1.35	m <sup>3</sup> /s	0.15
Capacity, Q at 407.95m =	2.09	m <sup>3</sup> /s	0.20
Capacity, Q at 408m =	2.95	m <sup>3</sup> /s	0.25
Capacity, Q at 408m =	<b>2.953</b>	<b>m<sup>3</sup>/s</b>	0.25
<b>Emergency Flow via Spillway =</b>	<b>2.577</b>	<b>m<sup>3</sup>/s</b>	Uncontrolled 100-yr Flow

**The proposed emergency spillway provides sufficient capacity.**

# B9 NORTH SWM DRY POND INLET SPILLWAY AND ROW CAPACITY

## Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Thursday, Aug 31 2023

### 21-684 Empire Erin North Dry Pond Inlet Spillway

#### Trapezoidal

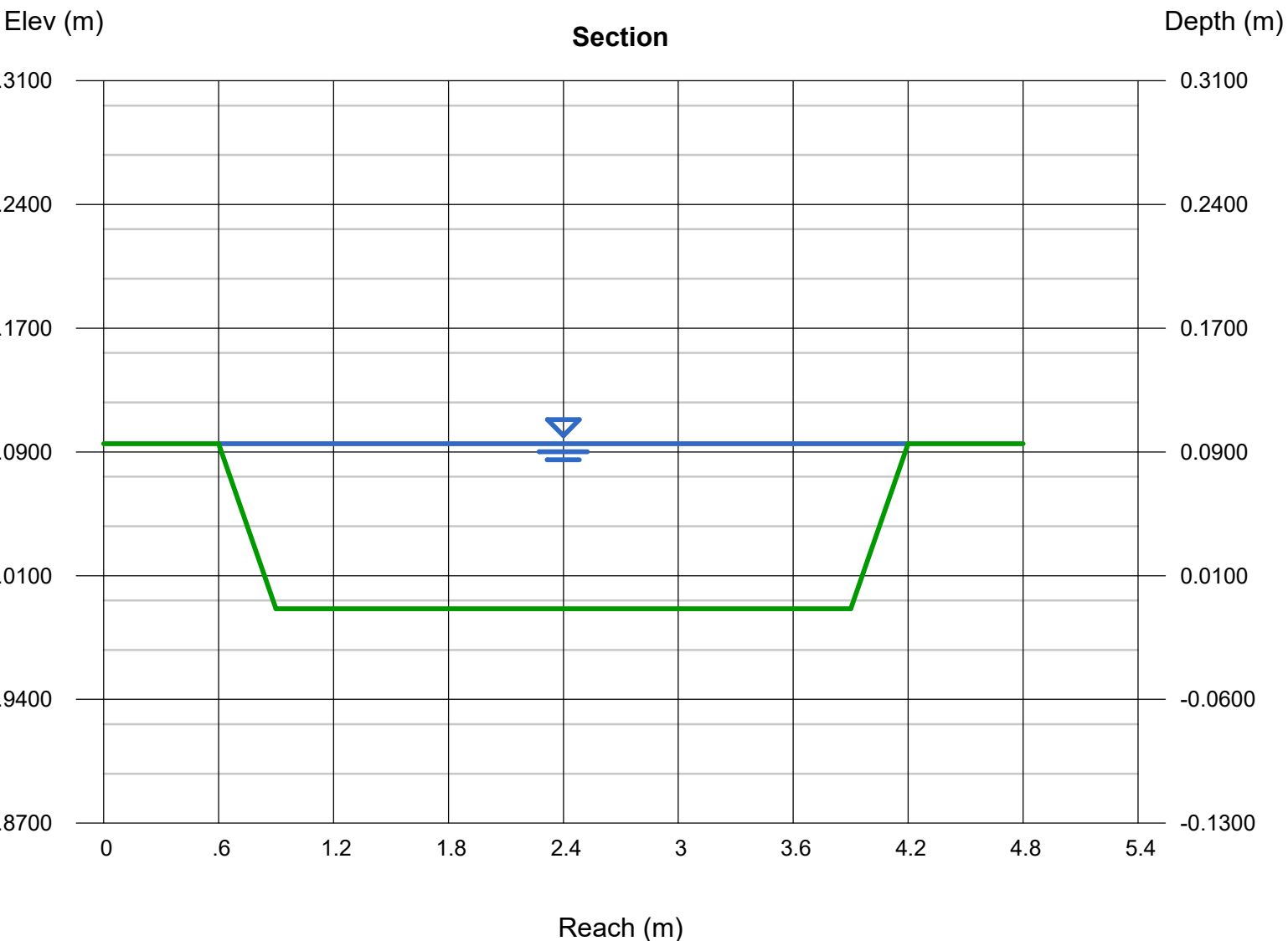
Bottom Width (m) = 3.0000  
Side Slopes (z:1) = 3.0000, 3.0000  
Total Depth (m) = 0.1000  
Invert Elev (m) = 410.0000  
Slope (%) = 6.0000  
N-Value = 0.013

#### Highlighted

Depth (m) = 0.1000  
Q (cms) = 1.2561  
Area (sqm) = 0.3300  
Velocity (m/s) = 3.8065  
Wetted Perim (m) = 3.6325  
Crit Depth, Yc (m) = 0.1000  
Top Width (m) = 3.6000  
EGL (m) = 0.8391

#### Calculations

Compute by: Q vs Depth  
No. Increments = 2



Depth	Q	Area	Veloc	Wp
(m)	(cms)	(sqm)	(m/s)	(m)
0.0500	0.389	0.157	2.4697	3.3162
0.1000	1.256	0.330	3.8065	3.6325

Yc	TopWidth	Energy
(m)	(m)	(m)
0.1000	3.3000	0.3611
0.1000	3.6000	0.8391

# Channel Report

## 21-684 Empire Erin 20.0m ROW Street B Capacity

### User-defined

Invert Elev (m) = 409.9250  
Slope (%) = 0.5000  
N-Value = Composite

### Highlighted

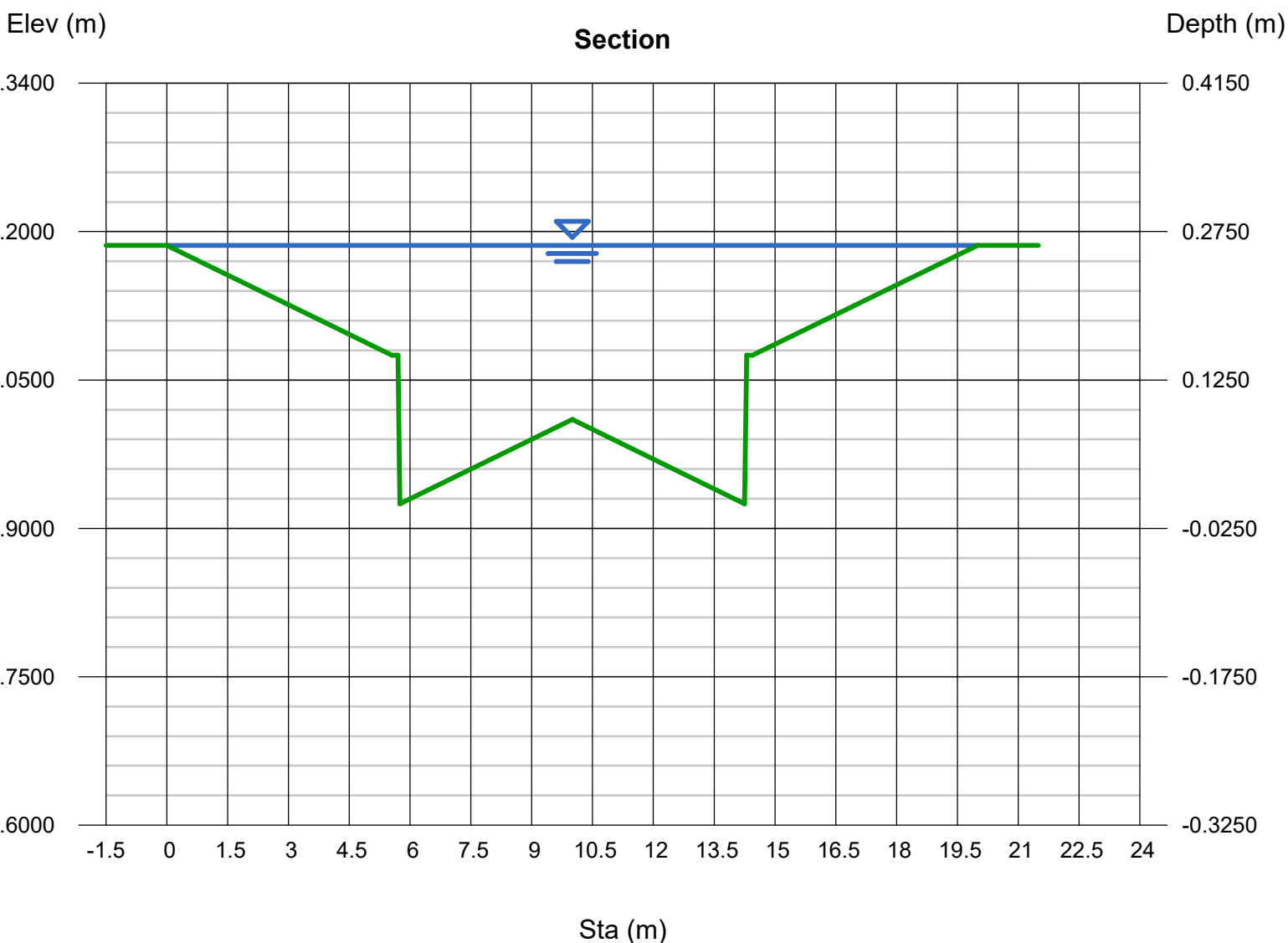
Depth (m) = 0.2610  
Q (cms) = 1.6997  
Area (sqm) = 2.5255  
Velocity (m/s) = 0.6730  
Wetted Perim (m) = 20.2203  
Crit Depth, Yc (m) = 0.2103  
Top Width (m) = 20.0000  
EGL (m) = 0.2841

### Calculations

Compute by: Q vs Depth  
No. Increments = 2

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 410.1860)-(3.7500, 410.1110, 0.035)-(5.5500, 410.0750, 0.035)-(5.7000, 410.0750, 0.013)-(5.7500, 409.9250, 0.013)-(10.0000, 410.0100, 0.013)-(14.2500, 410.0750, 0.013)-(14.4500, 410.0750, 0.013)-(16.2500, 410.1110, 0.035)-(20.0000, 410.1860, 0.035)



Depth	Q	Area	Veloc	Wp
(m)	(cms)	(sqm)	(m/s)	(m)
0.1305	0.800	0.754	1.0607	8.7769
0.2610	1.700	2.526	0.6730	20.2203

Yc	TopWidth	Energy
(m)	(m)	(m)
0.1402	8.5870	0.1879
0.2103	20.0000	0.2841

**SWM INFILTRATION TANK DESIGN CALCULATIONS**  
**SWMF-6 TARGET SUMMARY - Infiltration Tank**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**North Infiltration Tank**

Headwall(s)	
<b>Number of Headwalls:</b>	2C
<b>Drainage Area to HW:</b>	3.26 ha
<b>Minor System Flows @ HW:</b>	0.818 m <sup>3</sup> /s

Elevation	Storm Event	Surface Area (m <sup>2</sup> )	Incr. Volume (m <sup>3</sup> )	Cumulative Volume (m <sup>3</sup> )
404.80	Bottom Infiltration Tank	3282		0
404.85	--	3282	164	164
404.90	--	3282	164	328
404.95	--	3282	164	492
405.00	--	3282	164	656
405.05	--	3282	164	820
405.10	--	3282	164	984
405.15	--	3282	164	1149
405.20	--	3282	164	1313
405.25	--	3282	164	1477
405.30	2-YR	3282	164	1641
405.35	--	3282	164	1805
405.40	--	3282	164	1969
405.45	5-YR	3282	164	2133
405.50	10-YR	3282	164	2297
405.55	--	3282	164	2461
405.60	--	3282	164	2625
405.65	25-YR	3282	164	2789
405.70	50-YR	3282	164	2953
405.75	100-YR	3282	164	3117
405.80	--	3282	164	3282

Note: Surface area and storage volume are generated from AutoCAD

**SWM INFILTRATION TANK DESIGN CALCULATIONS**  
**SWMF-6 TARGET SUMMARY - Infiltration Tank**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**North Infiltration Tank**

**Design Target**

Event	Pre-Development Discharge Target Flow	Uncontrolled Flow	SWM (Total) Target Flow	SWM (North) Target Flow	SWM (North - Roof) Target Flow	
2 YR	0.306	0.145	0.161	0.193	<b>0.017</b>	m <sup>3</sup> /s
5 YR	0.530	0.210	0.320	0.408	<b>0.033</b>	m <sup>3</sup> /s
10 YR	0.700	0.253	0.447	0.520	<b>0.044</b>	m <sup>3</sup> /s
25 YR	0.949	0.312	0.637	0.727	<b>0.058</b>	m <sup>3</sup> /s
50 YR	1.136	0.380	0.756	0.875	<b>0.069</b>	m <sup>3</sup> /s
100 YR	1.310	0.423	0.887	0.899	<b>0.102</b>	m <sup>3</sup> /s

**Dry Pond Basic 60% long-term S.S. removal**

Impervious Level (%)	Water Quality Storage Vol m <sup>3</sup> /ha	Extended Detention m <sup>3</sup> /ha	Permanent Pool m <sup>3</sup> /ha
35%	90	40	-
55%	150	40	-
70%	200	40	-
85%	240	40	-

(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)

**Interpolated Storage Requirement**

<b>99%</b>	284	<b>40</b>	<b>244</b>
------------	-----	-----------	------------

	Area [ha]	IMP%
<b>Total Contributing Area</b>	3.26	99%
<b>Quantity Control Only</b>	3.26	99%
<b>Quality Control Only</b>	3.26	99%

Return Period	Stage (m)	Target Discharge (m <sup>3</sup> /s)	Required VO6 Volume to control to Targets (m <sup>3</sup> )	Provided Volume (m <sup>3</sup> )	Design Discharge Rate From Outlet Structure (m <sup>3</sup> /s)
Bottom Infiltration Tank	404.80	-	-	-	-
	-	-	-	-	-
2-YR	405.30	0.017	1556	1641	0.016
5-YR	405.45	0.033	1985	2133	0.031
10-YR	405.50	0.044	2269	2297	0.041
25-YR	405.65	0.058	2641	2789	0.056
50-YR	405.70	0.069	2900	2953	0.069
100-YR	405.75	0.102	3040	3117	0.093
	-	-	-	-	-

	SWM design sheet 100-Year Uncontrolled Flow (m <sup>3</sup> /s)	Emergency Flow (m <sup>3</sup> /s)
<b>HW1</b>	1.356	1.356

5-YR Uncontrolled Flow = 0.818 m<sup>3</sup>/s  
100-YR Uncontrolled Flow = 1.356 m<sup>3</sup>/s

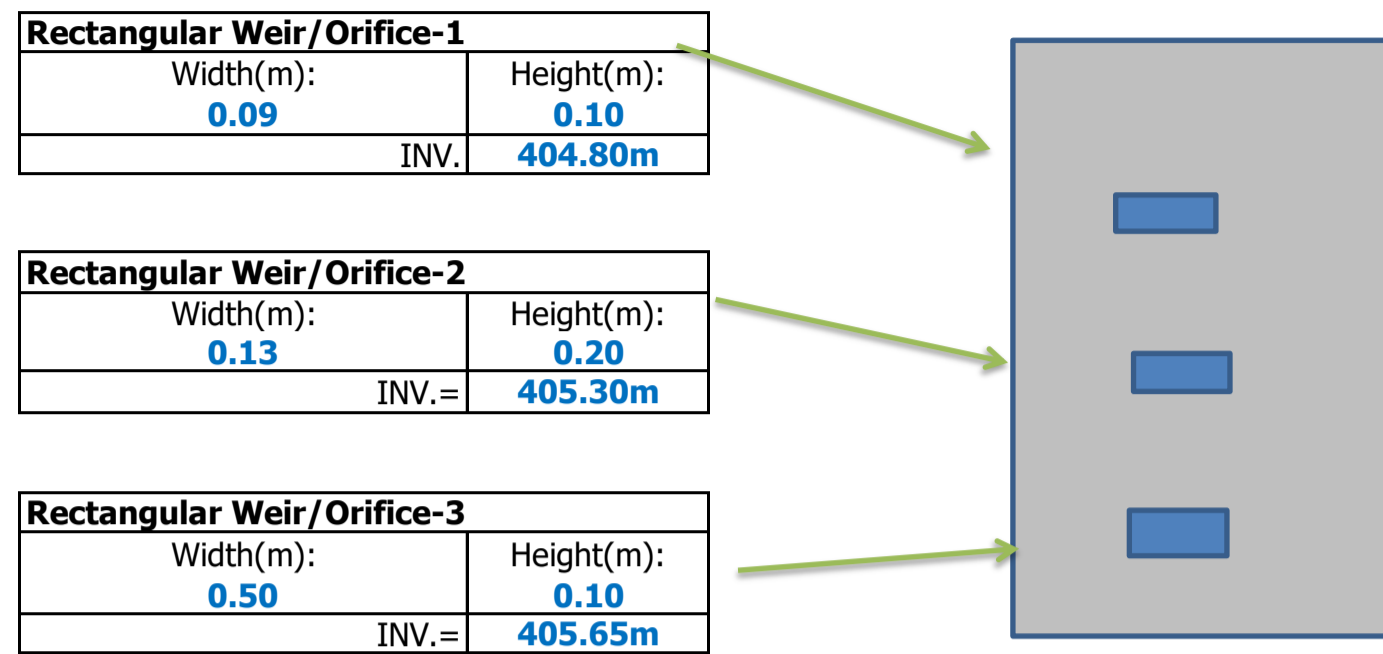
SWM INFILTRATION TANK DESIGN CALCULATIONS  
SWMF-7: Outlet Structure Calculation - Infiltration Tank

Project Name: Empire Erin, 5525 8th Line  
Municipality: Town of Erin  
Project No.: 21-684  
Date: 9/18/2022

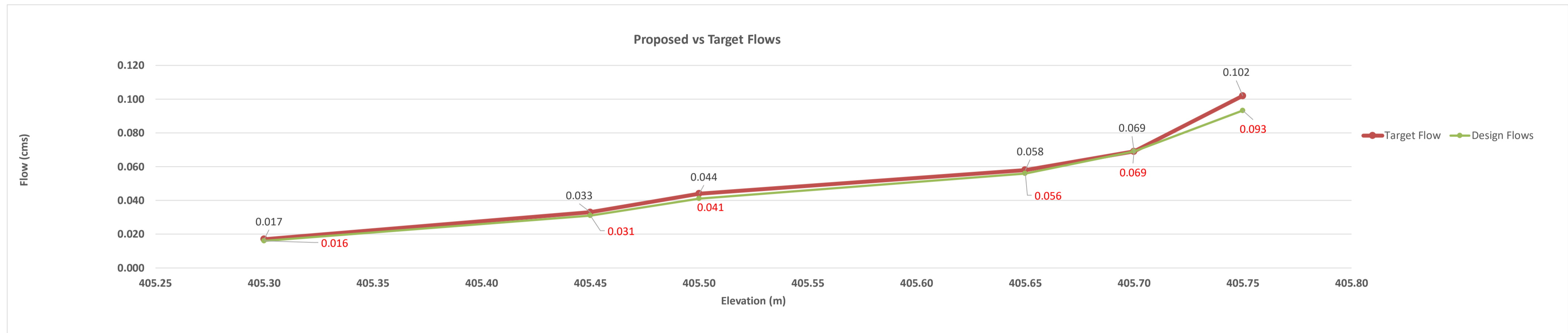
Prepared by: D.L.  
Checked by: A.B.  
Submission #: 2nd Submission

North Infiltration Tank  
OUTLET STRUCTURE CALCULATIONS

Return Period	Elevation	Q <sub>TARGET</sub>	H <sub>WEIR_1</sub>	H <sub>WEIR_2</sub>	H <sub>WEIR_3</sub>	Q <sub>WEIR_1</sub>	Q <sub>ORIFICE_1</sub>	Q <sub>WEIR_2</sub>	Q <sub>ORIFICE_2</sub>	Q <sub>WEIR_3</sub>	Q <sub>ORIFICE_3</sub>	Q <sub>TOTAL_PROVIDED VIA OPENINGS</sub>	Q <sub>TOTAL_PROVIDED</sub>
	[m]	[m <sup>3</sup> /s]	[m]	[m]	[m]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]			[m <sup>3</sup> /s]	[m <sup>3</sup> /s]
<b>Bottom Infiltration Tank</b>	<b>404.80</b>												
--	404.85		0.050			0.00						0.002	0.002
--	404.90		0.100				0.01					0.005	0.005
--	404.95		0.150				0.01					0.008	0.008
--	405.00		0.200				0.01					0.009	0.009
--	405.05		0.250				0.01					0.011	0.011
--	405.10		0.300				0.01					0.012	0.012
--	405.15		0.350				0.01					0.013	0.013
--	405.20		0.400				0.01					0.014	0.014
--	405.25		0.450				0.02					0.015	0.015
<b>2-YR</b>	<b>405.30</b>	<b>0.017</b>	0.500	0.000			0.02	0.00				0.016	0.016
--	405.35		0.550	0.050			0.02	0.00				0.019	0.019
--	405.40		0.600	0.100			0.02	0.01				0.025	0.025
<b>5-YR</b>	<b>405.45</b>	<b>0.033</b>	0.650	0.150			0.02	0.01				0.031	0.031
<b>10-YR</b>	<b>405.50</b>	<b>0.044</b>	0.700	0.200			0.02		0.02			0.041	0.041
--	405.55		0.750	0.250			0.02		0.03			0.047	0.047
--	405.60		0.800	0.300			0.02		0.03			0.052	0.052
<b>25-YR</b>	<b>405.65</b>	<b>0.058</b>	0.850	0.350	0.000		0.02		0.03	0.00		0.056	0.056
<b>50-YR</b>	<b>405.70</b>	<b>0.069</b>	0.900	0.400	0.050		0.02		0.04	0.01		0.069	0.069
<b>100-YR</b>	<b>405.75</b>	<b>0.102</b>	0.950	0.450	0.100		0.02		0.04		0.03	0.093	0.093
--	405.80		1.000	0.500	0.150		0.02		0.04		0.04	0.109	0.109



<b>Weir equation:</b>	$Q = BxC_d \times H^{3/2}$	$Q = BxC_d \times H^{3/2}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 1.65$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$b = \text{width of the weir (m)}$	$b = \text{width of the weir (m)}$	$C_d = \text{coefficient of discharge}$
<b>Orifice equation:</b>	$Q = C_d \times A \times (2gH)^{0.5}$	$Q = C_d \times A \times (2gH)^{0.5}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 0.6, A = (1/4 \times \pi \times D^2)$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$a = \text{area of orifice (m}^2\text{)}$	$a = \text{area of orifice (m}^2\text{)}$	$C_d = \text{coefficient of discharge}$



# B11 EAST SWM DRY POND CALCULATIONS



## SWM POND DESIGN CALCULATION SWMF-1 TARGET SUMMARY - East Dry Pond

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

### East Dry Pond

Headwall(s)	
<b>Number of Headwalls:</b>	1C
<b>Drainage Area to HW:</b>	0.970 ha
<b>Minor System Flows @ HW:</b>	0.172 m <sup>3</sup> /s

Elevation	Storm Event	Surface Area (m <sup>2</sup> )	Incr. Volume (m <sup>3</sup> )	Cumulative Volume (m <sup>3</sup> )
405.45	BOTTOM Dry Pond	333		0
405.50	--	347	17	17
405.55	--	361	18	34
405.60	--	375	18	53
405.65	--	390	19	72
405.70	--	404	20	92
405.75	--	419	20	112
405.80	--	433	21	133
405.85	--	448	22	155
405.90	--	463	23	178
405.95	--	479	23	201
406.00	--	494	24	225
406.05	--	509	25	250
406.10	--	525	26	276
406.15	--	541	27	303
406.20	--	556	27	330
406.25	--	573	28	358
406.30	2-YR	589	29	387
406.35	--	605	30	417
406.40	--	621	31	447
406.45	--	638	31	478
406.50	5-YR	655	32	511
406.55	--	672	33	544
406.60	10-YR	689	34	577
406.65	--	706	35	612
406.70	--	723	36	648
406.75	25-YR	740	36	684
406.80	--	758	37	721
406.85	50-YR	776	38	760
406.90	--	794	39	799
406.95	100-YR	826	41	840

Note: Surface area and storage volume are generated from AutoCAD

**SWM POND DESIGN CALCULATION  
SWMF-1 TARGET SUMMARY - East Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

**East Dry Pond**

**Design Target**

Event	Pre-Development Discharge Target Flow	Uncontrolled Flow	SWM (Total) Target Flow	SWM (East) Target Flow	
EXT DET					
2 YR	0.306	0.145	0.161	<b>0.008</b>	m <sup>3</sup> /s
5 YR	0.530	0.210	0.320	<b>0.012</b>	m <sup>3</sup> /s
10 YR	0.700	0.253	0.447	<b>0.015</b>	m <sup>3</sup> /s
25 YR	0.949	0.312	0.637	<b>0.020</b>	m <sup>3</sup> /s
50 YR	1.136	0.380	0.756	<b>0.024</b>	m <sup>3</sup> /s
100 YR	1.310	0.423	0.887	<b>0.025</b>	m <sup>3</sup> /s

**Dry Pond Basic 60% long-term S.S. removal**

Impervious Level (%)	Water Quality Storage Vol m <sup>3</sup> /ha	Extended Detention m <sup>3</sup> /ha	Permanent Pool m <sup>3</sup> /ha
35%	90	40	-
55%	150	40	-
70%	200	40	-
85%	240	40	-

(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)

**Interpolated Storage Requirement**

<b>90%</b>	256	<b>40</b>	<b>216</b>
------------	-----	-----------	------------

	Area [ha]	IMP%
<b>Total Contributing Area</b>	0.97	90%
<b>Quantity Control Only</b>	0.97	90%
<b>Quality Control Only</b>	0.97	90%

Return Period	Stage (m)	Target Discharge (m <sup>3</sup> /s)	Required V06 Volume to control to Targets (m <sup>3</sup> )	Provided Volume (m <sup>3</sup> )	Design Discharge Rate From Outlet Structure (m <sup>3</sup> /s)
<b>BOTTOM DRY POND</b>	405.45	-	-	-	-
	-	-	-	-	-
2-YR	406.30	0.008	387	387	0.008
5-YR	406.50	0.012	497	511	0.012
10-YR	406.60	0.015	569	577	0.015
25-YR	406.75	0.020	664	684	0.019
50-YR	406.85	0.024	730	760	0.022
100-YR	406.95	0.025	840	840	0.025
EMERGENCY	0.00	0.286	-	-	0.299

	SWM design sheet 100-Year Uncontrolled Flow (m <sup>3</sup> /s)	Emergency Flow (m <sup>3</sup> /s)
<b>HW1</b>	0.286	0.286

5-YR Uncontrolled Flow = 0.172 m<sup>3</sup>/s  
100-YR Uncontrolled Flow = 0.286 m<sup>3</sup>/s

**SWM POND DESIGN CALCULATIONS**  
SWMF-2: Outlet Structure Calculation - East Dry Pond

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Submission #:** 2nd Submission

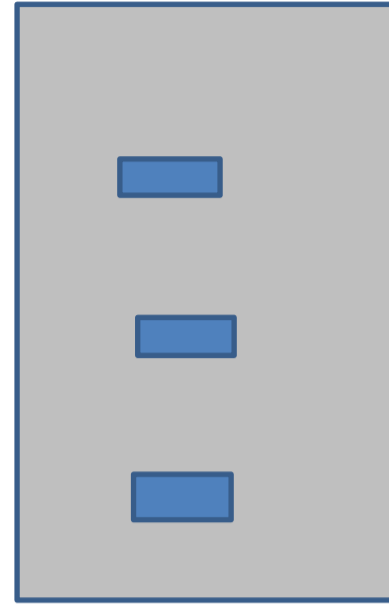
**East Dry Pond**  
**OUTLET STRUCTURE CALCULATIONS**

Return Period	Elevation	Q <sub>TARGET</sub>	H <sub>WEIR_1</sub>	H <sub>WEIR_2</sub>	H <sub>WEIR_3</sub>	Q <sub>WEIR_1</sub>	Q <sub>ORIFICE_1</sub>	Q <sub>WEIR_2</sub>	Q <sub>ORIFICE_2</sub>	Q <sub>WEIR_3</sub>	Q <sub>ORIFICE_3</sub>	Q <sub>TOTAL_PROVIDED VIA OPENINGS</sub>	Q <sub>TOTAL_PROVIDED</sub>
	[m]	[m <sup>3</sup> /s]	[m]	[m]	[m]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]	[m <sup>3</sup> /s]			[m <sup>3</sup> /s]	[m <sup>3</sup> /s]
<b>BOTTOM Dry Pond</b>	<b>405.45</b>												
--	405.50		0.050			0.00						0.001	0.001
--	405.55		0.100				0.00					0.002	0.002
--	405.60		0.150				0.00					0.003	0.003
--	405.65		0.200				0.00					0.004	0.004
--	405.70		0.250				0.00					0.004	0.004
--	405.75		0.300				0.00					0.005	0.005
--	405.80		0.350				0.01					0.005	0.005
--	405.85		0.400				0.01					0.006	0.006
--	405.90		0.450				0.01					0.006	0.006
--	405.95		0.500				0.01					0.006	0.006
--	406.00		0.550				0.01					0.007	0.007
--	406.05		0.600				0.01					0.007	0.007
--	406.10		0.650				0.01					0.007	0.007
--	406.15		0.700				0.01					0.008	0.008
--	406.20		0.750				0.01					0.008	0.008
--	406.25		0.800				0.01					0.008	0.008
<b>2-YR</b>	<b>406.30</b>	<b>0.008</b>	0.850				0.01					0.008	0.008
--	406.35		0.900				0.01					0.009	0.009
--	406.40		0.950	0.000			0.01	0.00				0.009	0.009
--	406.45		1.000	0.050			0.01	0.00				0.010	0.010
<b>5-YR</b>	<b>406.50</b>	<b>0.012</b>	1.050	0.100			0.01		0.00			0.012	0.012
--	406.55		1.100	0.150			0.01	0.00				0.014	0.014
<b>10-YR</b>	<b>406.60</b>	<b>0.015</b>	1.150	0.200			0.01		0.01			0.015	0.015
--	406.65		1.200	0.250			0.01	0.01				0.016	0.016
--	406.70		1.250	0.300	0.000		0.01		0.01	0.00		0.017	0.017
<b>25-YR</b>	<b>406.75</b>	<b>0.020</b>	1.300	0.350	0.050		0.01		0.01	0.00		0.019	0.019
--	406.80		1.350	0.400	0.100		0.01		0.01		0.00	0.021	0.021
<b>50-YR</b>	<b>406.85</b>	<b>0.024</b>	1.400	0.450	0.150		0.01		0.01		0.00	0.022	0.022
--	406.90		1.450	0.500	0.200		0.01		0.01		0.00	0.024	0.024
<b>100-YR</b>	<b>406.95</b>	<b>0.025</b>	1.500	0.550	0.250		0.01		0.01		0.00	0.025	0.025

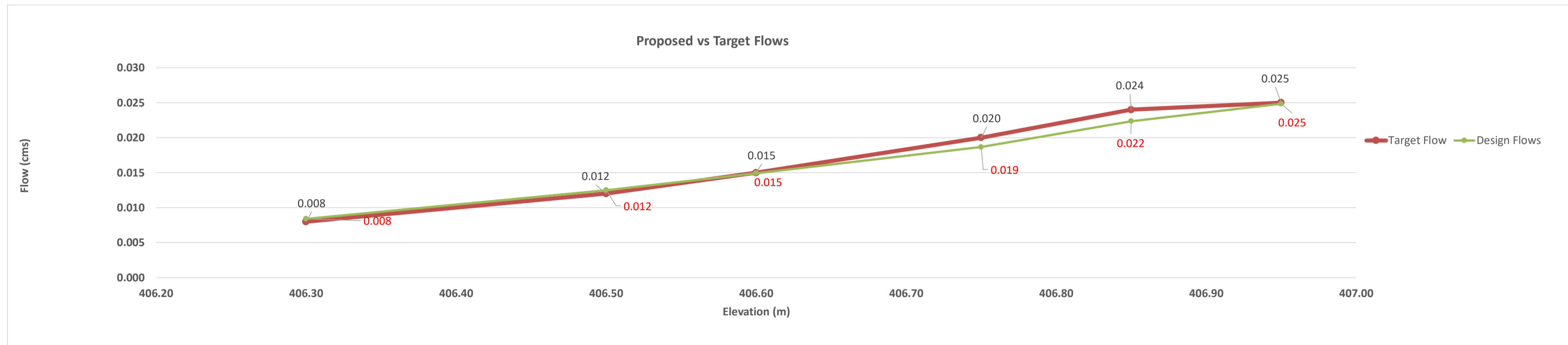
Rectangular Weir/Orifice-1	
Width(m): <b>0.05</b>	Height(m): <b>0.07</b>
INV. = <b>405.45m</b>	

Rectangular Weir/Orifice-2	
Width(m): <b>0.06</b>	Height(m): <b>0.08</b>
INV. = <b>406.40m</b>	

Rectangular Weir/Orifice-3	
Width(m): <b>0.06</b>	Height(m): <b>0.06</b>
INV. = <b>406.70m</b>	



<b>Weir equation:</b>	$Q = BxC_d \times H^{3/2}$	$Q = BxC_d \times H^{3/2}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 1.65$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$b = \text{width of the weir (m)}$	$b = \text{width of the weir (m)}$	$C_d = \text{coefficient of discharge}$
<b>Orifice equation:</b>	$Q = C_d \times A \times (2gH)^{0.5}$	$Q = C_d \times A \times (2gH)^{0.5}$	
where:	$q = \text{flow rate (m}^3/\text{s)}$	$q = \text{flow rate (m}^3/\text{s)}$	$C_d = 0.6, A = (1/4 \times \pi \times D^2)$
	$h = \text{head on the weir (m)}$	$h = \text{head on the weir (m)}$	$g = 9.81 \text{ (m/s}^2\text{) gravity}$
	$a = \text{area of orifice (m}^2\text{)}$	$a = \text{area of orifice (m}^2\text{)}$	$C_d = \text{coefficient of discharge}$





**SWM POND DESIGN CALCULATIONS**  
**SWMF-3 EMERGENCY SPILLWAY WEIR - East Dry Pond**

**Project Name:** Empire Erin, 5525 8th Line  
**Municipality:** Town of Erin  
**Project No.:** 21-684  
**Date:** 9/18/2022

**Prepared by:** D.L.  
**Checked by:** A.B.  
**Last Revised:** 2nd Submission

**East Dry Pond**

**Input Parameters:**

Side Slope, S <sub>1</sub>	3	:1
Side Slope, S <sub>2</sub>	3	:1
Weir Invert	406.95	m
Water Level	407.05	m
Flow Depth, H	0.10	m
Bottom Width, B:	6.00	m

**Weir equation:**  $Q = BxC_d \times H^{3/2} + SxC_d \times H^{5/2}$

$C_d = 1.5$

where:  $Q = \text{flow rate (m}^3/\text{s)}$

$H = \text{head on the weir (m)}$

$B = \text{width of the weir (m)}$

$S = \text{side slopes of weir (H:V)}$

**Computed Values:**

			Depth (m)
Capacity, Q at 407m =	0.10	m <sup>3</sup> /s	0.05
Capacity, Q at 407.05m =	0.30	m <sup>3</sup> /s	0.10
Capacity, Q at 407.1m =	0.56	m <sup>3</sup> /s	0.15
Capacity, Q at 407.15m =	0.89	m <sup>3</sup> /s	0.20
Capacity, Q at 407.2m =	1.27	m <sup>3</sup> /s	0.25
Capacity, Q at 407.05m =	<b>0.30</b>	<b>m<sup>3</sup>/s</b>	0.10
<b>Emergency Flow via Spillway =</b>	<b>0.29</b>	<b>m<sup>3</sup>/s</b>	Uncontrolled 100-yr Flow

**The proposed emergency spillway provides sufficient capacity.**

# B12 SWALE DESIGN

## Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Friday, Sep 1 2023

### 21-684 North Swale to Wetland

#### Trapezoidal

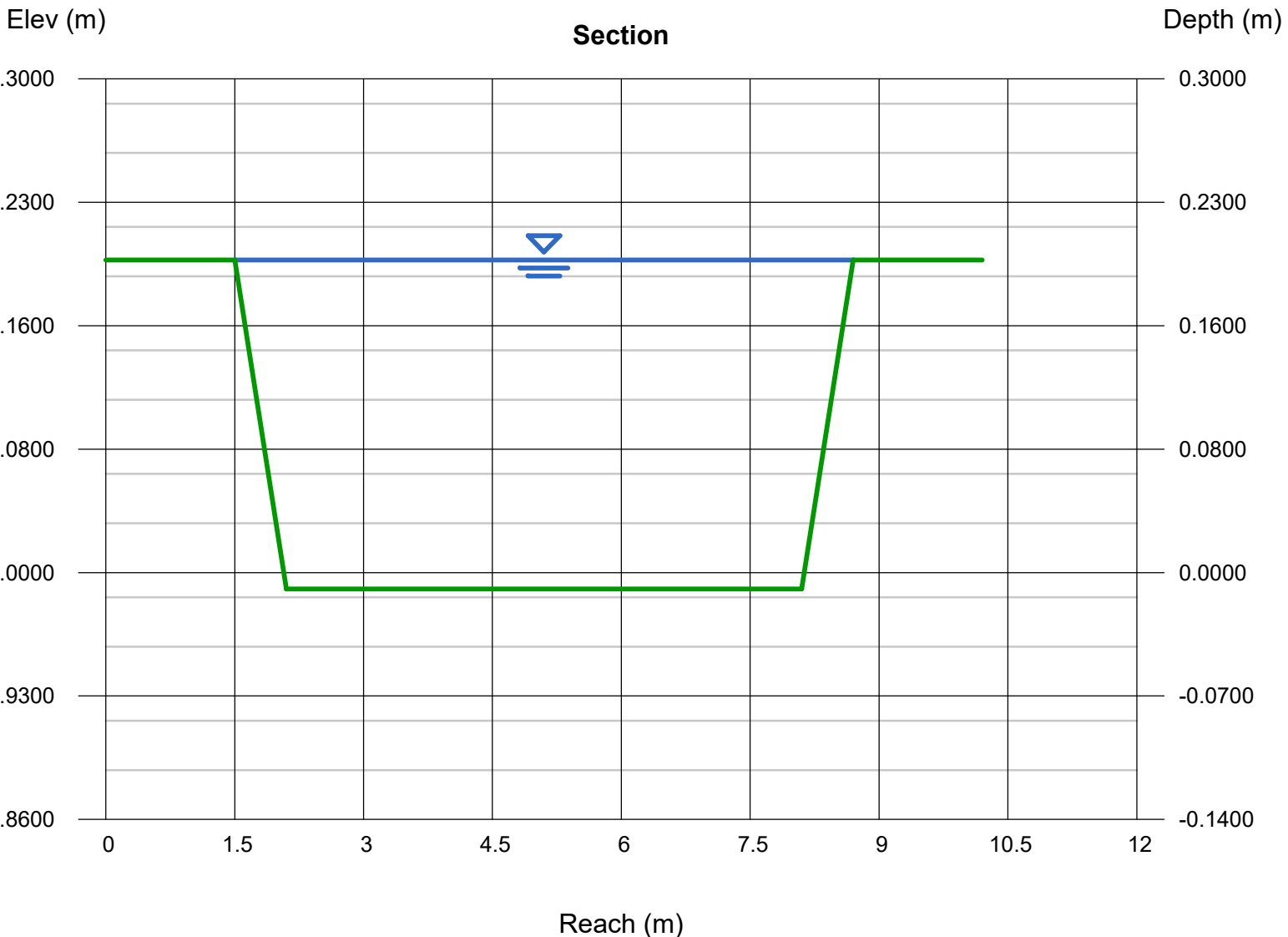
Bottom Width (m) = 6.0000  
Side Slopes (z:1) = 3.0000, 3.0000  
Total Depth (m) = 0.2000  
Invert Elev (m) = 403.0000  
Slope (%) = 3.0000  
N-Value = 0.025

#### Highlighted

Depth (m) = 0.2000  
Q (cms) = 2.9334  
Area (sqm) = 1.3200  
Velocity (m/s) = 2.2223  
Wetted Perim (m) = 7.2649  
Crit Depth, Yc (m) = 0.2000  
Top Width (m) = 7.2000  
EGL (m) = 0.4519

#### Calculations

Compute by: Q vs Depth  
No. Increments = 2



Depth	Q	Area	Veloc	Wp	Yc
(m)	(cms)	(sqm)	(m/s)	(m)	(m)
0.1000	0.908	0.630	1.4418	6.6325	0.1311
0.2000	2.933	1.320	2.2223	7.2649	0.2000

TopWidth	Energy
(m)	(m)
6.6000	0.2060
7.2000	0.4519

## **APPENDIX C**

### **BACKGROUND STUDIES**

Updated Hydrogeological Assessment, Water Balance Assessment and Source Water  
Protection Analysis, Erin Fairways Subdivision, 5525 Eighth Line  
(Terra-Dynamics Consulting Inc., Sep 2023)

---

**Updated Hydrogeological Assessment,  
Water Balance Assessment and Source  
Water Protection Analysis, Erin Fairways  
Subdivision, 5525 Eighth  
Line, Town of Erin,  
Ontario**

*Prepared for:*

**EC (Erin) GP Inc., 125 Villarboit Crescent Vaughan, ON L4K 4K2**

*Prepared by:*

**Terra-Dynamics Consulting Inc.  
432 Niagara Street, Unit 2  
St. Catharines, ON L2M 4W3  
(905) 646-7931**

**September 19, 2023**



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- D. Provincial Maps



# **Terra-Dynamics Consulting Inc.**

**432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3**

September 19, 2023

Mr. Thanassi Lefas, P.Eng.  
Project Manager, Land Development  
EC (Erin) GP Inc.  
125 Villarboit Crescent  
Vaughan, ON L4K 4K2

Re: Updated Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis,  
Erin Fairways Subdivision, 5525 Eighth Line, Town of Erin, ON

Dear Mr. Lefas,

## **EXECUTIVE SUMMARY**

The Erin Fairways Subdivision is proposed for development at the Erin Heights Golf Course. A water level monitoring network of groundwater monitoring wells, and downgradient monitors of wetlands, surface water and shallow groundwater have been in operation since mid-2021 to document pre-development conditions over a period of 24 months. Site design can (i) accommodate water balance maintenance for the downgradient Provincially significant wetlands, and (ii) the protection of the nearby municipal supply well.

### **1.0 Introduction and Background Information**

Terra-Dynamics Consulting Inc. (Terra-Dynamics) respectfully submits this updated study (previously submitted as Terra-Dynamics Consulting Inc., 2022) of the proposed Erin Fairways Subdivision (the Site, Figure 1) providing additional monitoring data and responding to comments from government review agencies (Town of Erin, 2022). 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 (Credit Valley Conservation (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 generally 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.

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. as the Site includes a municipal WHPA, this 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 m ASL (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 Conservation et al, 2011). It is noted that downstream of the golf course on the Erin Branch, the thermal regime is historically reported as cool water (Credit Valley Conservation et al, 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 phreatophytes or 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 on the Erin Branch, which was responsive to precipitation events (Appendix A). Surface

water flows have also been measured at SW-2 as well as downstream at SW-3 in spring, summer and fall and the results discussed in the next Section.

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). A staff gauge (ID SW-1) was installed in summer 2021, but was destroyed during the fall season of 2021 as part of a washout of the tributary, and the station re-installed in spring season of 2022 and re-equipped with a water level datalogger. It is currently presumed that this tributary intersects the shallow groundwater table adjacent to the Site. The pre-development portion of the Site was 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<sup>3</sup>/s was calculated, including a mean flow of 0.47 m<sup>3</sup>/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 90<sup>th</sup> 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<sup>2</sup>, August 1992) as well as an area of groundwater recharge (-9.1 L/sec/km<sup>2</sup>, 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 artesian or 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 Hydrogeology and Golder Associates, 2010).

Manual surface water flow measurements from 2021 to 2023 have been completed at SW-1, SW-2 and SW-3, to include two sets of measurements in the spring, summer and fall seasons. The dates of these measurements include: (i) August 25, 2021, (ii) November 10, 2021, (iii) April 5, 2022, (iv) August 4, 2022, (v) November 10, 2022, and (vi) May 19, 2023. The results (discussed below) generally showed the Erin Branch of the West Credit River between Stations SW-2 and SW-3 as a gaining reach, with the exception of April 5, 2022.

1. No measurable precipitation occurred for 8 days prior to the August 25, 2021 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, 2021 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, which may represent baseflow, 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, which may represent baseflow, in the Erin Branch of the West Credit River decreased from 729 to 562 L/s between Stations SW-2 and SW-3, respectively.
4. Precipitation was 26 mm the day before flow measurements on August 4, 2022, although precipitation had been less than 3.5 mm the 9 days prior to that. The approximate flow at the tributary (Station SW-1) was estimated as 0.5 L/s. The measured flow in the Erin Branch of the West Credit River increased from 131 to 205 L/s, between stations SW-2 and SW-3, respectively.
5. No precipitation was measured 5 days prior, or less than 3 mm over the 10 days prior to the flow measurements on November 10, 2022. The approximate baseflow at the tributary (Station SW-1) was 0.26 L/s. The measured baseflow in the Erin Branch of the West Credit River increased from 229 to 242 L/s, between Stations SW-2 and SW-3, respectively.
6. No precipitation was measured for 11 days prior to the flow measurements of May 19, 2023. The approximate baseflow at the tributary (Station SW-1) was 0.59 L/s. The measured baseflow in the Erin Branch of the West Credit River increased from 459 to 691 L/s between stations SW-2 and SW-3, respectively.

The surface water measurements indicated the West Credit reach between SW-2 and SW-3 was generally a gaining reach, i.e. groundwater discharge increased surface water flows, however, it can also be a losing reach upon occasion, i.e. groundwater recharge decreases surface water flows.

### 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).

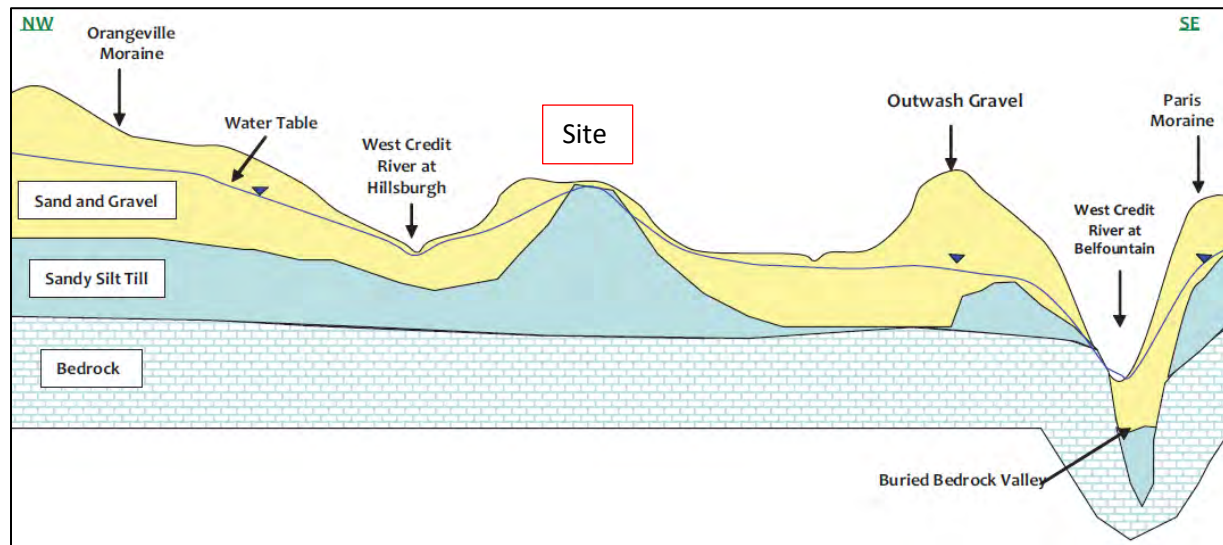


Figure 4 – Hillsburgh and Erin Schematic Cross-Section (Credit Valley et al, 2011)

### 3.4 Overburden Groundwater

#### 3.4.1 Hydraulic Conductivity

The hydraulic conductivity of overburden materials was investigated using a combination of (i) hydraulic conductivity testing of on-site monitoring wells and (ii) grain-size analyses from the geotechnical investigation.

#### Shallow Soil Grain-Size Analyses

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):  $7 \times 10^{-6}$  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):  $5 \times 10^{-7}$  m/s
6. Silty Sand Fill (boreholes BH21-9 and MW21-10):  $1 \times 10^{-7}$  to  $6 \times 10^{-8}$  m/s

While the calculated hydraulic conductivity results appear low for some of the reported shallow 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  $5 \times 10^{-4}$  to  $5 \times 10^{-6}$  m/s were identified for approximately 28% of the Site (AquaResource Inc., 2009), e.g.  $1 \times 10^{-7}$  m/s at BH21-9 is the same as reported by the MECP for sandy/silty diamicton (2006).

### Monitoring Well Testing

Monitoring well hydraulic conductivity testing was completed on August 2, 2023. A bail-down/ rising-head approach was used at the four on-site monitoring well locations (MW21-1, MW21-2, MW21-3 and MW21-10).

The hydraulic conductivity test results were analyzed using a Bouwer and Rice analysis (Bouwer, 1989) as recommended when the water level is within the screen (Bair, 2005) which occurred in some cases. The analyses were completed in Aqtesolv™ and are presented in Appendix C. The results are listed below with the hydraulic conductivity assigned to the most permeable geologic unit screened at each well, e.g. MW21-20 is screened across silty sand and silty sand till, however the hydraulic conductivity of  $2 \times 10^{-5}$  m/s is assigned to the silty sand. It is noted that the results for the silty sand varied within the minimum to maximum expected published range of  $10^{-5}$  to  $10^{-7}$  m/s (Fetter, 1995).

- a) Silty Sand (MW21-3)  $5 \times 10^{-5}$  m/s
- b) Silty Sand (MW21-10)  $2 \times 10^{-5}$  m/s
- c) Silty Sand (MW21-2)  $3 \times 10^{-7}$  m/s
- d) Silty Sand Till (MW21-1),  $2 \times 10^{-7}$  m/s

The geometric mean value for the silty sand is  $6 \times 10^{-6}$  m/s.

The silty sand till value of  $2 \times 10^{-7}$  m/s is comparable to published ranges for this material (Fetter, 1995, AquaResource Inc., 2009). It should be noted that groundwater control pumping methods are “*not feasible and may not be necessary*” for granular soils with hydraulic conductivities of  $10^{-7}$  m/s or less (Preene, 2020). For example, an excavation 250 m wide and 5 m deep into the saturated silty sand till would be expected to generate less than 3,000 Litres/day based upon a Darcy flow calculation (Fetter, 1995).

### **3.4.2 Shallow Overburden Groundwater Flow On-Site**

In April 2021, four monitoring wells were constructed on-site as part of the geotechnical investigation (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 underlying silty sand till from 7.6 to 10.6 m BGS. DS Consultants have completed manual and datalogger monitoring at these locations since Spring 2021 and continue measurements in 2023. The data collected for greater than two years exceeds the Town’s requirement for “*a minimum of 12 months to confirm the seasonally high groundwater table*” (Town of Erin, 2022). The water level plots and manual measurements are presented in Appendix A.

The greater than two years of groundwater monitoring have captured the spring season high water levels in 2022 and 2023. Above average March precipitation was observed in both those years compared to climate normals for the Shand Dam Environment Canada Station, i.e. 125% and 214% of average, respectively for 2022 and 2023 (Table A-1). An extensive period of below average precipitation was also captured from the spring to fall seasons of 2022, e.g. the April to November, 2022 precipitation was 69% of average.

On-site groundwater level measurements are summarized in Table 2, with the following observations:

- a) Spring groundwater levels less than 1 m BGS were observed at MW21-2 (0.3 m BGS) and MW21-10 (0.1 m BGS);
- b) Water table levels were generally in the silty sand till in the southern/upland portion of the Site and in the overlying sand in the northern/downgradient portions of the Site. This divide roughly follows the top of till at 410 m ASL;
- c) An upward vertical gradient was generally observed between MW21-1 and MW21-10 at the southern upland area of the Site;
- d) The average water table change/variation from fall season to spring season was an increase of 2.1 m; and
- e) Groundwater levels regularly fluctuate at MW21-2 on the order of 0.5 m, which may be related to operation of municipal well E8 that is approximately 65 metres away.

**Table 2 - Groundwater Level Measurements**

Location	Spring 2022	Fall 2022	Spring 2023	Spring 2022	Fall 2022	Spring 2023	Spring/Fall 2022	Fall 2022/ Spring 2023
	Elevation (m ASL)			Depth (m BGS)			Variation (m)	
<b>WATER TABLE</b>								
MW21-2	398.5	396.3	398.4	0.3	2.5	0.4	2.2	2.1
MW21-3	400.2	398.8	400	5.5	6.9	5.7	1.4	1.2
MW21-10	418.7	416.1	419	0.4	3	0.1	2.6	2.9
<b>UNDERLYING SILTY SAND TILL</b>								
MW21-1	419.6	414.2	419.7	3.2	8.6	3.1	5.4	5.5

Shallow overburden groundwater flow mimics the topography 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). A hydraulic gradient of 0.061 m/m is calculated from Figure 5. 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 (Figure 3). It is noted that the Spring/April 2022 high groundwater level shown on Figure 3 is generally 1 m higher than that visualized on Figure 5 for December 2021, except near the northern part of the Site which was relatively the same elevation.

### 3.4.3 Shallow Overburden Groundwater Flow Off-Site/Downgradient

In August, 2021, shallow drive-point piezometers and staff gauges were installed to monitor (a) shallow groundwater at the two wetland polygons (GW-1 and GW-2), (b) surface watercourses (SW-1 Tributary and SW-2 Erin Branch of the West Credit River), (c) wetland surface water levels (WET-1 and WET-2) and (d) shallow groundwater adjacent the 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, while 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 water level datalogging pressure transducers were installed in each. The hydrographs for these are shown in Appendix A and described below. During the monitoring period precipitation conditions were (i) above average from August, 2021 to April, 2022, (ii) below average from May, 2022 to November, 2022 and (iii) above average from December, 2022 to July, 2023 (Table A-1).

1. Water levels in the SWM3-2 poplar swamp (WET-1/GW-1): (a) water levels at the wetland varied 30 cm (WET-1) and varied 70 cm at the drive-point piezometer (GW-1) from dry conditions (e.g. summer 2022) to wet conditions (e.g. spring 2022 and 2023), (b) water levels were generally below ground surface except during fall season of 2021 and spring season of 2022 during a period of above average precipitation (Table A-1), and (c) the vertical gradient was generally downwards, however upward gradients did occur in response to precipitation and during the 2023 spring season high water level conditions. Groundwater levels at monitoring well MW21-2 were generally lower than GW-1 except during spring, meaning generally a downgradient gradient in the shallow system.
2. Water levels in the SWM4-1 cedar swamp (WET-2/GW-2) were (a) below ground surface during the two years of monitoring, (b) at the wetland staff gauge (WET-2) generally 30 cm below ground surface and at the drive-point piezometer 45 cm, (c) a downward vertical gradient was observed between the wetland staff gauge (WET-2) and the deeper drive-point piezometer (GW-2) and (d) the groundwater levels at GW-2 showed some responsiveness to precipitation events. To further characterize groundwater conditions near the cedar swamp two additional monitoring wells (MW-2-00 and MW-6-00), up- and down-gradient of the wetland, were installed with water level loggers in November, 2022 and November, 2021, respectively. The monitoring wells are 4.1 and 2.8 m BGS deep. The average monitoring well groundwater levels up-gradient of the wetland were about 3 m BGS (MW-2-00) and downgradient of the wetland 1 m BGS (MW-6-00), suggesting an overall downward vertical gradient from the wetland to the groundwater table.
3. Shallow groundwater levels adjacent the west tributary (GW-3) were (a) generally 40 to 60 cm below of ground surface until 2023 when backflow from the Irrigation Pond elevated levels sometimes above ground surface, and (b) since deepening the drive-point piezometer in April, 2022 upward gradients compared to surface water station SW-1. The water level depth at SW-1 was generally less than 10 cm until the summer season of 2023 when back flow into channel from the Irrigation Pond was noted.
4. Shallow groundwater levels adjacent to the Erin Branch of the West Credit River (GW-4) were (a) generally within 20 cm of ground surface, (b) responsive to precipitation events, and (c) had a fairly consistent upward vertical gradient compared to nearby surface water gauge SW-2.

### **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 (Credit Valley Conservation 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 Conservation 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 artesian in nature or 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 three 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 and so does not function as an aquifer. 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 and (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 the wetland water level monitoring stations noted (i) 0.65 metres of clay and silt at the SWM4-1 cedar swamp over sand (WET-2, SWM4-1, polygon 4a), and (ii) 0.75 m clay and silt over silty sand at the SWM3-2 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). Perched conditions were commonly noted at both wetlands as shown by the shallow water level monitoring (Section 3.4.3).

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).

As discussed in Section 3.4.3, water level monitoring has been on-going since late August, 2021 and includes a measure of the vertical gradient. Based upon the water level monitoring:

- a) The SWM3-2 poplar swamp (WET-1/GW-1) was generally under recharge conditions however, groundwater discharge could occur (e.g. spring season of 2022). Wetland water levels were very shallow, on average 7 cm below ground surface in the clay and silt, and the shallow groundwater levels were also shallow averaging 30 cm below ground surface.
- b) The SWM4-1 cedar swamp (WET-2/GW-2) was under recharge conditions as water levels were generally 30 cm below ground surface in wetland silt and clay and the shallow groundwater levels 45 cm below ground surface.

The wetlands are a combination of three types, as visualized below in Figure 6: (ID (a)) surface water depression, (ID (c)) groundwater depression and (ID (d)) groundwater slope wetlands as reported by Mitsch and Gosselink (2007). The relevant portions of the definitions of these groundwater flow schematics are also presented below. This combination model is proposed as (i) the wetlands are underlain by a low permeability layer allowing some perched to mounded conditions, (ii) the ground surface gently slopes, (iii) at the SWM4-1 cedar swamp the water table is below ground surface under recharge conditions and at the SWM3-2 poplar swamp the water table is usually below ground surface but groundwater discharge can occur and (iv) a shallow depth to groundwater allows for root uptake of groundwater (McBean, Rovers and Farquhar, 1995).

Surface Water depression wetlands (ID (a)): “...little groundwater outflow due to a layer of low-permeability soils...where the wetland is separated from the water table by an unsaturated zone”

Groundwater depression wetlands (ID (c)): “...groundwater discharge wetlands...in a depression low enough to intercept the local groundwater table... can occur in coarse-textured glaciofluvial deposits...Water-level fluctuations...less dramatic than... surface flow....because of the relative stability of the groundwater levels”

Groundwater slope wetlands (ID (d)): “Wetlands often develop on slopes ...Groundwater flow into these wetlands can be ...seasonal...”

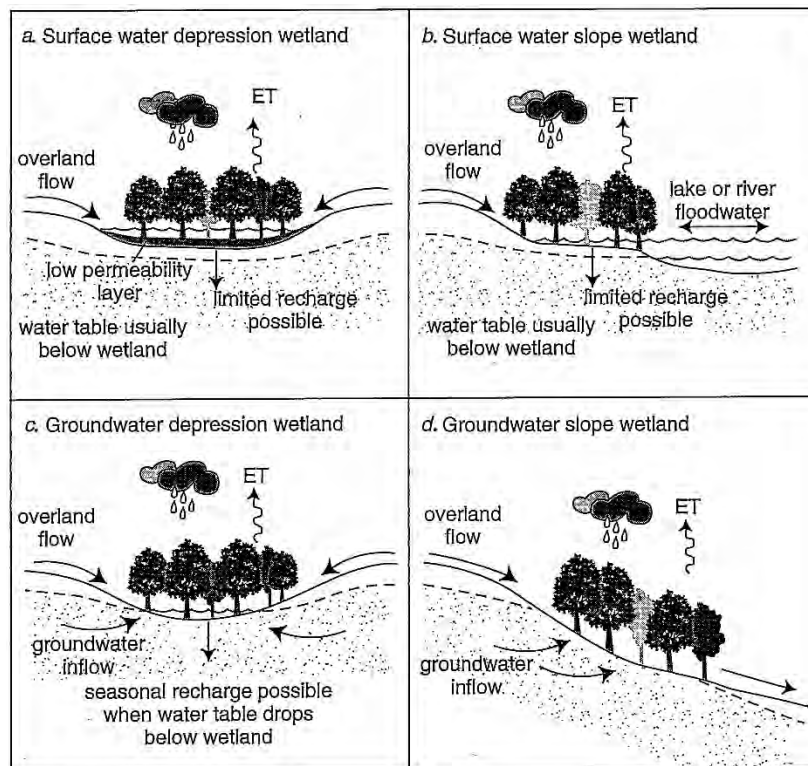


Figure 6 – Groundwater flow patterns for wetlands (Mitsch and Gosselink, 2007)

The upgradient catchment areas for each wetland were calculated using topographic contours and are 2.16 and 7.56 hectares for the cedar (SWM4-1, 4a wetland polygon) and poplar (SWM3-2, 5a wetland

polygon) swamps, respectively (Table 3, Figure 5). The cedar and poplar swamps are 1.2 and 1.0 hectares approximately in size, respectively, with upgradient wetland catchment drainage areas of 1.38 and 6.05 (Table 3, Figure 5). It should be noted that 0.78 ha (Cedar wetland) and 1.51 ha (Poplar wetland) 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).

**Table 3 – Wetland Catchment Areas**

Wetland	ELC	Size (ha)	Upgradient Catchment (ha)	Upgradient Catchment Within Site (ha)	Unchanged Upgradient Area (ha)
Cedar - 4a	SWM4-1	1.2	2.16	1.38	0.78
Poplar - 5a	SWM3-2	1.0	7.56	6.05	0.51

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 may not be in operation following residential development of the Site. Consequently, this would benefit wetland hydrology, as the Irrigation Pond would not be drawn down for irrigation purposes during the growing season.

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 8<sup>th</sup> Line and the Site. Surface water balance analyses of the 1961-2004 dataset provided the following water balance results in mm per year: (i) Precipitation 894, (ii)

Evapotranspiration 437 (49% of precipitation), (iii) Runoff 139 (16% of precipitation) and (iv) Recharge 319 (36% of precipitation). 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 average groundwater recharge was completed for the period 1960-2005. The results for the Site in mm per year 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<sup>3</sup>/year. However, it should be noted that these modelled results remain significantly in excess of typical MECP groundwater recharge rates (Table 4).

Table 4 - 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 4, MECP, 1995). Consequently, given a CVC modelled recharge rate of 374 mm/year for the Site (Section 3.6.2), the Site 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 5. 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 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 5). These values exceed the modelled Site pre-development recharge rate of 340 mm/year, with an average '10 mm or greater precipitation' value of 425 mm/year exceeding the modelled recharge by 25%. However, a larger amount of precipitation abstraction is required for the Site as 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) 20 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 6). If a higher recharge rate is required more permeable soils than loam could be specified for fill areas. Table 6 is further explained below:

- (a) Infiltration of ‘clean’ runoff from 3.86 hectares of impervious areas (i.e. multiplied by 727 mm/year for capture or precipitation events from 1 to 15 mm) via a 3<sup>rd</sup> pipe system to infiltration areas at the stormwater management facilities resulting in an estimated annual recharge volume of 28,062 m<sup>3</sup>/year; and
- (b) 4.90 hectares of continuing recharge for the permeable areas of lots, the park and the stormwater management areas.
  - a. 3.10 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 4,278 m<sup>3</sup>/year.
  - b. 1.80 hectares multiplied by 302 mm/year (representing areas where native soils will be at-surface not fill) for an annual recharge volume of 5,436 m<sup>3</sup>/year. This was calculated in the southern portion of the Site to include areas of less than 2 m of excavation.

The eastern infiltration area will provide groundwater recharge to, and discharge to, the eastern tributary and the eastern wetland (Figure 5).

It is also noted that recent annual precipitation amounts are generally above the 1980-2010 climate normal of 946 mm/year. 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 and increase in winter groundwater recharge (Shifflett, 2014).

**Table 5 - 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	1,199 (127%)	152 (42%)	395	175 (48%)	686	184 (50%)	840
2014	1,102 (116%)	152 (42%)	407	174 (48%)	677	177 (48%)	731
2015	866 (92%)	138 (38%)	386	149 (41%)	523	156 (43%)	643
2016 (Leap)	1,032 (109%)	138 (38%)	420	151 (41%)	588	160 (44%)	740
2017	1,110 (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)	1,017 (108%)	123 (34%)	423	139 (38%)	622	147 (40%)	765
2021	878 (93%)	144 (39%)	428	150 (41%)	498	151 (41%)	516
2022	808 (85%)	145 (40%)	426	159 (44%)	597	159 (44%)	706
Average	996 (105%)	144 (39%)	425	159 (43%)	604	165 (45%)	727

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)
Median	1,025 (109%)	145 (40%)	422	153 (42%)	605	163 (45%)	720

Note: \* - Shand Dam (Station 6142400) 1981-2010 Average Precipitation of 946 mm/year, 20 km away

**Table 6 – Annual Estimated Site Recharge Rates**

	Area (hectares)	Recharge (mm/year)	Volume (m <sup>3</sup> /year)
<b>Pre-development</b>	13.86	340	<b>47,081</b>
<b>Post-development</b>	3.86 (clean impervious roof areas via 3 <sup>rd</sup> pipe to infiltration systems)	727	28,062
	3.10 (pervious areas fill)	138	4,278
	1.80 (pervious areas native)	302	5,436
		SUM	<b>37,776</b>

#### 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/year 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/year was higher than that modelled by CVC, and may be a result of the more detailed CVC 1-hour modelling time steps. The monthly modelling wetland results (Table 7) 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 7 – Monthly Wetland Water Balance (mm)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Precipitation (mm)</b>	68	56	60	74	87	84	89	97	93	77	93	69
<b>Potential (mm) Evapotranspiration</b>	8	10	18	36	67	98	113	91	54	29	15	9
<b>Soil Moisture (mm)</b>	350	350	350	350	350	<b>332</b>	<b>305</b>	<b>306</b>	<b>340</b>	350	350	350
<b>Soil Water Depletion (mm)</b>						18	45	44	10			

#### 4.6 Maintenance of the Wetland Water Balance

The water balances for the wetlands can be maintained post-development (Tables 8a/8b) and excess/increased recharge can continue to flow in the subsurface downgradient of the wetlands. The details presented in Tables 8a/8b details 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. Stormwater management infiltration of clean roof runoff will occur at two proposed infiltration facilities upgradient of the wetlands providing infiltration of events up to 20 mm (Urbantech, 2023a).
4. Uncontrolled drainage areas will provide recharge as well as discharge from impervious areas.
5. Lot-level infiltration will occur in pervious areas upgradient on-site.

**Table 8a – Annual Estimated Upgradient Wetland Recharge**

East SWM4-1 Cedar Wetland 4a Catchment	Area – on and off-site (hectares)	Recharge (mm/year)	Volume (m <sup>3</sup> )
<b>Pre-development</b>	2.16	374	<b>8,078</b>
<b>Post-development</b>	0.60 (clean roof runoff infiltrated at SWM)	727	4,362
	0.78 (preserved off-site upgradient buffer area)	374	2,917
	0.53 (uncontrolled drainage area recharge)	138	729
	0.14 (uncontrolled drainage area discharge)	996	1,394
	0.17 (pervious drainage upgradient on-site)	138	229
		<b>SUM</b>	<b>9,631</b>

**Table 8b – Annual Estimated Upgradient Wetland Recharge**

West SWM3-2 Poplar Wetland 5a Catchment	Area – on and off-site (hectares)	Recharge (mm/year)	Volume (m <sup>3</sup> )
<b>Pre-development</b>	7.56	359	<b>27,140</b>
<b>Post- development</b>	3.26 (clean roof runoff infiltrated at SWM)	727	23,700
	1.51 (preserved off-site upgradient buffer area)	374	5,647
	0.89 (uncontrolled drainage area recharge)	138	1,227
	0.11 (uncontrolled drainage area discharge)	996	1,084
	1.03 (pervious drainage upgradient on-site)	138	1,421
		SUM	<b>33,079</b>

## 4.7 Wetland Risk Evaluation

### 4.7.1 Magnitude of Hydrological Change

TRCA’s (2017) wetland risk evaluation decision tree includes four key hydrological change criteria):

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) Future impervious cover in for the Site is 73% (Urbantech, 2023a) which meets the criteria for a high magnitude of hydrological change as it is greater than 25%. However, this is without consideration of SWM infiltration mitigation measures.

(4) Active construction dewatering is not expected to be required (Section 6.0).

### 4.7.2 Sensitivity of the Wetlands

The risk assignment 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).
  - Years of monitoring both wetlands began in August, 2021.
- (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 (2023a).
- (iv) Additional emphasis placed on characterization of groundwater interaction [High Risk only, i.e. Wetland 4a]
  - Additional monitoring was implemented adding water level dataloggers to monitoring wells located up- and down-gradient of the wetland confirming an overall downwards vertical gradient at the Cedar wetland, with no groundwater discharge observed at the wetland monitoring stations Wet-2/GW-2.
- (v) Integrated hydrological model may be required where groundwater interaction is high [High Risk only, i.e. Wetland 4a]
  - Groundwater interaction is not considered high at the Cedar wetland and was under recharge conditions during the two years of monitoring which included both dry and wet precipitation periods. However, it is acknowledged that shallow groundwater levels were measured within a metre of surface. The existing CVC FEFlow model (AquaResource Inc., 2009) could be used if required, however it is unclear of the benefit of doing so as the conceptual model appears well understood and appropriate mitigation have been designed.

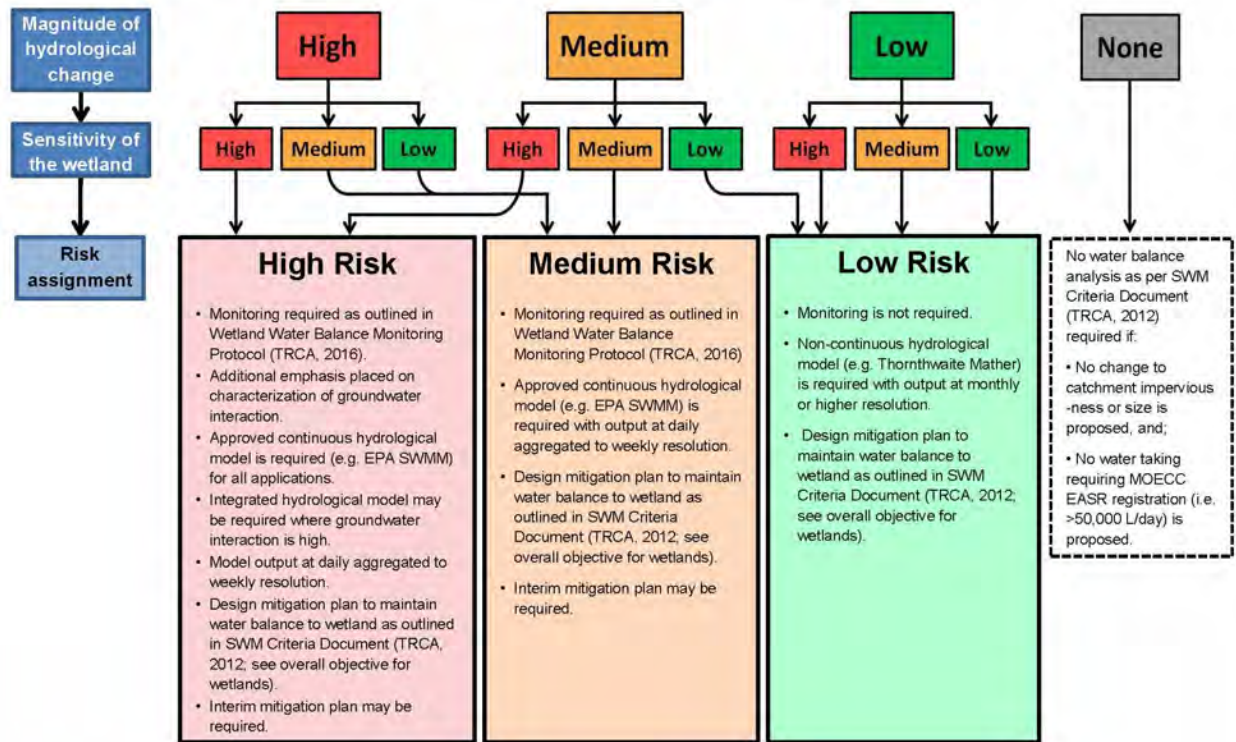


Figure 6 - Wetland Risk Evaluation Decision Tree

## 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: Sanitary sewer pipes proposed within the WHPA-A require higher than normal construction and operational standards in order that potential leakage is not a significant municipal drinking water threat. 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 8<sup>th</sup> Line right-of-way and therefore pass through the WHPA-A and require additional standards for implementation such as ensuring a closed system such as extra-flange protectors to prevent potential leakage.

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. However, 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 enforceable 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”*. Town Planning and Wellington Source Water Protection have asked to be providing a Salt Management Plan (Town of Erin, 2022). The Town of Erin was contacted by e-mail in July, 2023 to receive a copy of their plan, however no response was received. However, the Town of Erin previously shared that their approach is a 5% salt/95% sand mix except during freezing rain events whereby 10% salt/90% sand is applied. We would propose a similar approach for the Site. In addition the bedrock aquifer will be protected via a third-pipe system whereby only clean runoff will be infiltrated on-site. This is a reasonable approach given the bedrock aquifer supplying the municipal well is not highly vulnerable and previous study has concluded that the municipal well is not under the influence of surface water.

Wellington Source Water Protection have also asked that the at-surface/above-ground stormwater management facility *“have an impervious liner to avoid recharge of water containing contaminants, particularly sodium and chloride, back to the aquifer”* (Wellington Source Water Protection, 2023).

### **5.4 Existing Transport Pathways and Creation of Transport Pathways**

Transport pathways are existing, man-made 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 Permit to Take Water 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.

## 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 Dewatering Considerations

Responding to the comments on the first submission for development of the Site (Town of Erin, 2022), construction dewatering was considered and is not predicted to require an MECP Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW). This is because of:

- a) The large amount of fill required for development of the Site limiting the amount of construction below the water table (Urbantech, 2022); and
- b) Where the excavations are anticipated to be below the water table which generally correspond with the water table being at, or within the, lower permeability silty sand till, (i.e. the southern/upland areas of the Site, even compared to the spring season of 2022 high water table).

The deepest excavations are associated with the installation of sanitary sewers (Urbantech 2023b). These depths were compared to the top of the silty sand till and the associated water table in order to determine areas where the more permeable overlying sand may require dewatering.

1. In the northern/downgradient part of the Site, sanitary sewer excavations are above, or at, the high spring season of 2022 water table elevations because of the large amount of fill are being added to the existing surface of the Site. Consequently, construction dewatering is not predicted.
2. In the southern/upland areas of the Site where excavations are anticipated to generate very little need for dewatering, if any, because of the low permeability of the silty sand till (Section 3.4.1).
3. Where the water table could be within the permeable silty sand in some upland/southern areas during higher water table conditions. This is not expected to generate greater than 50,000 L/day of dewatering. For example, if 3 m of silty sand along a 250 m northeast-southwest trench required dewatering during the April high water table, the calculated Darcy flow is less than 25,000 L/day (Fetter, 1995). This is based upon a hydraulic gradient of 0.061 m/m (Section 3.4.2), and a hydraulic conductivity of  $6 \times 10^{-6}$  m/s (Section 3.4.1).

No negative impacts are predicted to the tributary east of the Site as active dewatering is not predicted to be required.

Post-construction dewatering is not an expected concern due to the amount of fill proposed for the Site combined with the low permeability of the underlying silty sand till. It is acknowledged that there is removal of soils in the southern part of the Site as part of the cut/fill plan (Urbantech, 2023c), however this removes the most permeable overlying soils in an area where the water table is generally lower (e.g. in the underlying silty sand till).

## 7.0 Conclusions and Recommendations

### 7.1 Conclusions

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%. Pre-development 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 making lot-level infiltration implementable
4. Surficial geology ranged from gravel and gravelly sand, to silty sand and silt, with a general 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 from the south-southeast to the north-northwest.
6. Bedrock groundwater levels at the Erin Branch of the West Credit River are artesian or 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, and the sand and gravel is also not a potable water supply immediately downgradient of the Site and consequently this designation should not apply.
10. Credit Valley Conservation annual water balance modelling results for the Site were precipitation (897 mm/year), evapotranspiration (402 to 408 mm/year), runoff (114 to 122 mm/year) and recharge (368 to 381 mm/year). Considering soil conditions at the Site and existing impervious areas, the pre-development recharge rate for the Site was calculated as 340 mm/year.

11. Annual precipitation on average totals (i) 422 mm/year for precipitation events of 1 to 10 mm, (ii) 605 mm/year for precipitation events of 1 to 15 mm and (iii) 747 mm/year for events of 1 to 20 mm.
12. The pre-development recharge rate can be maintained to 80% during post-development with a combination of (a) infiltration of 'clean' runoff from precipitation events of 20 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) (Figure 5). These wetlands have high and medium hydrological sensitivity, respectively.
14. Two years of wetland and nearby water level monitoring have indicated:
  - a. The SWM3-2 poplar (west) swamp was generally under recharge conditions with very shallow wetland water levels on average 7 cm below ground surface in clay and silt, with shallow groundwater levels on average 30 cm below ground surface.
  - b. The SWM4-1 cedar (east) swamp was under recharge conditions and water levels were generally 30 cm below ground surface in wetland silt and clay with shallow groundwater levels 45 cm below ground surface.
15. Credit Valley Conservation 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 pre-development monthly water balance for the wetlands indicated that soil water holding capacities are expected to be less than saturated during the summer season months of June to September.
17. Post-development Groundwater recharge rates upgradient of the wetlands can be maintained from infiltration of (a) clean roof runoff at SWM facilities, (b) preserved buffer areas, (c) uncontrolled area recharge and discharge and (c) upgradient pervious areas.
18. The develop risk assignment is high for Wetland 4a SWM4-1 cedar, and medium for Wetland 5a SWM3-2 poplar. The Wetland Risk Evaluation requirements have been met: (i) pre-development monitoring, which has been completed for 2 years, (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 was completed that included two additional monitoring wells up- and down-gradient of the wetland.
19. Sanitary infrastructure required within the Municipal Well E8 WHPA-A, requires a higher than standard construction/monitoring requirements to ensure a closed system, such as implementing extra flange protection.

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". This has been incorporated into Site planning and design.
21. Construction is not predicted to require groundwater control pumping methods for dewatering or an MECP EASR or PTTW.

## 7.2 Recommendations

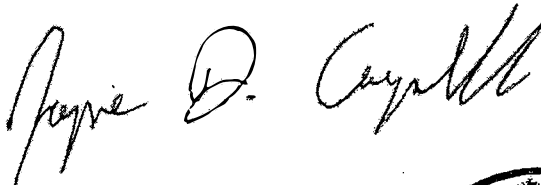
The following recommendations are provided:

1. Submit our updated report to the Town of Erin and the Credit Valley Conservation;
2. Discontinue the surface water and groundwater monitoring program once Site Plan Approval is received from the Town of Erin, Credit Valley Conservation and Wellington Source Water Protection.
3. The fill material to be imported or relocated on Site should be permeable loam or a material with a higher infiltration rate than the underlying native silty sand till.
4. Implement a salt management plan for the Site based upon the Town of Erin approach which required a 5% salt/95% sand mix except during freezing events where 10% salt/90% sand is applied.
5. All existing private water supply wells and monitoring wells should be decommissioned by a licensed Ontario water well contractor in compliance with the Ontario Water Resources Act Regulation 903.

We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions.

Yours truly,

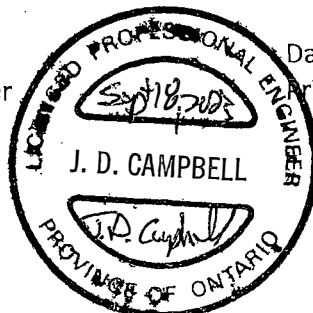
TERRA-DYNAMICS CONSULTING INC.



Jayme D. Campbell, P. Eng.  
Senior Water Resources Engineer



David D. Slaine, M.Sc., P. Geo.  
Principal Hydrogeologist & President



cc. Cesare Pittelli, Senior Planner, Project Manager, Armstrong Planning & Project Management

### **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 – Hydraulic Conductivity Analyses  
Appendix D – Provincial Maps

### **8.0 References**

AquaResource Inc., 2009. Integrated Water Budget Report – Tier 2 Credit Valley Source Protection Area. Prepared for the Credit Valley Conservation Authority.

AquaResource Inc. and NPCA, 2009. Water Availability Study for the Twenty Mile Creek Watershed Plan Area, Niagara Peninsula Source Protection Area.

Armstrong Planning Project Management (Armstrong), 2021. Erin Concept Plan, Town of Erin, County of Wellington.

Bair, S.E., 2005. Analysis and Design of Aquifer Tests including Slug Tests and Fracture Flow. National Groundwater Association course, Dublin, Ohio.

Blackport Hydrogeology Inc. and Golder Associates Ltd., 2010. WHPA Delineation and Vulnerability Assessment, Town of Erin, Municipal Wells, Final Report. Prepared for the Town of Erin and Credit Valley Conservation.

Bouwer, H., 1989. The Bouwer and Rice Slug Test – An Update. Vol.27, No.3, Groundwater, p.7-9.

Burt, A.K. and Dodge, J.E.P., 2016. Three-dimensional modelling of surficial deposits in the Orangeville-Fergus area of southern Ontario; Ontario Geological Survey, Groundwater Resources Study 15, 155 p.

Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2.

Conservation Ontario, 2013. Hydrogeological Assessment Submissions, Conservation Authority Guidelines for Development Applications.

Credit Valley Conservation, Aquafor Beech Inc. and Blackport Hydrogeology Inc., 2011. Erin Servicing and Settlement Master Plan, Phase 1 – Environmental Component – Existing Conditions Report.

Credit Valley Conservation, 2012. Stormwater Management Criteria.

Credit Valley Conservation, 1998. West Credit Subwatershed Study, Characterization Report. Prepared for the County of Wellington.

Credit Valley-Toronto and Region – Central Lake Ontario (CTC) Source Protection Committee, 2019. Approved Source Protection Plan: CTC Source Protection Region.

CTC Source Protection Committee, 2015. Approved Updated Assessment Report: Credit Valley Source Protection Area.

CTC Source Protection Region, 2010. SPC Accepted Groundwater Quality Vulnerability Analysis, Highly Vulnerable Aquifer Delineation. Prepared and written by Rick Gerber (YPDT-CAMC Oak Ridges Moraine Hydrogeology Program) and Rick Wilson (Toronto Region Conservation Authority).

Devlin, J.F., 2015. HydrogeoSieveXL: an Excel-based tool to estimate hydraulic conductivity from grain-size analysis.

DS Consultants Ltd., 2021. Report on Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Erin Heights Golf Course, 5525 8<sup>th</sup> Line, Erin, Ontario. Prepared for Empire Homes.

Environment and Climate Change Canada, 2022. Climate Station Data, Shand Dam Station, ID 6142400.

GEO Morphix Ltd., 2020. Erin Heights Golf Course, Meander Belt Width and Erosion Hazard Assessment for the Credit river – Erin Branch.

Golder Associates Ltd, 2006. County of Wellington, Groundwater Protection Study, prepared for the County of Wellington.

Groundwater Science Corp, 2020. Town of Erin Water Supply EA, New Water Supply Source Investigation, Test Well Drilling and Testing Hydrogeological Report. Prepared for Corporation of the Town of Erin.

Hoffman, D.W., Matthews, B.C. and Wicklund, R.E., 1963. Soil survey of Wellington County, Ontario. Report No. 35 of the Ontario Soil Survey.

MacViro, 2009. Baseflow Monitoring Guidelines.

McBean, E.A., Rovers, F. and Farquhar, G.J., 1995. Solid Waste Landfill Engineering and Design.

McCabe, G.J., and Markstrom, S.L., 2007. A monthly water-balance model driven by a graphical user interface. U.S. Geological Survey Open-File report 2007-1008, 6p.

Ministry of Agriculture, Food and Rural Affairs (OMAFRA), 2021. AgMaps.

Ministry of the Environment, (Conservation and Parks), 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications.

Ministry of the Environment, (Conservation and Parks), 2006. Assessment Report: Draft Guidance Module 3, Groundwater Vulnerability Analysis.

Ministry of Natural Resources and Forestry, 1995. West Credit River Wetland Complex, Southern Ontario Wetland Evaluation, Data and Scoring Record.

Mitsch, W.J. and Gosselink, J.G., 2007. Wetlands, 4<sup>th</sup> Edition.

Ontario Clean Water Agency, 2021. Re: Water level monitoring at Eighth Line Municipal Well, Erin. Email from Don Irvine to Jayme Campbell.

Ontario Geological Survey (OGS), 2003. Surficial Geology of Southern Ontario.

Preene, M., 2020. Conceptual modelling for the design of groundwater control systems. Quarterly Journal of Engineering Geology and Hydrogeology.

Salsberg, J., 2021. Pre-consultation Meeting Response & Development Application Submission Requirements for 'Erin Fairways'.

Shifflet, S., 2014. Climate Change Scenario Modeling, Grand River Watershed Water Management Plan.

Terra-Dynamics Consulting Inc., 2022. Hydrogeological Assessment, Water Balance Assessment and Source Water Protection Analysis, Erin Fairways Subdivision, 5525 Eighth Line, Town of Erin, ON.

Toronto and Region Conservation Authority (TRCA), 2017. Wetland Water Balance Risk Evaluation.

Toronto and Region Conservation Authority (TRCA), 2016. Wetland Water Balance Monitoring Protocol.

Town of Erin, 2022. First Submission of 23T-2202, Z22-02, EC (Erin) GP Inc., 5525 Eighth Line, Part Lot 16, RCP 686; Parts 6 to 12 on RP 61R-7462, letter sent to Carleigh Oude-Reimerink, Armstrong Planning.

United States Department of Agriculture (USDA), 1986. Urban Hydrology for Small Watersheds.

Urbantech, 2023a. Stormwater Management Plan, Drawing No. 4.0.

Urbantech, 2023b. Sanitary Drainage Plan, Drawing No. 7.1.

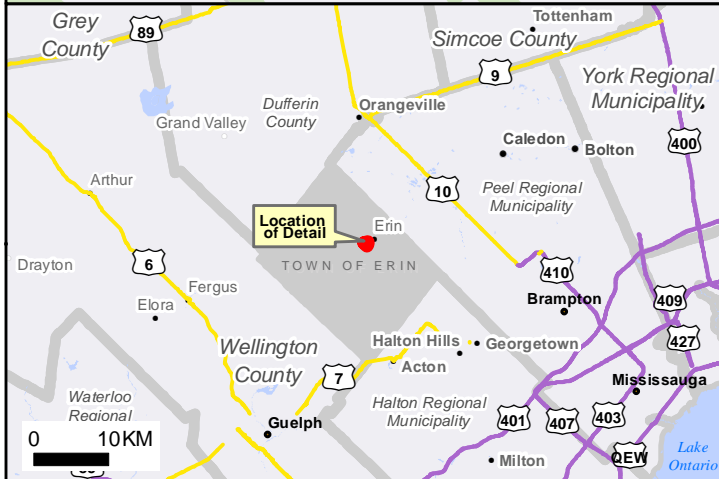
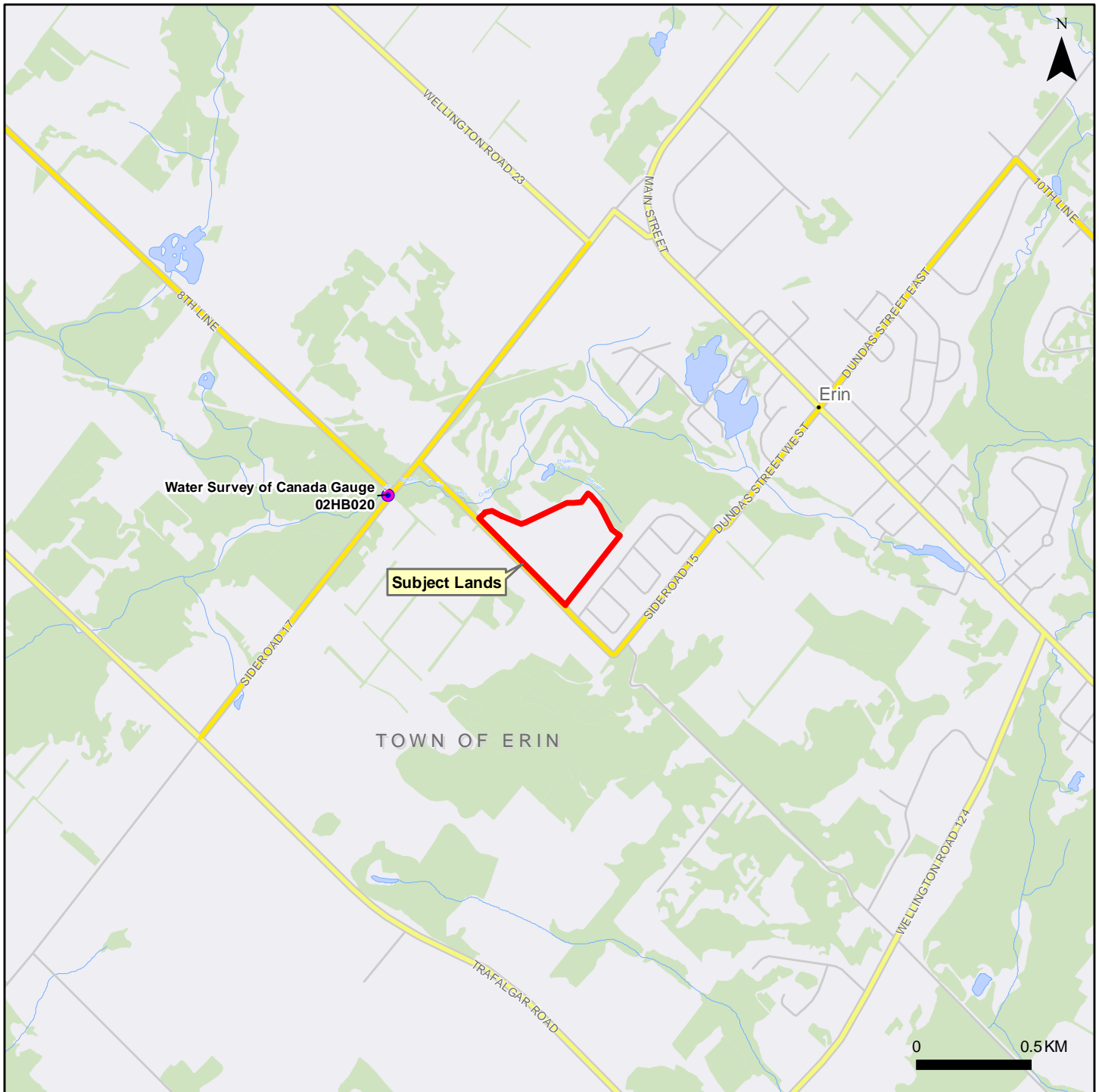
Urbantech, 2023c. Preliminary Cut-Fill Plan.


Vandermeulen, E., 2021. Erin Fairways Subdivision Pre-consultation, 5525 Eighth Line, Erin. Memo to Joanna Salsberg, Town of Erin. Wellington Source Water Protection.

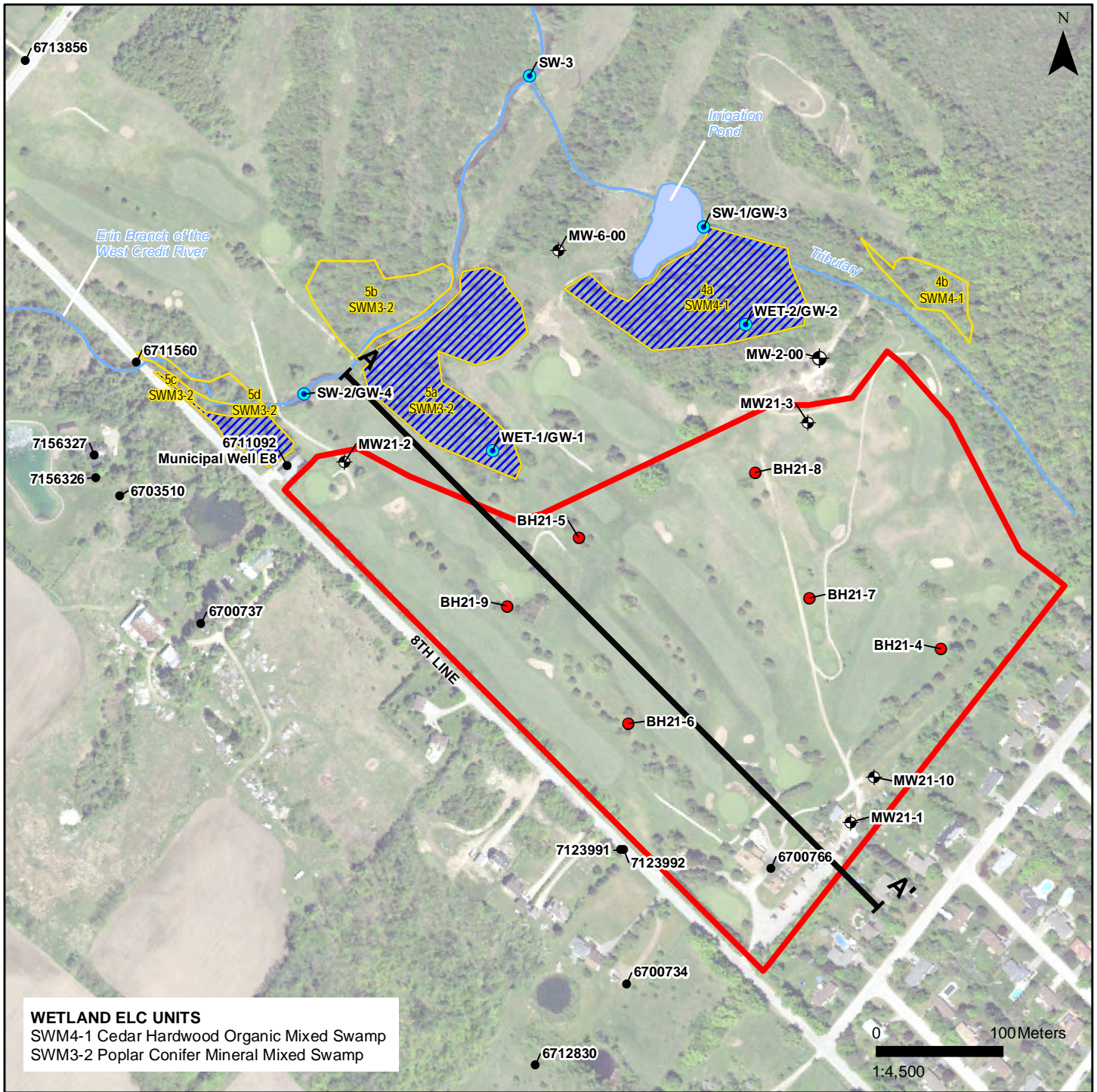
Wellington Source Water Protection, 2023. Re: Comment Clarification Request, E-mail from Danielle Walker (Source Protection Coordinator) to Jayme Campbell (Terra-Dynamics Consulting Inc.).

EC (Erin) GP Inc.  
September 19, 2023  
Page 30

WSP, 2022. Scoped Environmental Impact Study (EIS) Report, 5525 Eighth Line, Erin, Ontario – Erin Fairways Subdivision.



<h2>Site Location</h2>	
Erin Fairways Subdivision 5525 8th Line, Town of Erin, ON EC (Erin) GP Inc.	
 <b>TDC</b> Terra-Dynamics Consulting Inc.	
<h3>Figure 1</h3>	



**WETLAND ELC UNITS**  
 SWM4-1 Cedar Hardwood Organic Mixed Swamp  
 SWM3-2 Poplar Conifer Mineral Mixed Swamp

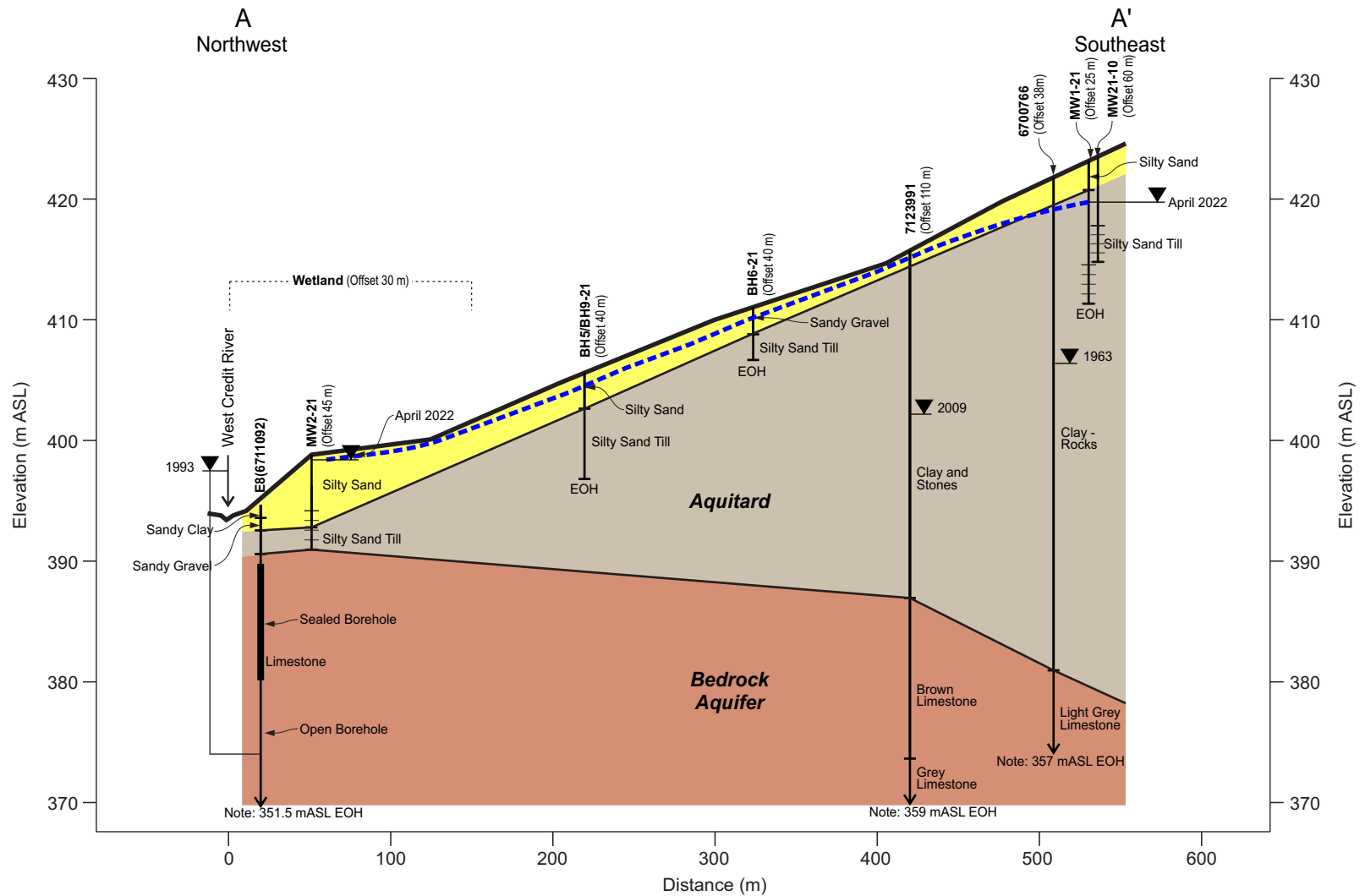
- Subject Lands
- Wetlands
- Irrigation Pond
- Ecological Land Classification
- Geologic Cross-section Location
- Ground Surface Contour (5m)
- Watercourse
- Geotechnical Borehole
- ⊕ Monitoring Well
- Water Well Record (MECP)
- Drive-point Piezometers and Staff Gauges

### Site Details

Erin Fairways Subdivision  
 5525 8th Line, Town of Erin, ON  
 EC (Erin) GP Inc.



**Figure 2**



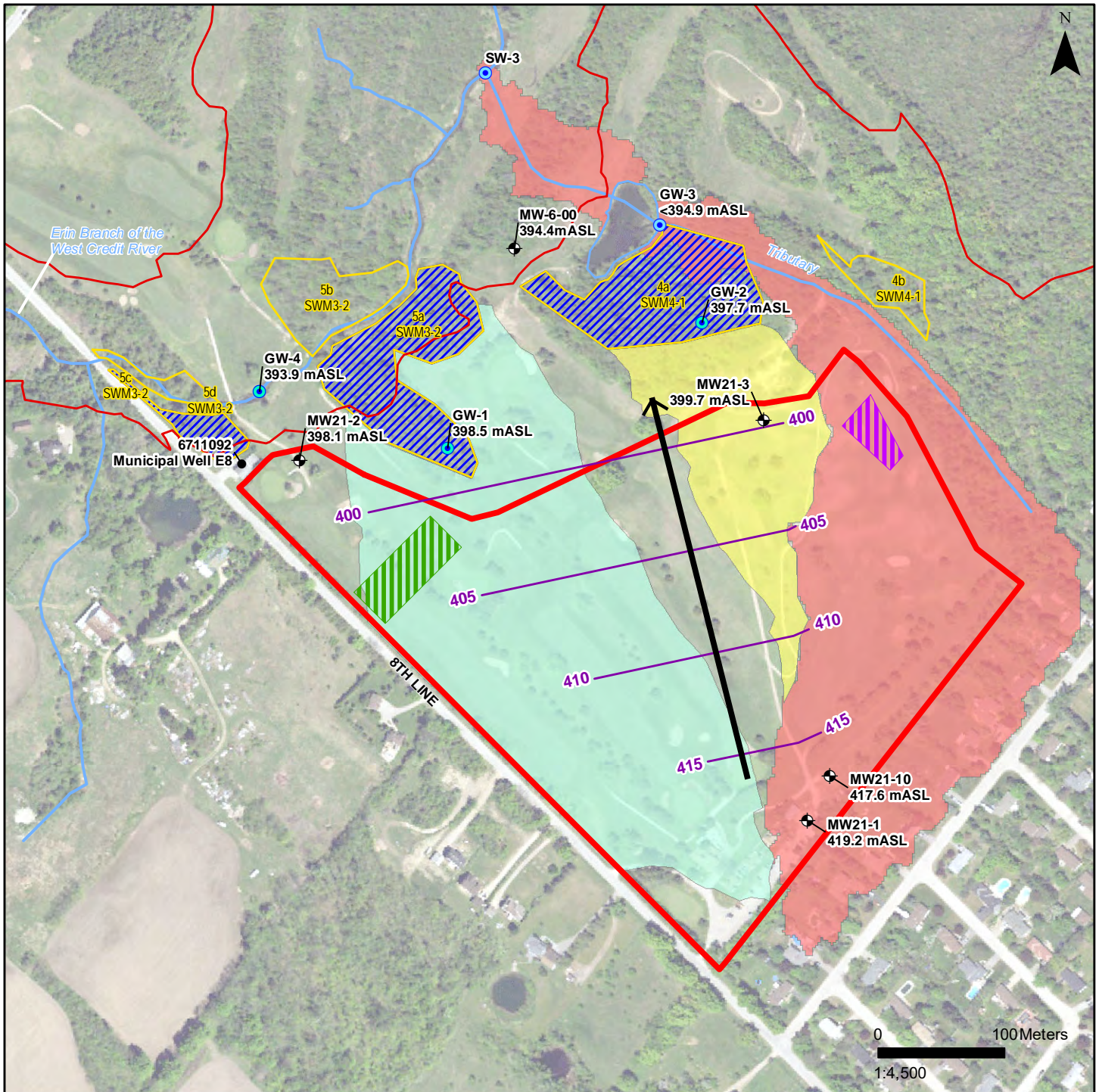
- Borehole
- Well Screen
- EOH End of Hole
- Water Level
- High Water Table April 2022
- Sand/Gravel
- Silty Sand Till
- Bedrock

## Geologic Cross-section A-A'

Erin Fairways Subdivision  
5525 8th Line, Town of Erin, ON  
EC (Erin) GP Inc.



**Figure 3**



- Subject Lands
  - Ecological Land Classification
  - Wetlands
  - 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)
  - Shallow Groundwater Flow Direction
- 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.



**Figure 5**

## **Appendix A**

### **Hydrographs**

**TABLE A-1  
PRECIPITATION ANALYSES**

Year	2021									
Month	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	36.6	54.5	25.2	105.4	92.7	54.6	162.5	100.5	54.6	94.2
Average Precipitation (mm)	60	74	87	84	89	97	93	77	93	69
% Difference	61%	74%	29%	125%	104%	56%	175%	131%	59%	137%
3-Month %			55%	76%	86%	95%	112%	121%	121%	109%

Year	2022											
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	43.6	125.4	75.1	55.1	62.8	59.4	46.5	119.1	35.1	43.2	63.4	83.7
Average Precipitation (mm)	68	56	60	74	87	84	89	97	93	77	93	69
% Difference	64%	224%	125%	74%	72%	71%	52%	123%	38%	56%	68%	121%
3-Month %	86%	142%	138%	141%	91%	72%	65%	82%	71%	72%	54%	82%

Period of below-average precipitation

Year	2023						
Month	Jan	Feb	Mar	Apr	May	Jun	Jul
Precipitation (mm)	76.8	73.8	128.3	79.2	38.2	98.5	140.9
Average Precipitation (mm)	68	56	60	74	87	84	89
% Difference	113%	132%	214%	107%	44%	117%	158%
3-Month %	101%	122%	153%	151%	122%	89%	106%

Note: The climate station used for the precipitation values is Fergus Shand Dam, Ontario.

The climate station had a missing precipitation value on December 23, 2022.

Therefore, the precipitation value for that day was taken from the Georgetown WWTP, Ontario climate station.

**Table A-2  
Monitoring Well Details and Water Levels**

Well I.D.	Ground Elevation (m ASL)	Stick-Up (m)	TOC Elevation (m ASL)	Well Depth Below TOC (m)	Well Depth below ground (m)	Date	Water level (m below TOC)	Water Level below ground (m)	Depth at Staff Gauge (m)	Water Level Elevation (m ASL)
GW-1	398.66	0.90	399.56	1.74	0.84	25-Aug-21	Dry	Dry	-	Dry
						10-Nov-21	1.03	0.13	-	398.53
						5-Apr-22	0.89	-0.01	-	398.67
						4-Aug-22	Dry	Dry	-	Dry
						10-Nov-22	Dry	Dry	-	Dry
						19-May-23	0.97	0.07	-	398.59
						2-Aug-23	1.14	0.24	-	398.42
GW-2	398.16	1.10	399.26	2.37	1.27	25-Aug-21	Dry	Dry	-	Dry
						10-Nov-21	1.60	0.50	-	397.66
						5-Apr-22	1.52	0.42	-	397.74
						4-Aug-22	Dry	Dry	-	Dry
						10-Nov-22	1.62	0.52	-	397.64
						19-May-23	1.46	0.36	-	397.80
						2-Aug-23	1.46	0.36	-	397.80
GW-3	395.91	0.92	396.83	2.05	1.13	5-Apr-22	1.86	0.94	-	394.97
						4-Aug-22	Dry	Dry	-	Dry
						10-Nov-22	1.67	0.75	-	395.16
						19-May-23	Dry	Dry	-	Dry
						2-Aug-23	1.35	0.43	-	395.48
GW-4	394.04	1.09	395.13	1.74	0.65	25-Aug-21	Dry	Dry	-	Dry
						10-Nov-21	1.28	0.19	-	393.85
						5-Apr-22	1.86	0.77	-	393.27
						4-Aug-22	1.50	0.41	-	393.63
						10-Nov-22	1.38	1.38	-	393.76
						19-May-23	1.35	0.26	-	393.78
						2-Aug-23	Dry	Dry	-	Dry

**Table A-2  
Monitoring Well Details and Water Levels**

Well I.D.	Ground Elevation (m ASL)	Stick-Up (m)	TOC Elevation (m ASL)	Well Depth Below TOC (m)	Well Depth below ground (m)	Date	Water level (m below TOC)	Water Level below ground (m)	Depth at Staff Gauge (m)	Water Level Elevation (m ASL)
Wet-1	398.66	0.72	399.38	0.99	0.27	25-Aug-21	Dry	-	Dry	Dry
						10-Nov-21	Dry	-	Dry	Dry
						5-Apr-22	0.70	-	0.03	398.68
						4-Aug-22	Dry	-	Dry	Dry
						10-Nov-22	Dry	-	Dry	Dry
						19-May-23	Dry	-	Dry	Dry
						2-Aug-23	Dry	-	Dry	Dry
Wet-2	398.16	0.56	398.72	0.99	0.43	25-Aug-21	Dry	-	Dry	Dry
						10-Nov-21	Dry	-	Dry	Dry
						5-Apr-22	Dry	-	Dry	Dry
						4-Aug-22	Dry	-	Dry	Dry
						10-Nov-22	Dry	-	Dry	Dry
						19-May-23	Dry	-	Dry	Dry
						2-Aug-23	Dry	-	Dry	Dry
SW-1	394.51	0.73	395.24	0.99	0.26	25-Aug-21	0.70	-	0.04	394.55
						10-Nov-21	NA	NA	NA	NA
As Apr 5, 2022	~394.92	0.30	395.22	0.79	0.49	5-Apr-22	0.24	NA	0.06	394.99
						4-Aug-22	0.24	-	0.03	394.98
						10-Nov-22	0.23	-	0.04	394.99
						19-May-23	0.25	-	0.02	394.97
						2-Aug-23	-0.02	-	0.24	395.24
SW-2	393.51	0.64	394.15	0.80	0.16	25-Aug-21	0.48	-	0.14	393.67
						10-Nov-21	0.38	-	0.22	393.77
						5-Apr-22	0.36	-	0.22	393.80
						4-Aug-22	0.45	-	0.17	393.70
						10-Nov-22	0.43	-	0.21	393.72
						19-May-23	0.42	-	0.22	393.73
					2-Aug-23	0.42	-	0.23	393.73	

**Table A-2  
Monitoring Well Details and Water Levels**

Well I.D.	Ground Elevation (m ASL)	Stick-Up (m)	TOC Elevation (m ASL)	Well Depth Below TOC (m)	Well Depth below ground (m)	Date	Water level (m below TOC)	Water Level below ground (m)	Depth at Staff Gauge (m)	Water Level Elevation (m ASL)
SW-3	392.76	1.25	394.01	NA	NA	25-Aug-21	NA	-	0.46	~392.46
						10-Nov-21	0.36	-	0.62	393.65
						5-Apr-22	0.42	-	0.61	393.59
						4-Aug-22	0.73	-	0.18	393.28
						10-Nov-22	0.64	-	0.32	393.37
						19-May-23	0.61	-	0.23	393.41
						2-Aug-23		-	0.23	394.01
MW-6-00	395.15	0.87	396.02	3.62	2.75	10-Nov-21	1.69	0.81	-	394.34
						5-Apr-22	1.61	1.61	-	394.41
						4-Aug-22	2.37	2.37	-	393.65
						10-Nov-22	2.09	1.22	-	393.93
						19-May-23	1.96	1.08	-	394.07
						2-Aug-23	1.82	0.95	-	394.20
MW-2-00	401.40	0.61	402.01	397.32	396.71	10-Nov-22	4.29	3.68	---	397.72
						19-May-23	3.41	2.80	---	398.60
						2-Aug-23	3.67	3.06	---	398.34

Note:

MW=Monitoring well; SG=Staff gauge; TOC= Top of Casing; m ASL=metres above sea level; \* - Depth at staff gauge

On April 5, 2022 GW-3 was shifted deeper by 0.17 m

On April 5, 2022 SW-1 was re-installed



**Summary of Groundwater Monitoring Data**

Date			2021-04-28 (Loggers installed)			2021-08-11			2021-12-14			2022-01-12		
Well ID	Ground Elevation	Stickup	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation
	masl	mags	T.O.P	mbgs	masl	T.O.P	mbgs	masl	T.O.P	mbgs	masl	T.O.P	mbgs	masl
BH 21-1	422.8	0.00	5.0	5.00	417.80	3.81	3.81	418.99	3.63	3.63	419.17	*	*	*
BH 21-2	398.8	0.94	2.1	1.18	397.62	2.68	1.74	397.06	1.65	0.71	398.09	1.87	0.93	397.87
BH21-3	405.7	0.95	7.3	6.33	399.37	7.81	6.86	398.84	6.94	5.99	399.71	6.97	6.02	399.68
BH 21-10	419.1	0.93	2.6	1.69	417.41	3.22	2.29	416.81	2.39	1.46	417.64	2.66	1.73	417.37

Date			2022-02-16			2022-03-21			2022-04-28			2022-07-25		
Well ID	Ground Elevation	Stickup	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation
	masl	mags	T.O.P	mbgs	masl	T.O.P	mbgs	masl	T.O.P	mbgs	masl	T.O.P	mbgs	masl
BH 21-1	422.8	0.00	*	*	*	*	*	*	3.70	3.70	419.10	5.77	5.77	417.03
BH 21-2	398.8	0.94	2.22	1.28	397.52	1.59	0.65	398.15	1.52	0.58	398.22	2.82	1.88	396.92
BH21-3	405.7	0.95	7.29	6.34	399.36	6.48	5.53	400.17	6.74	5.79	399.91	7.67	6.72	398.98
BH 21-10	419.1	0.93	3.00	2.07	417.03	1.47	0.54	418.56	2.52	1.59	417.51	3.49	2.56	416.54

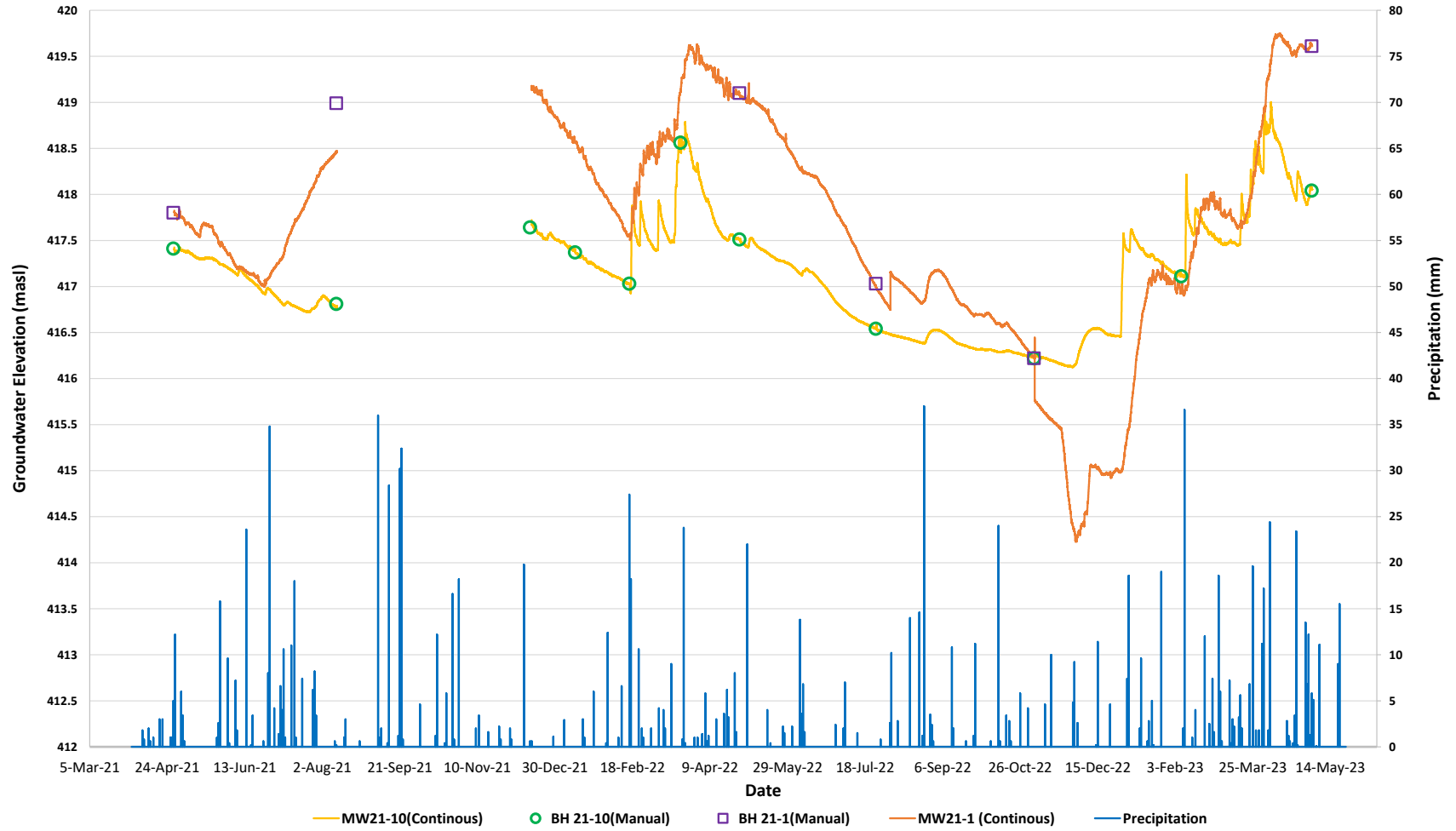
Date			2022-11-04			2023-02-06			2023-05-02		
Well ID	Ground Elevation	Stickup	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation	Water Level	Water Level	Water Elevation
	masl	mags	T.O.P	mbgs	masl	T.O.P	mbgs	masl	T.O.P	mbgs	masl
BH 21-1	422.8	0.00	6.58	6.58	416.22	*	*	*	3.19	3.19	419.61
BH 21-2	398.8	0.94	3.35	2.41	396.39	3.17	2.23	396.57	1.56	0.62	398.18
BH21-3	405.7	0.95	7.83	6.88	398.82	7.65	6.70	399.00	6.73	5.78	399.92
BH 21-10	419.1	0.93	3.81	2.88	416.22	2.92	1.99	417.11	1.99	1.06	418.04

Note:

\* BH21-1 was not accessible due to snow/ice cover

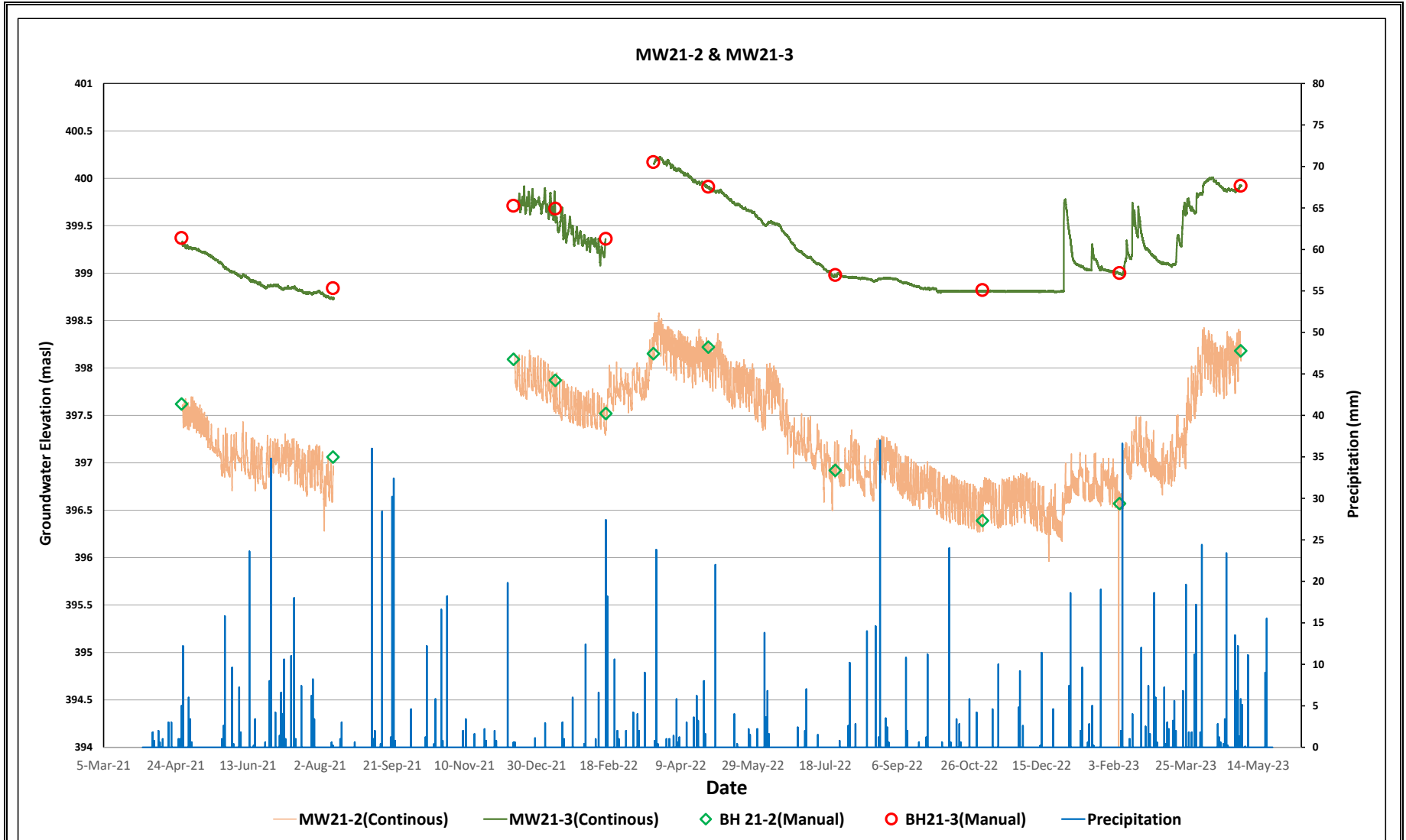
# WATER LEVEL HYDROGRAPH

MW21-1 & MW21-10





# WATER LEVEL HYDROGRAPH



Erin Heights Golf Course, Erin, ON

HYDROGRAPH

Baseline Groundwater and Surface Water Monitoring

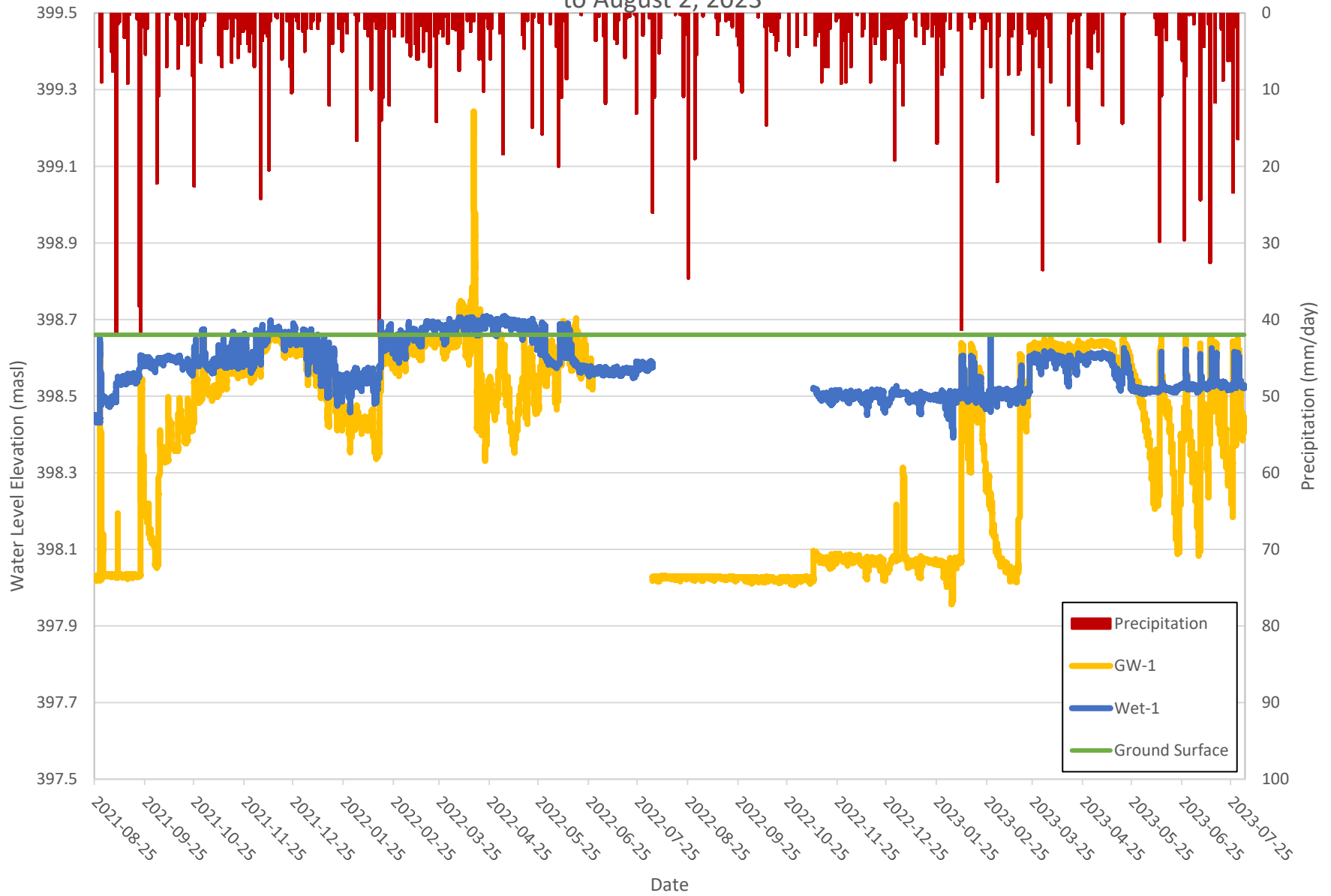
April 2021 - Nov 2022



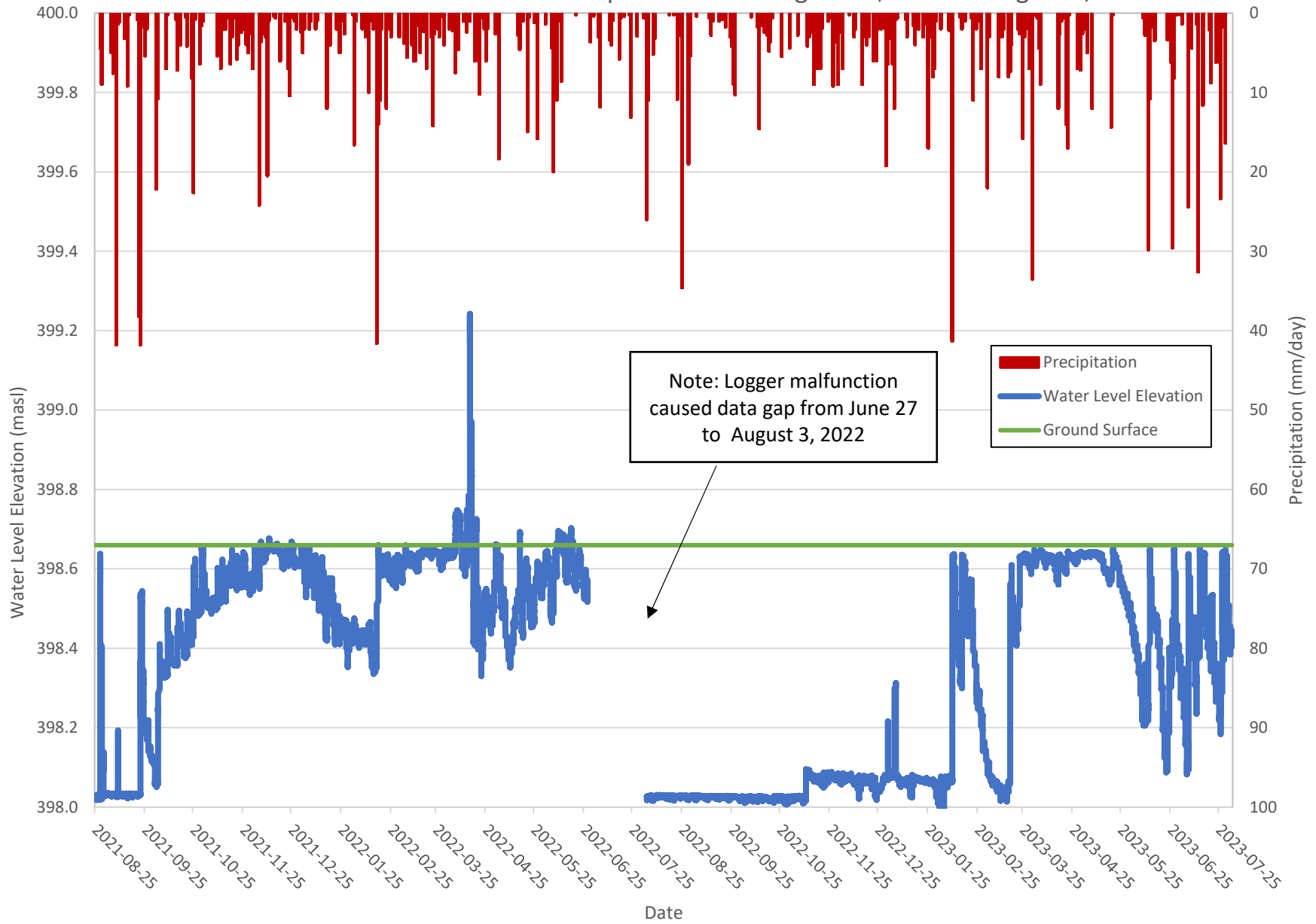
**DS CONSULTANTS LTD.**  
 Geotechnical • Environmental • Materials • Hydrogeology



GW-1 and Wet-1 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



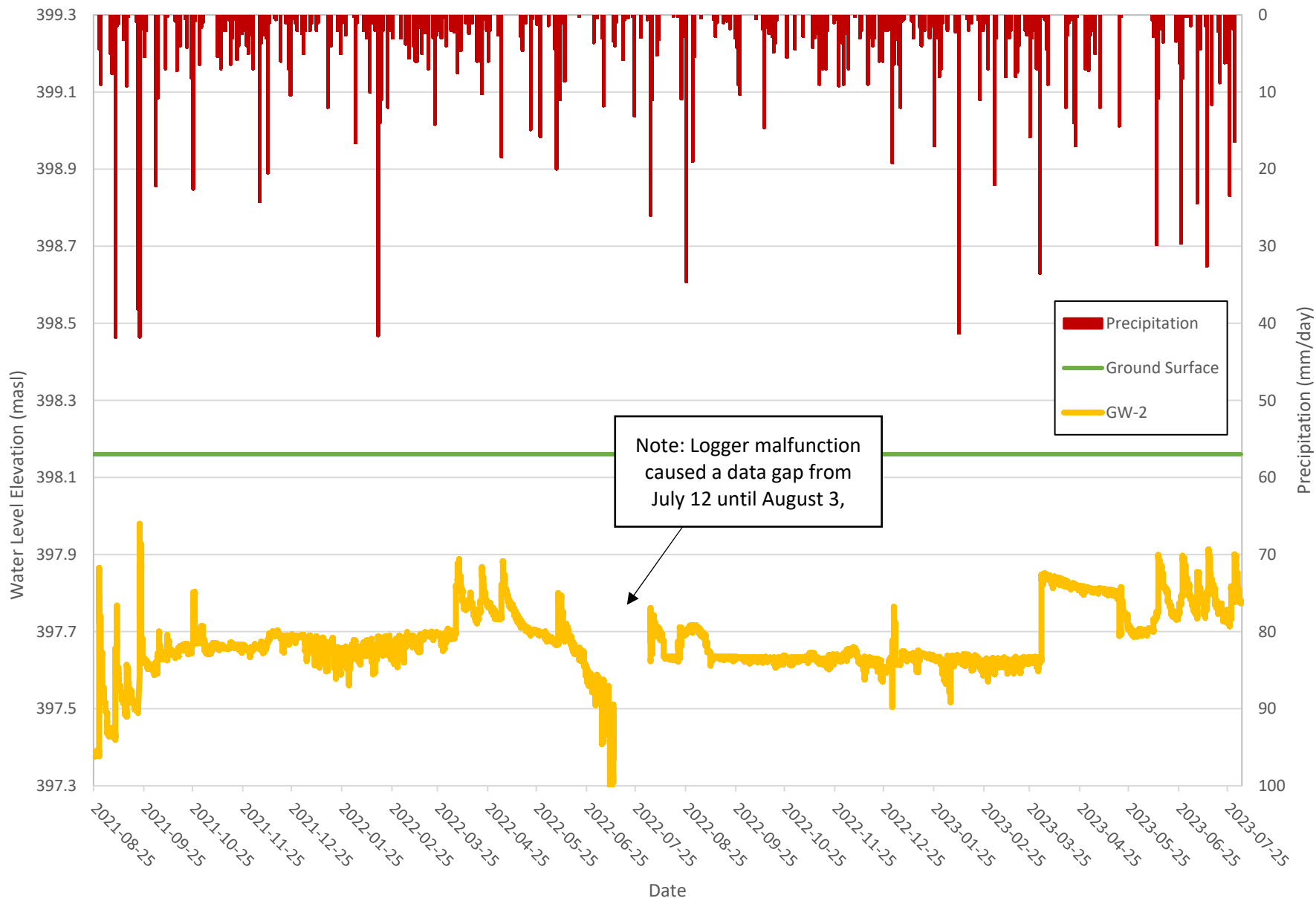
GW-1 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



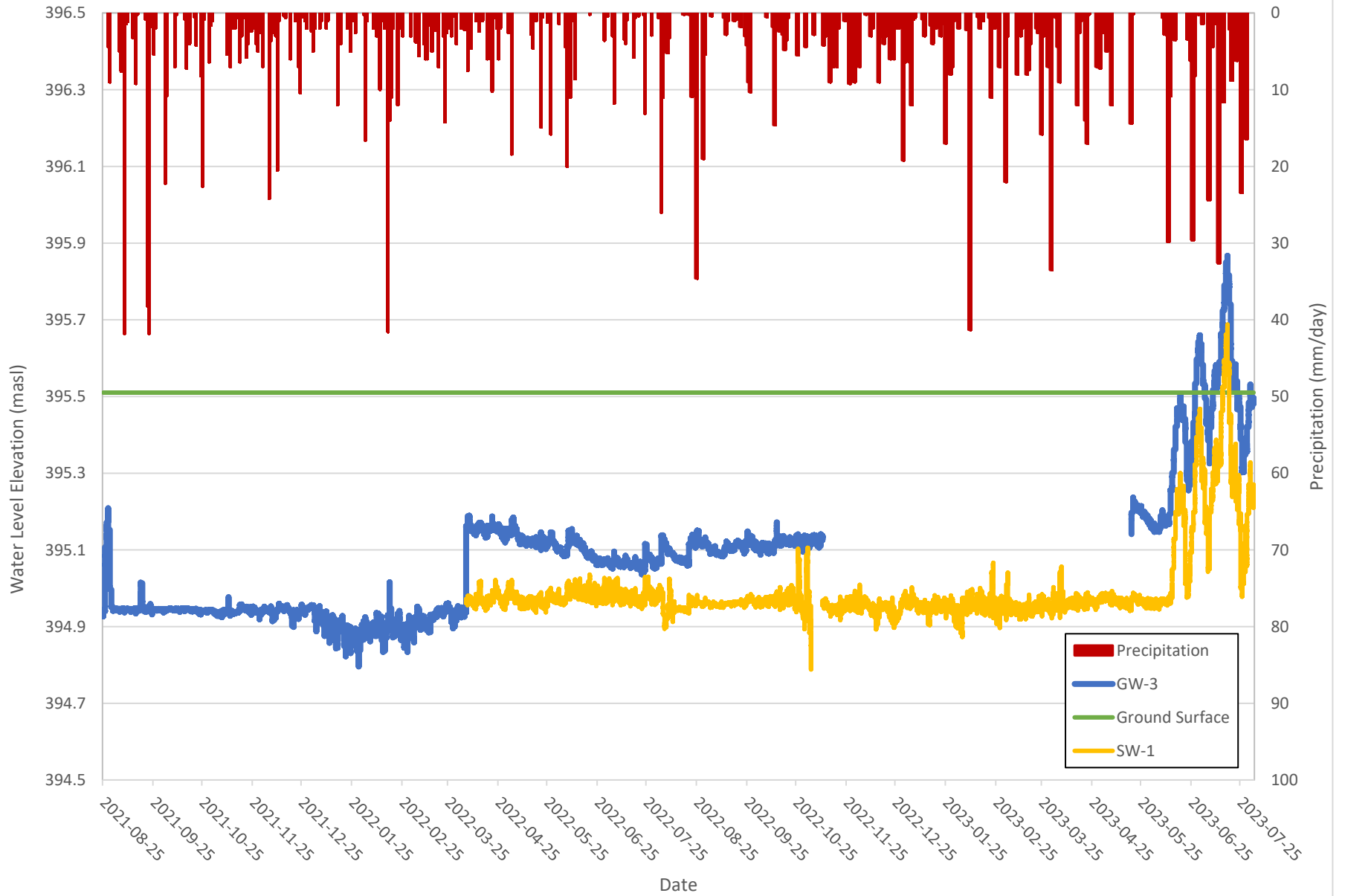
GW-2 and Wet-2 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



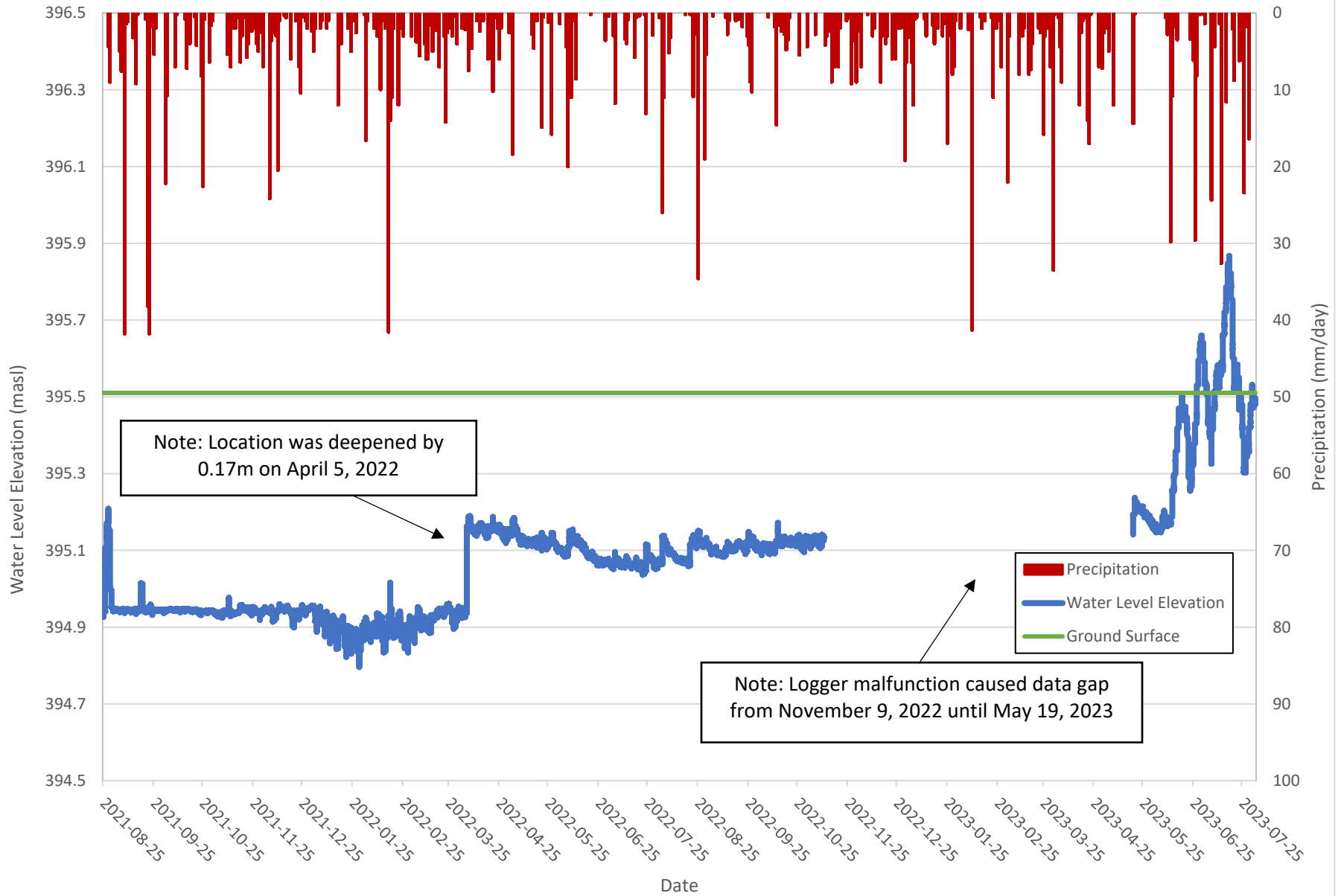
GW-2 Water Level Elevation and Precipitation from August 25, 2021 August 2, 2023



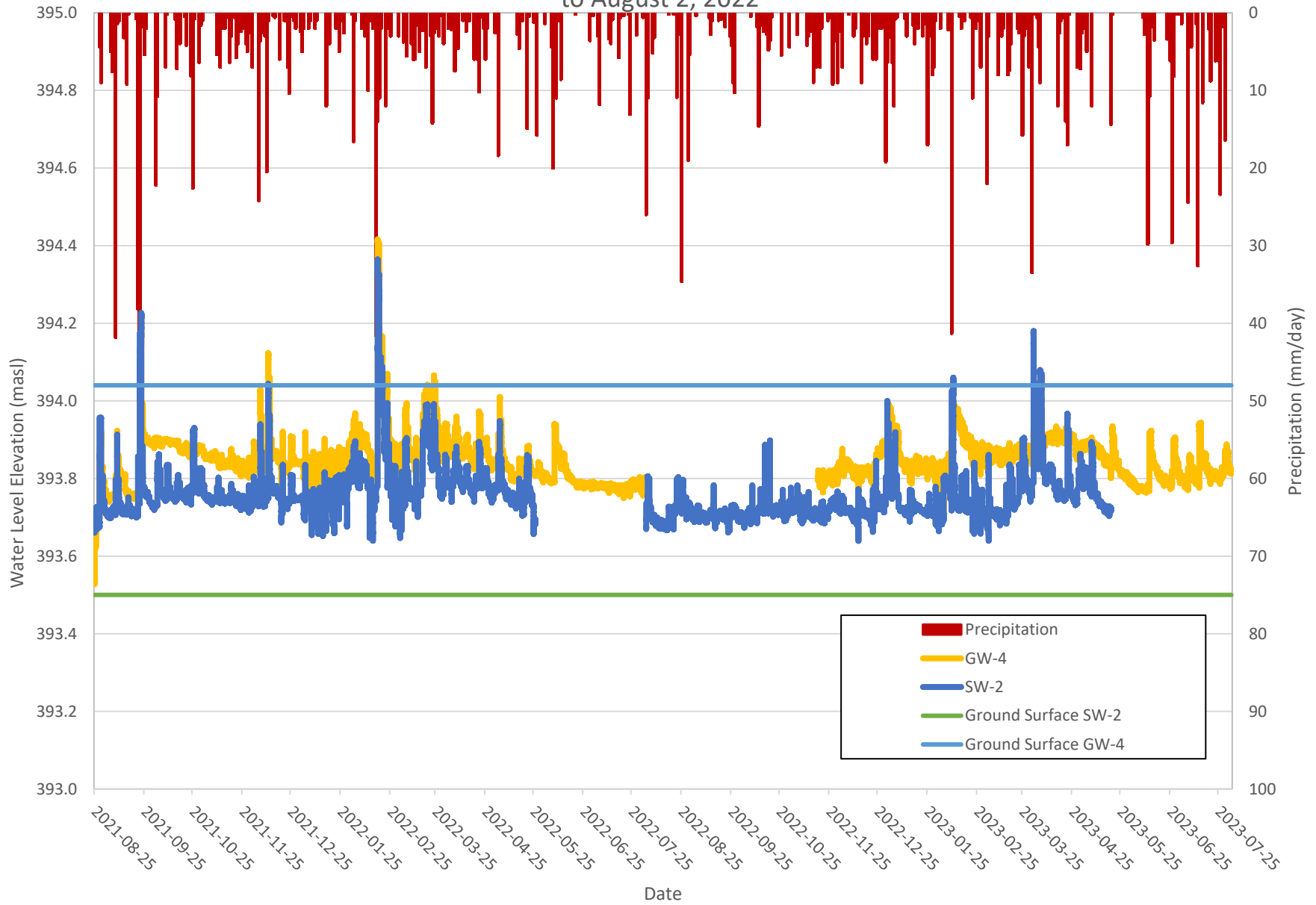
SW-1 GW-3 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



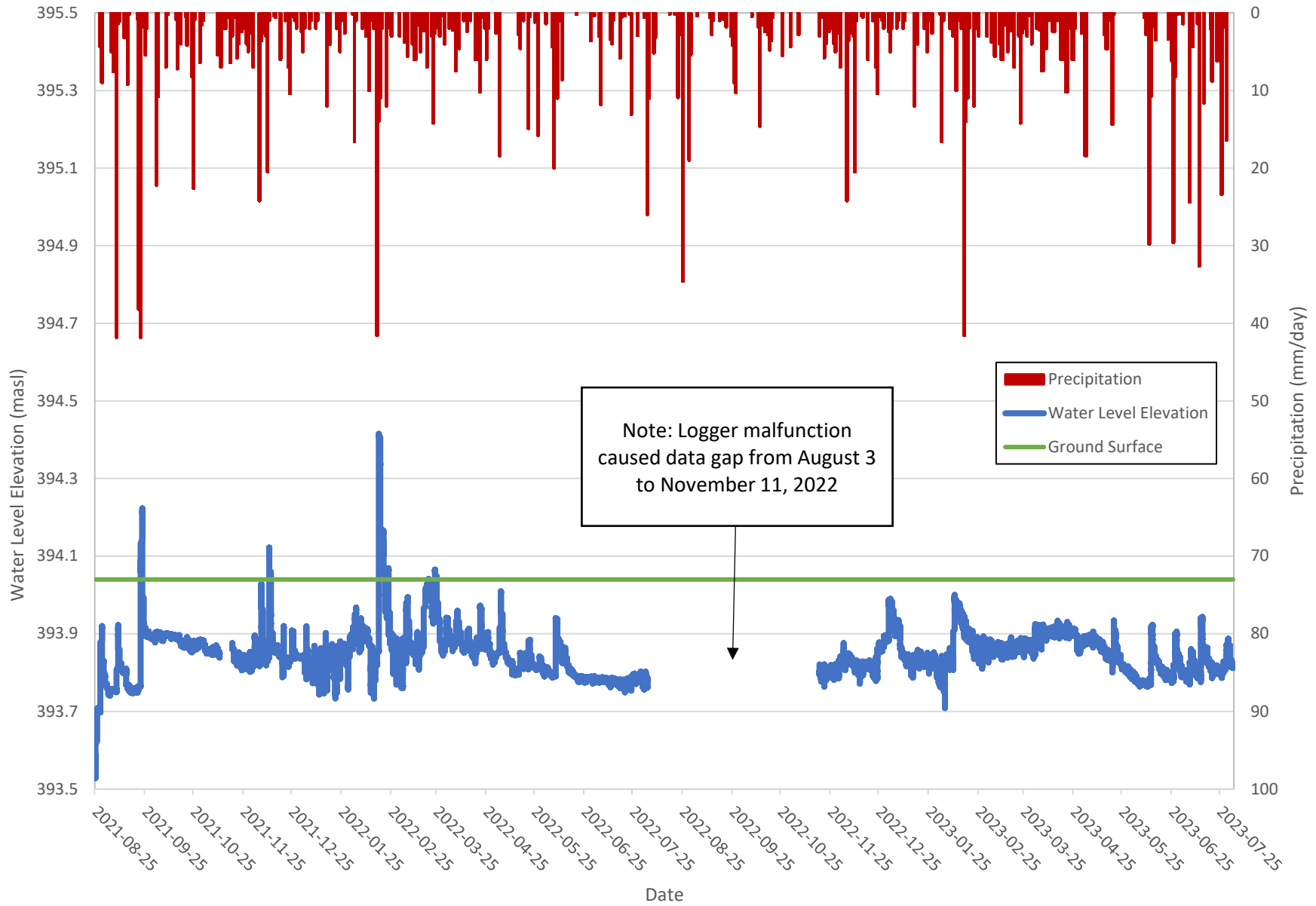
GW-3 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



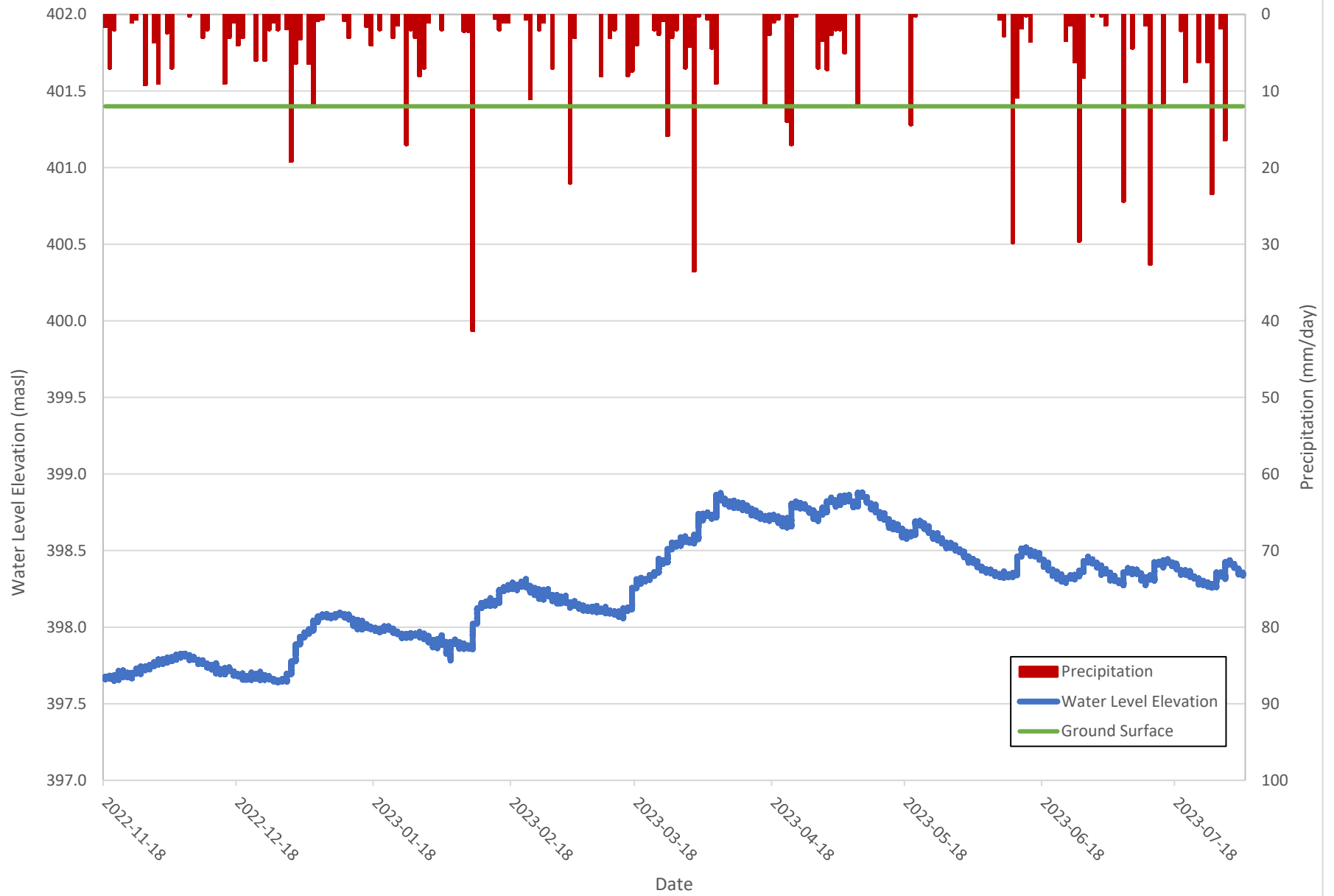
GW-4 and SW-2 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2022



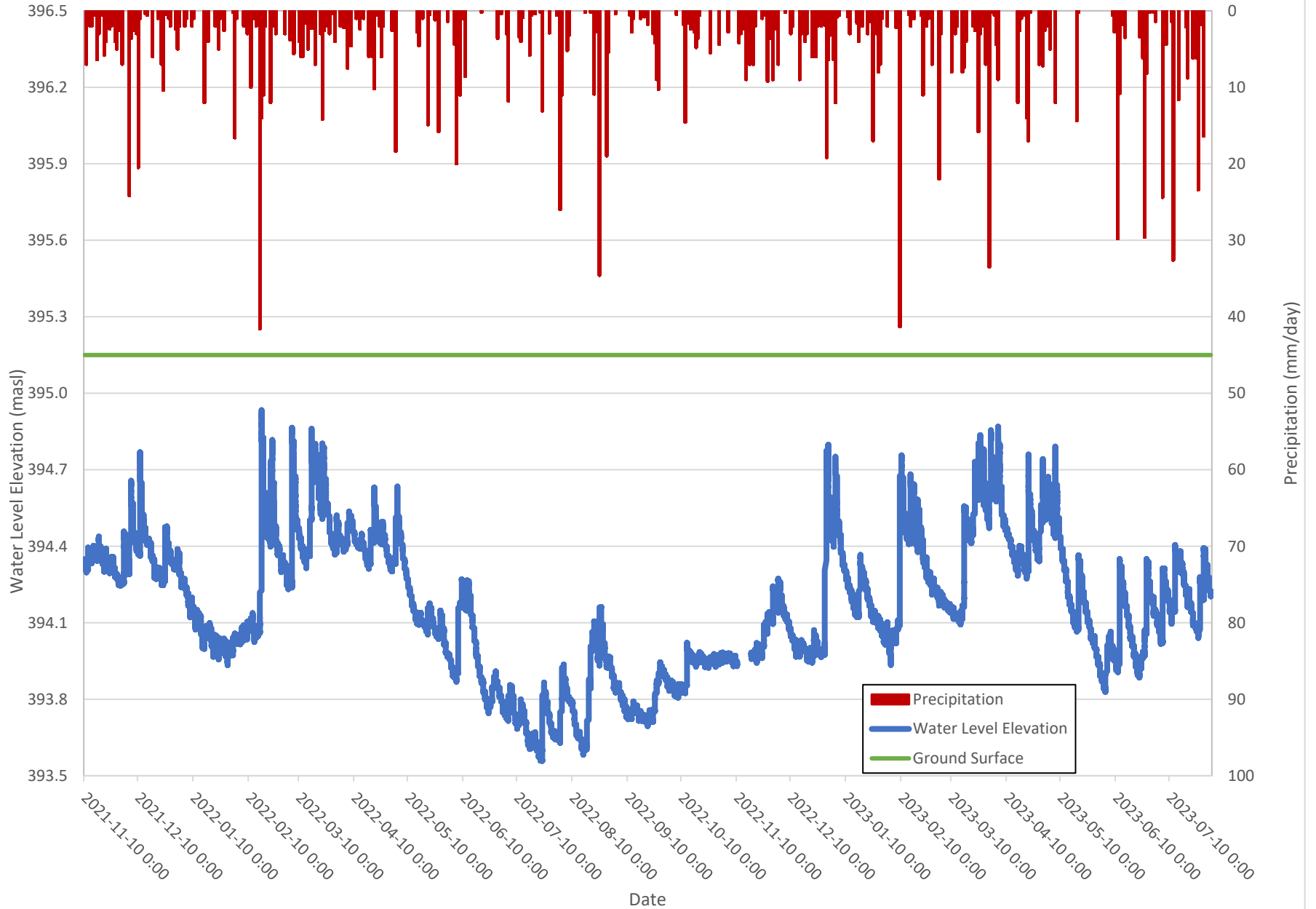
GW-4 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



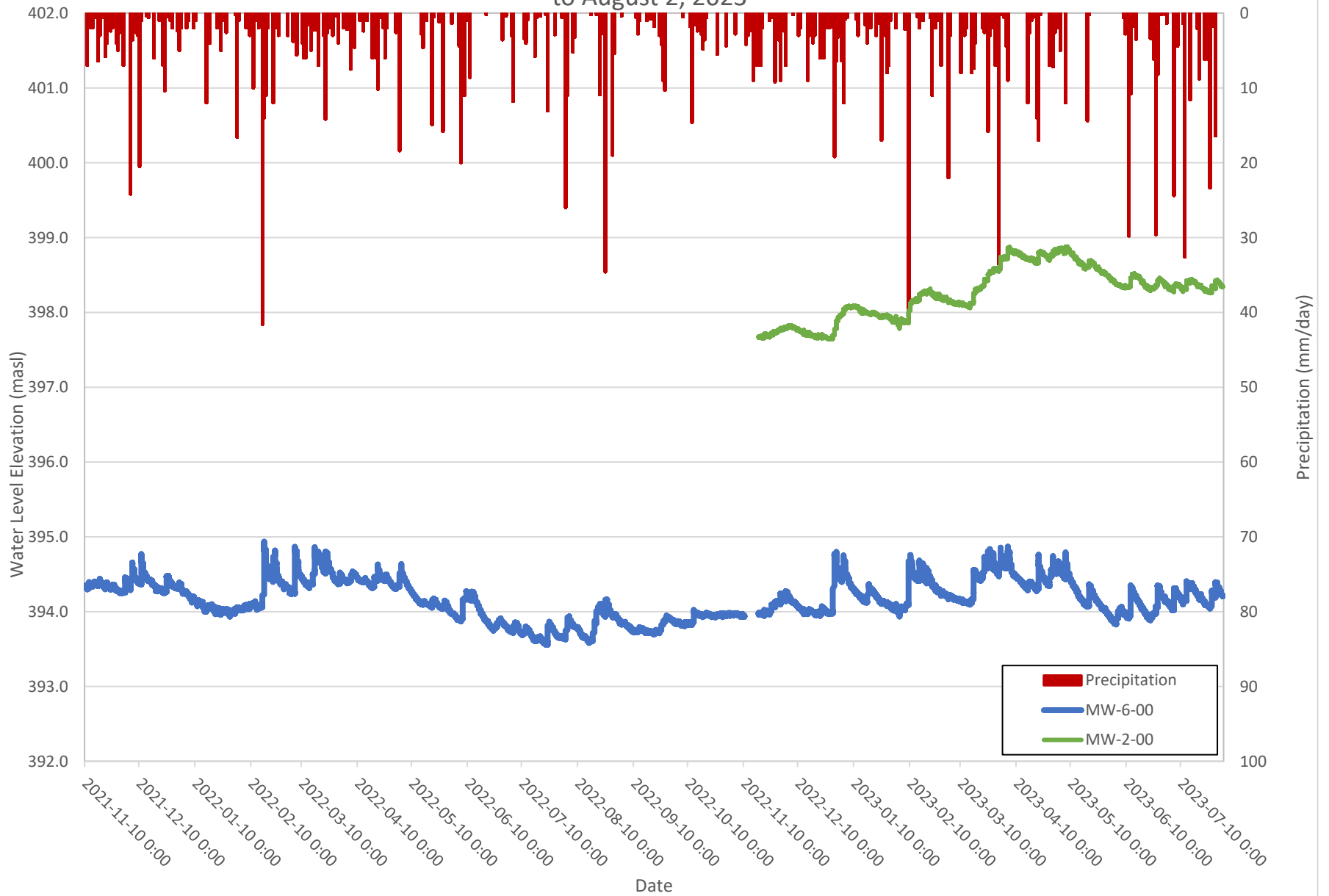
MW-2-00 Water Level Elevation and Precipitation from November 18, 2021 to August 2, 2023



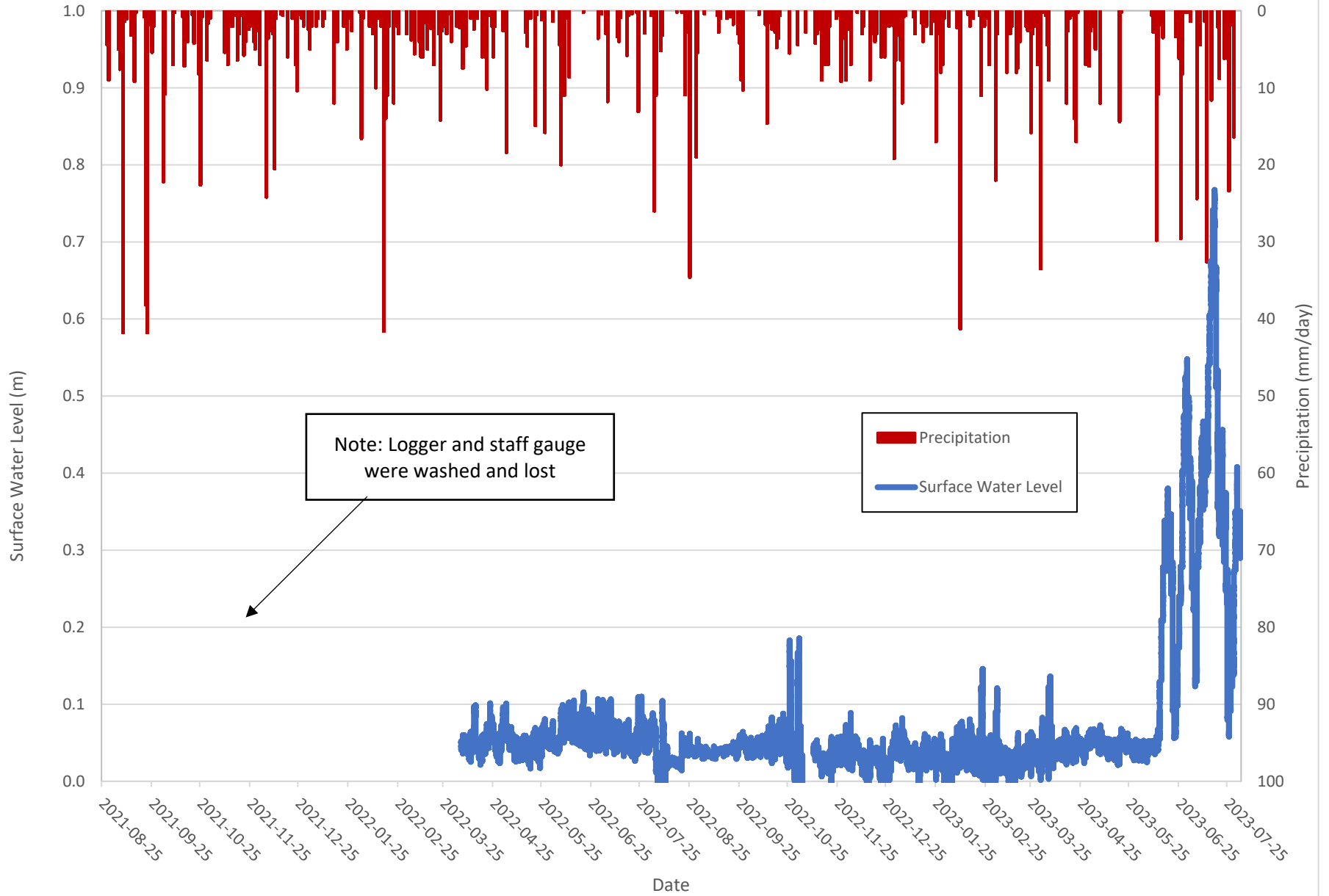
MW-6-00 Water Level Elevation and Precipitation from November 11, 2021 to August 2, 2023



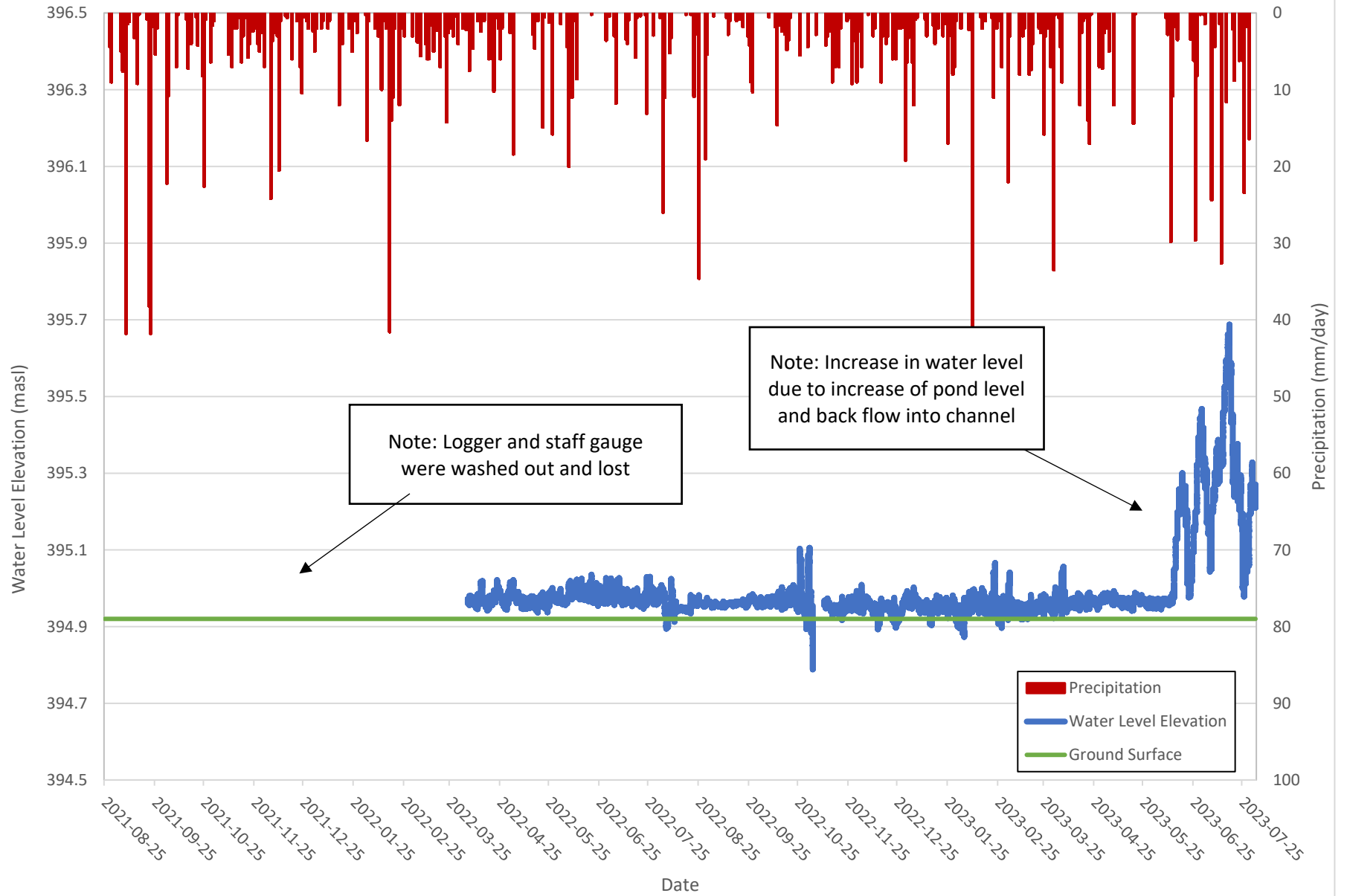
MW-6-00 and MW-2 Water Level Elevation and Precipitation from November 11, 2021 to August 2, 2023



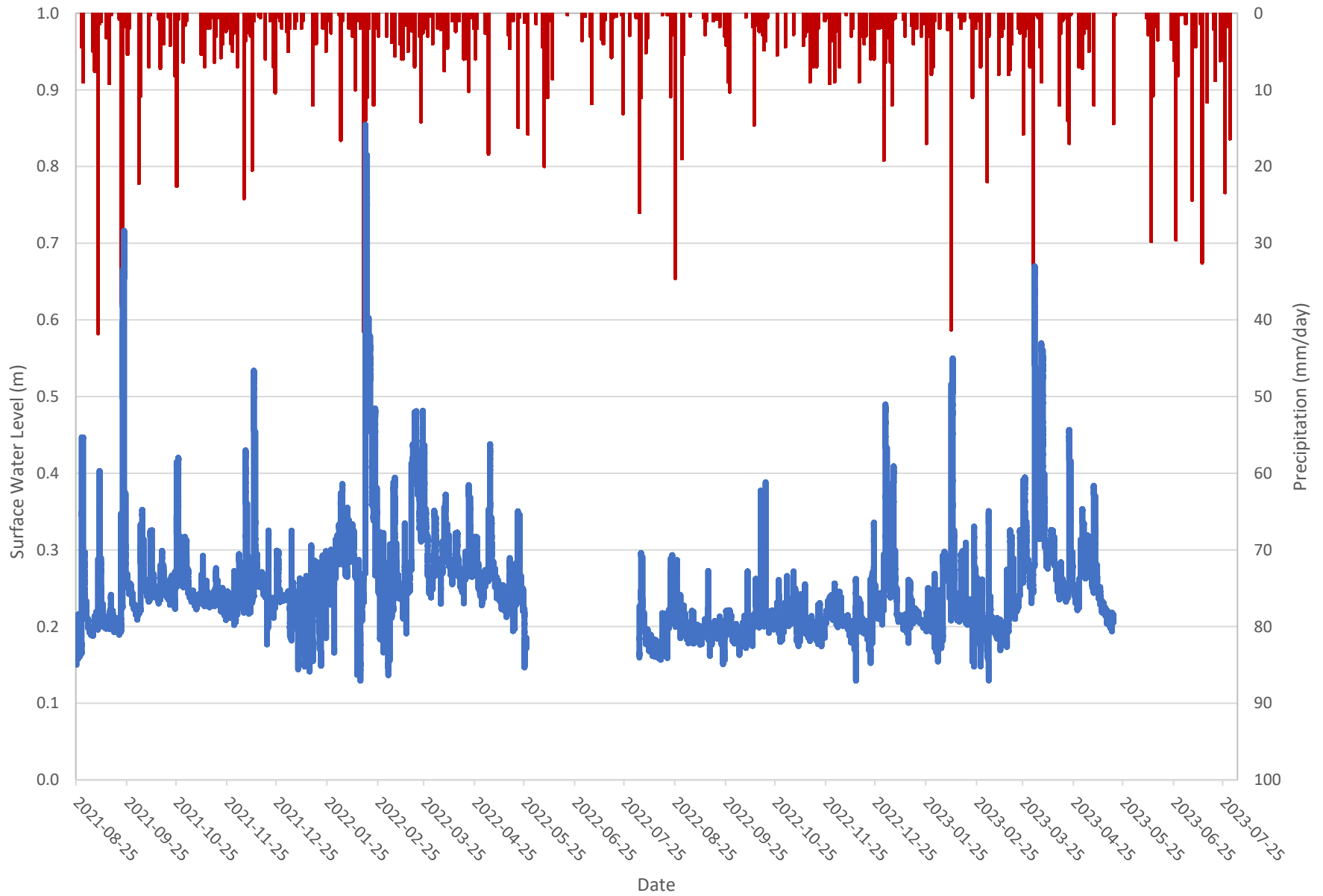
SW-1 Surface Water Level and Precipitation from August 25, 2021 to August 2, 2023



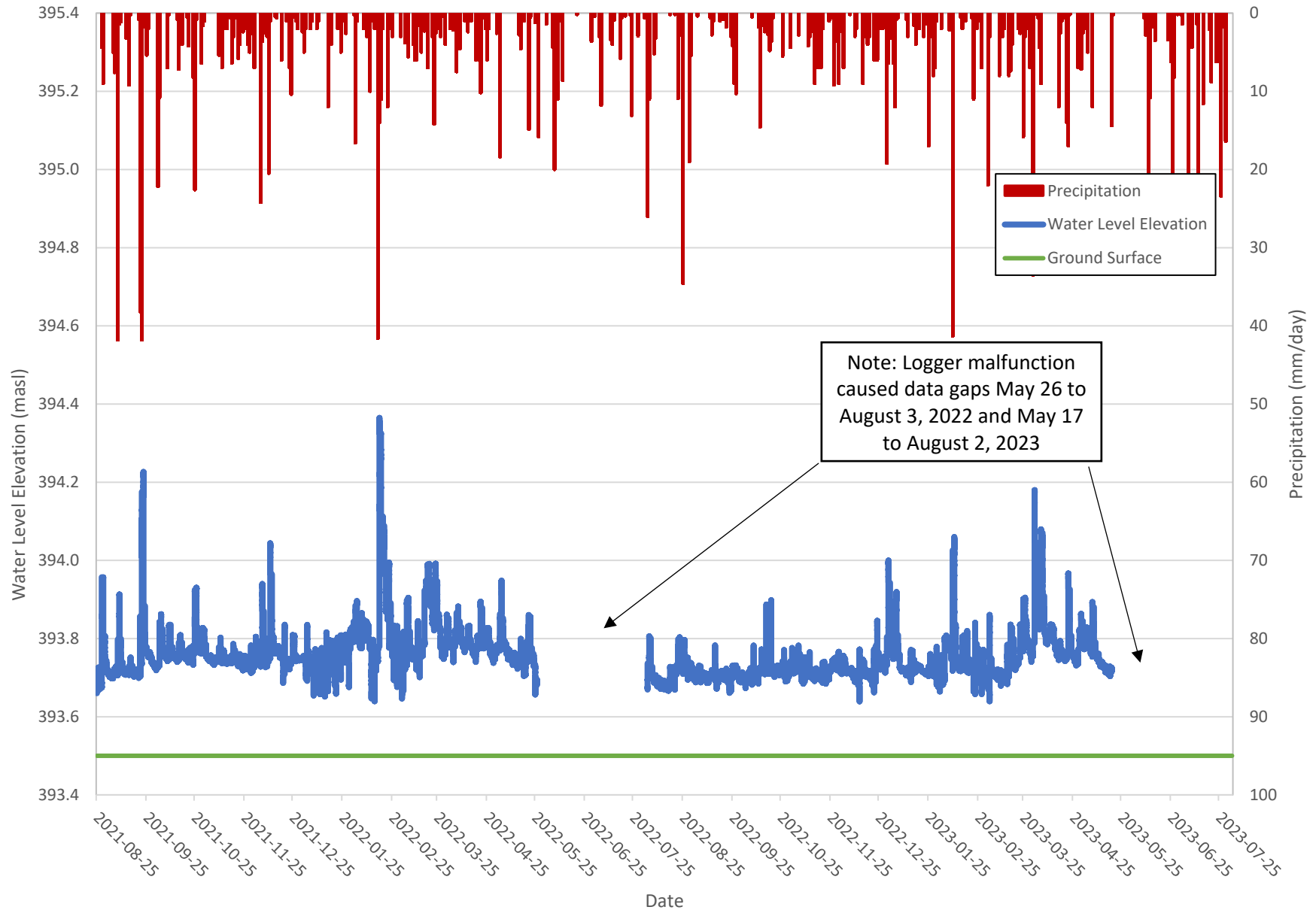
SW-1 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



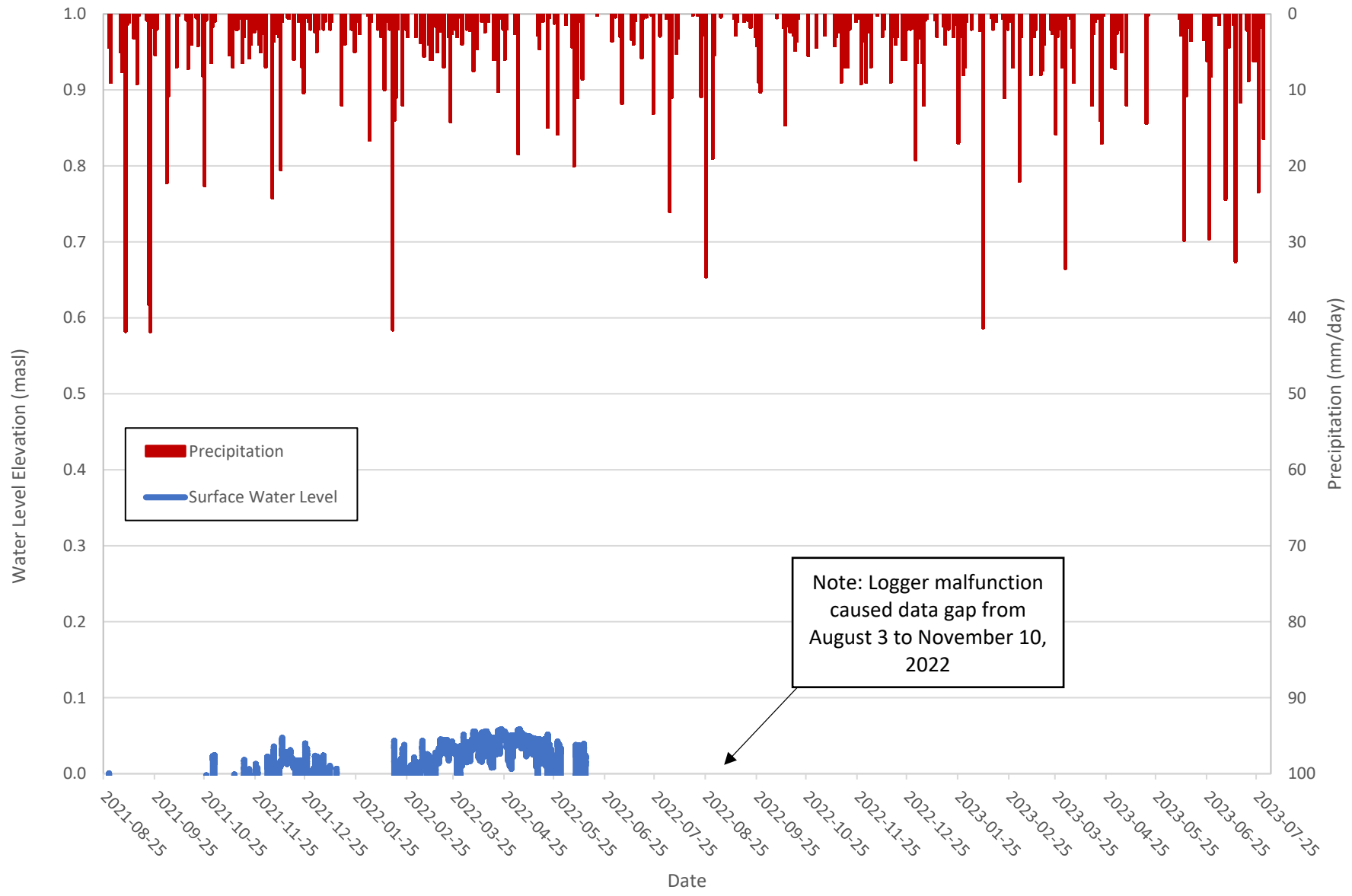
SW-2 Surface Water Level and Precipitation from August 25, 2021 to August 2, 2023



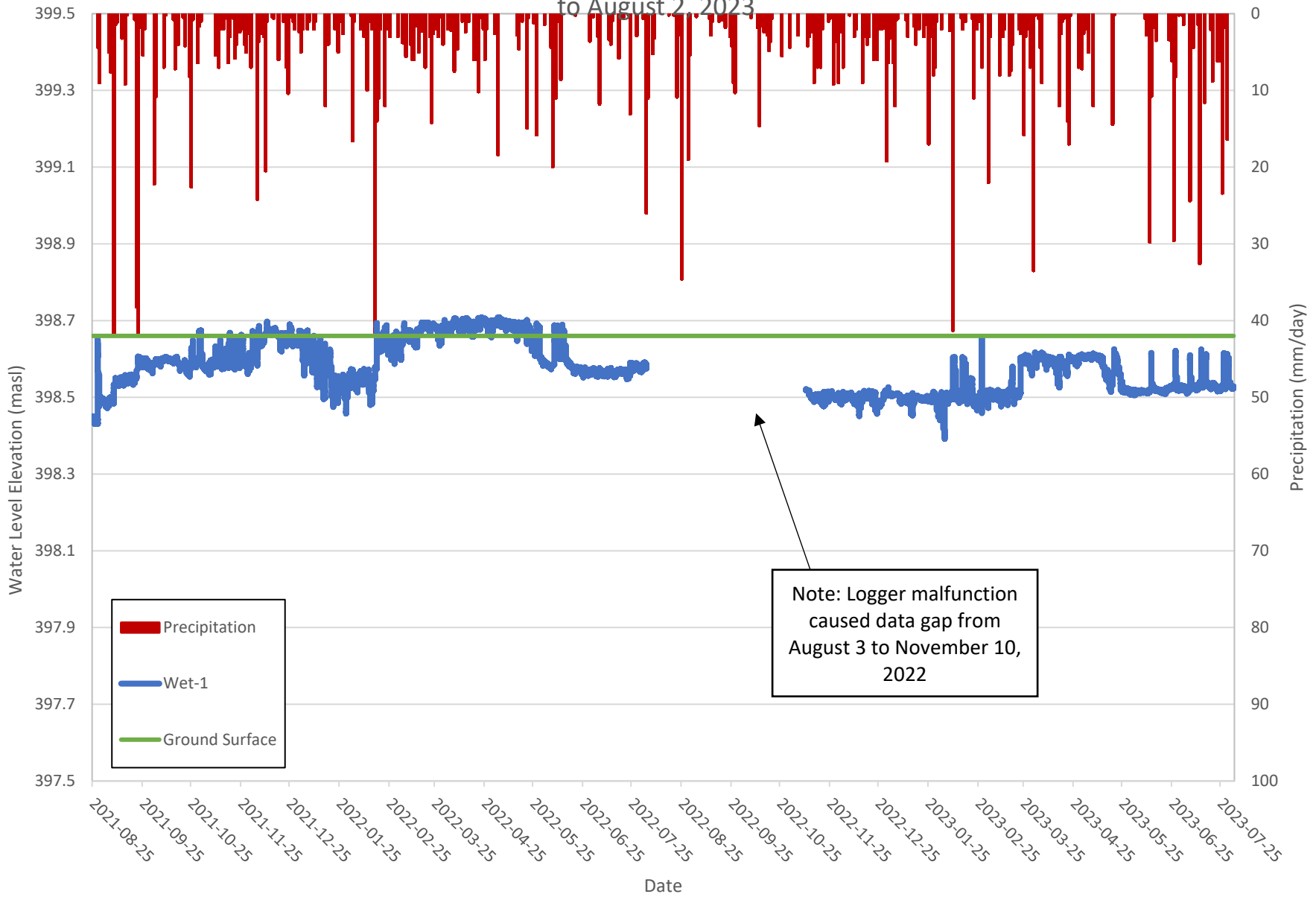
SW-2 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



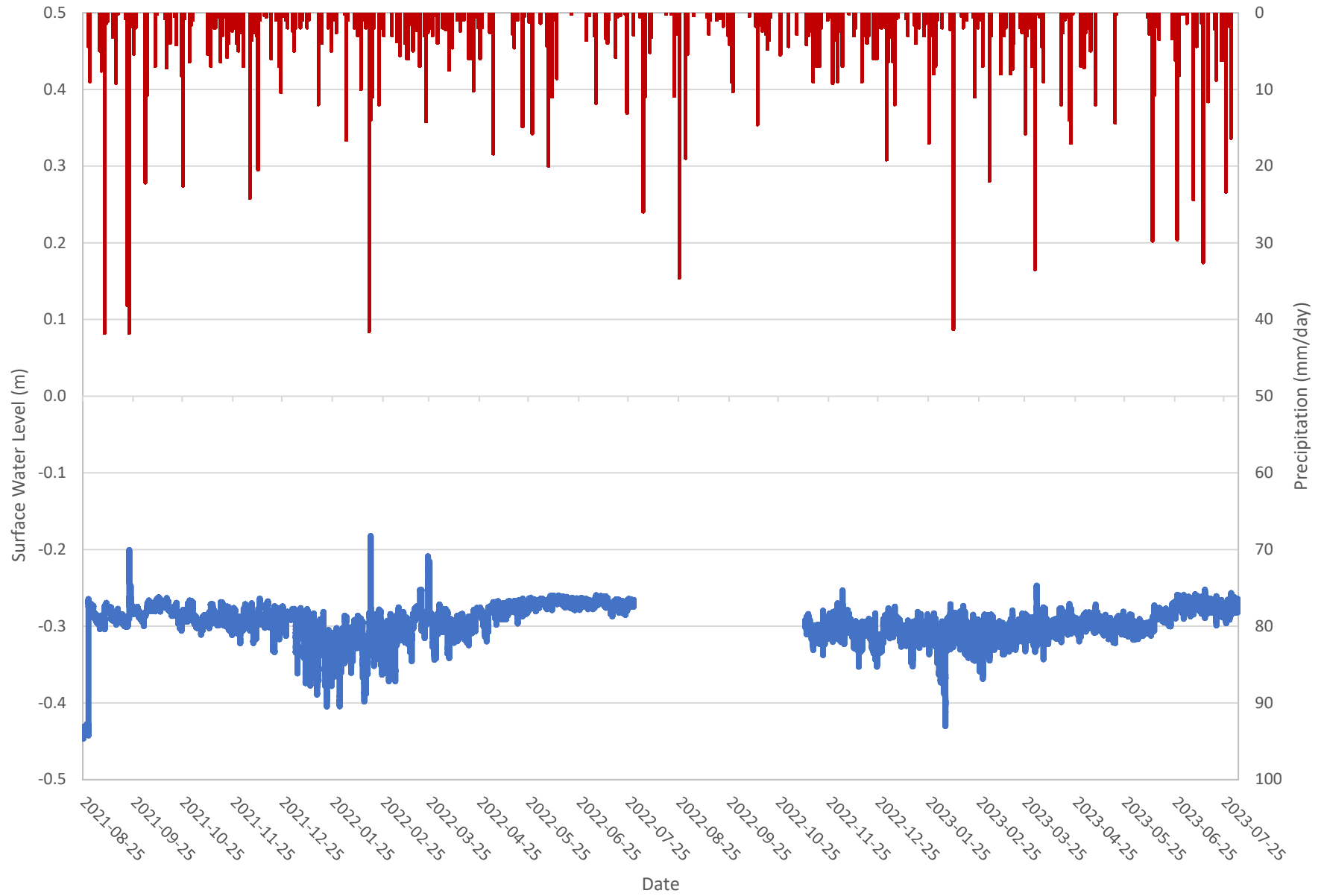
# Wet-1 Surface Water Level and Precipitation from August 25, 2021 to August 2, 2023



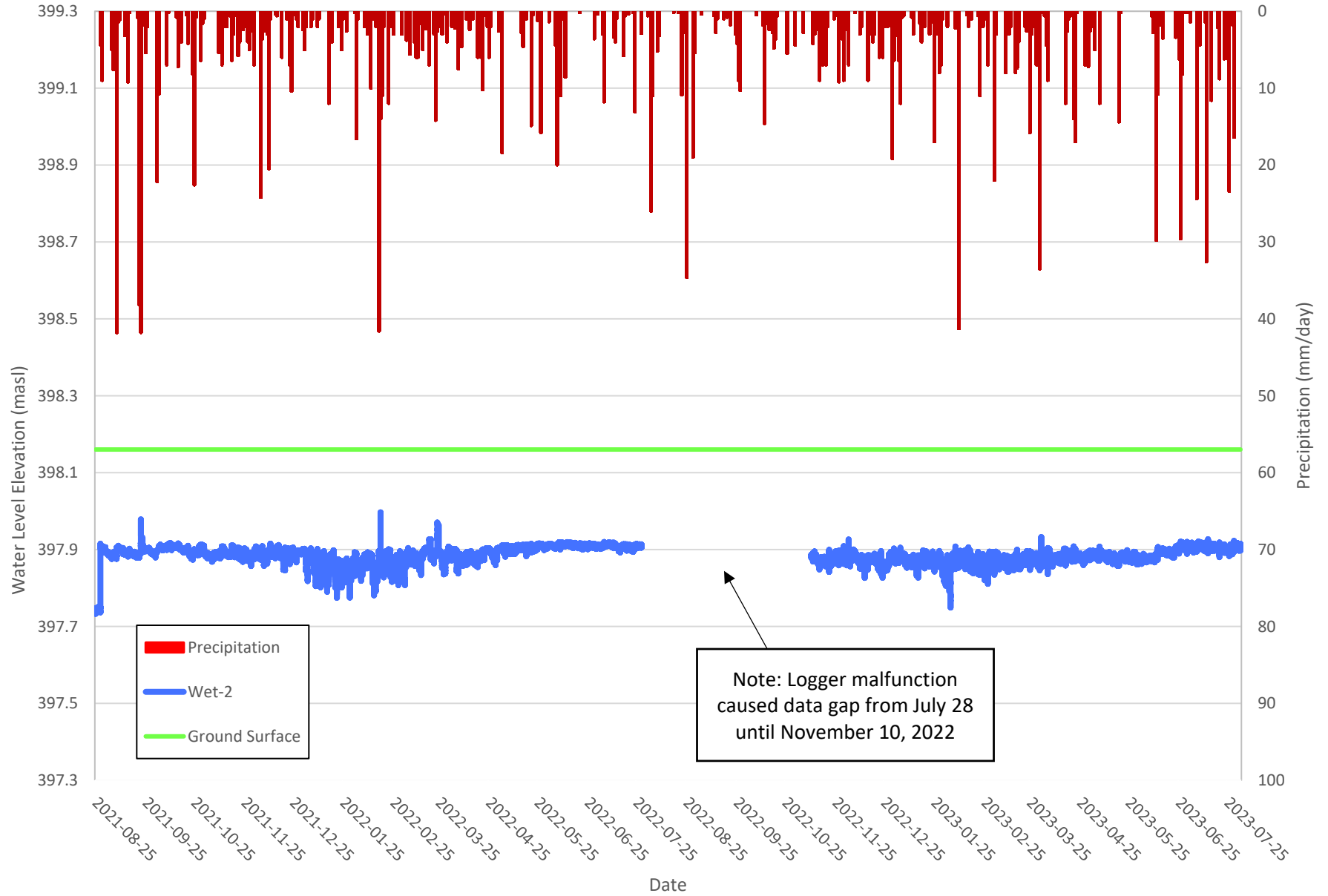
# GW-1 and Wet-1 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



Wet-2 Surface Water Level and Precipitation from August 25, 2021 August 2, 2023



Wet-2 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



## **Appendix B**

### **Borehole Logs**



PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course	<b>DRILLING DATA</b>
CLIENT: Empire Communities	Method: Hollow Stem Auger
PROJECT LOCATION: 5525 8 Line, Erin, ON	Diameter: 200mm
DATUM: Geodetic	Date: Apr-19-2021
BOREHOLE LOCATION: See Drawing 1 N 4846813.344 E 573411.482	REF. NO.: 21-129-300
	ENCL NO.: 3

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)					
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	GR
398.8	<b>TOPSOIL:</b> 350mm																	
0.0		1	SS	10													1 58 35 6	
398.4	<b>SILTY SAND:</b> trace to some gravel, trace clay, brown, moist, loose to compact	2	SS	13														
0.4		3	SS	8														
	wet below 1.5m	4	SS	12														
		5	SS	17														
		6	SS	31													10 69 (22)	
392.7	<b>SILTY SAND TILL:</b> some clay, cobble/boulder sizes, brown, moist, very dense	7	SS	62														
6.1		8	SS	50/25mm														
390.9	<b>END OF BOREHOLE:</b> Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading:  Date:            Water Level (mbgl): April 28, 2021    1.18																	

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    ○ ● = 3% Strain at Failure

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)					
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	GR
405.7	<b>TOPSOIL:</b> 250mm																	
405.4	<b>FILL:</b> sand, some silt to silty, some gravel, trace clay, trace organics, brown, moist, loose to compact	1	SS	4														
0.3		2	SS	6													14 67 15 4	
		3	SS	8														
		4	SS	22														
402.7	<b>SILTY SAND:</b> trace gravel, trace clay, brown, moist to wet, compact to dense	5	SS	15														
3.0		6	SS	31													4 59 32 5	
	wet below 4.6m																	
399.6	<b>SILTY SAND TILL:</b> gravelly, brown, wet, compact	7	SS	12														
6.1		8	SS	12														
	layer of sand, medium to coarse																	
397.5	<b>END OF BOREHOLE:</b> Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading:  Date:            Water Level (mbgl): April 28, 2021   6.33																	

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   ○ = 3% Strain at Failure

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" BLOWS 0.3 m	SHEAR STRENGTH (kPa)						
0.0	<b>TOPSOIL:</b> 250mm													
0.3	<b>FILL:</b> silty sand, some gravel, trace clay, brown, moist, loose		1	SS	2									
			2	SS	6									16 44 32 8
			3	SS	9									
411.8	<b>SILTY SAND TILL:</b> cobble/boulder sizes, brown, moist to wet, very dense		4	SS	50/ 25mm									
2.3			5	SS	50/ 50mm									
			6	SS	50									
	wet below 4.6m		7	SS	50/ 75mm									
406.4	<b>END OF BOREHOLE:</b> Notes: 1) Water level in open borehole: Date:            Water Level (mbgl): on completion   4.6		8	SS	50/ 50mm									

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   ○ = 3% Strain at Failure



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

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)								
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT					
415.3	TOPSOIL: 200mm																					
416.0	SANDY GRAVEL: some silt, brown, moist, compact to dense		1	SS	17																	
0.2			2	SS	48																	
413.8	SILTY SAND TILL: cobble/boulder sizes, brown to grey, moist, compact to very dense		3	SS	19																	
1.5			4	SS	27																	
			5	SS	44																	
			6	SS	29																	
			7	SS	71																	
			8	SS	81																	
8.2	END OF BOREHOLE: Notes: 1) Borehole open and dry upon completion.																					

DS SOIL LOG 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

GROUNDWATER ELEVATIONS  
 Measurement

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

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

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)								
412.0							20	40	60	80	100					
410.9	<b>TOPSOIL:</b> 100mm <b>SAND AND GRAVEL:</b> some silt, brown, moist, loose to very dense		1	SS	4											
			2	SS	65											
			3	SS	50/100mm											
409.7	<b>SILTY SAND TILL:</b> cobble/boulder sizes, brown to grey, moist to wet, compact to very dense  wet below 3m depth		4	SS	28											
			5	SS	18											
			6	SS	50/25mm											
			7	SS	50/25mm											
404.3	<b>END OF BOREHOLE:</b> Notes:  1) Water level in open borehole:  Date:            Water Level (mbgl): on completion   3.0		8	SS	50/25mm											

DS SOIL LOG - 21-129-300 ERIN HEIGHTS BOREHOLE LOGS.GPJ DS.GDT 21-5-5

**GROUNDWATER ELEVATIONS**  
 Measurement

**GRAPH NOTES** + 3, × 3: Numbers refer to Sensitivity   ○ = 3% Strain at Failure

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

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	GR	SA
407.7	TOPSOIL: 150mm																			
407.0	GRAVELLY SAND: some silt, brown, moist, loose to compact		1	SS	3															
0.2			2	SS	19															
			3	SS	30															
			4	SS	24															
			5	SS	23															
403.1	SILTY SAND: some gravel, brown, moist to wet, dense to loose  wet at 6.1m depth disturbed at 6.1m		6	SS	35															
4.6			7	DIS	(disturbed)															
400.1	SILTY SAND TILL: brown, moist, dense		8	SS	39															
7.6																				
399.5																				
8.2	<b>END OF BOREHOLE:</b> Notes: 1) Water level in open borehole: Date:            Water Level (mbgl): on completion    6.1																			

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, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure



PROJECT: Preliminary Geotechnical Investigation - Erin Heights Golf Course	<b>DRILLING DATA</b>
CLIENT: Empire Communities	Method: Hollow Stem Auger
PROJECT LOCATION: 5525 8 Line, Erin, ON	Diameter: 200mm
DATUM: Geodetic	Date: Apr-19-2021
BOREHOLE LOCATION: See Drawing 1 N 4846573.281 E 573806.122	REF. NO.: 21-129-300
	ENCL NO.: 11

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80							100	20	40	60	80	100
0.0	<b>GRANULAR FILL:</b> 250mm					419																
0.3	<b>FILL:</b> silty sand, some gravel, trace clay, brown, moist, loose to compact	1	SS	10		419																
		2	SS	4		418																11 54 26 9
		3	SS	23		417																
416.8	<b>SILTY SAND:</b> trace gravel, trace clay, brown, wet, loose	4	SS	8		417																8 57 26 9
416.0	<b>SILTY SAND TILL:</b> gravelly, brown to grey, moist, dense to very dense	5	SS	44		416																
		6	SS	58		415																
		7	SS	80		414																
		8	SS	72		413																
410.9	<b>END OF BOREHOLE:</b> Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading:  Date:            Water Level (mbgl): April 28, 2021   1.69					412																
8.2						411																

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   ○ ● = 3% Strain at Failure

## **Appendix C**

### **Hydraulic Conductivity Analyses**



K from Grain Size Analysis Report

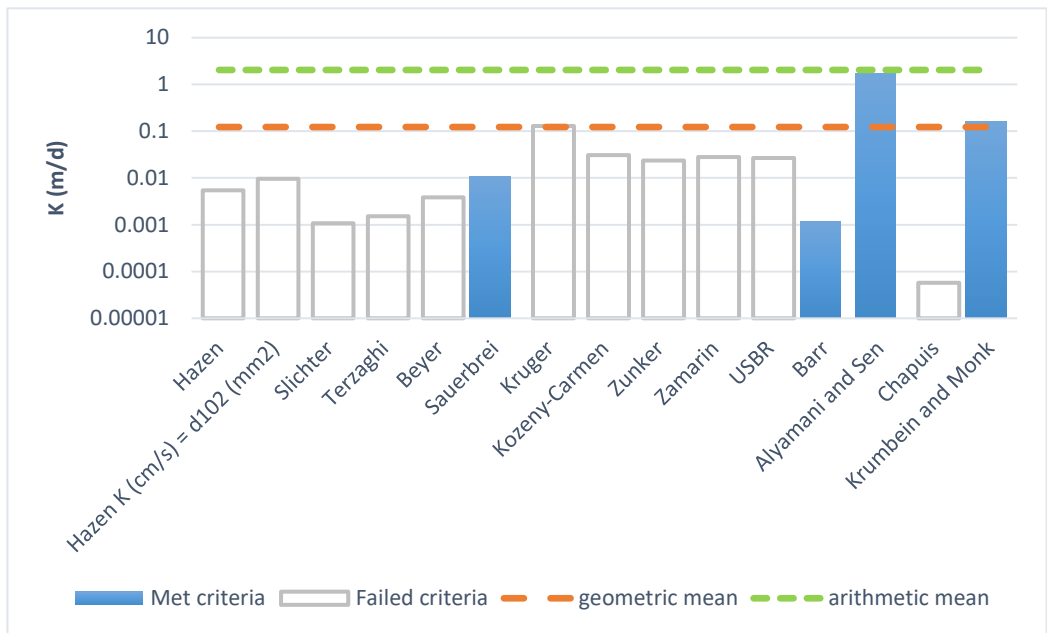
Date: 20-May-21

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 <sub>10</sub> (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	
Chapis	.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

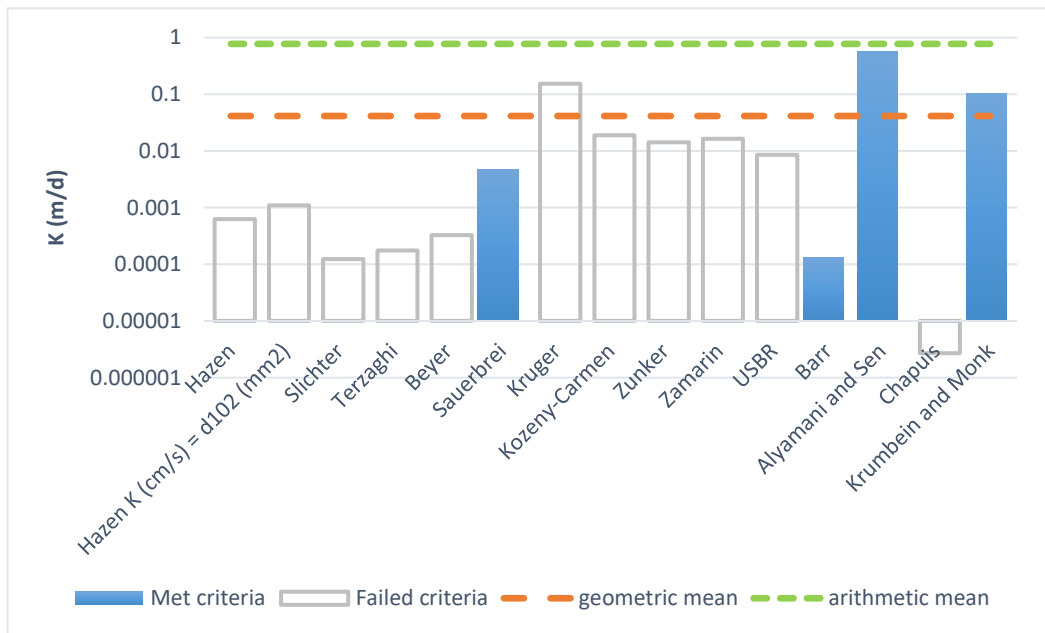
Date: 20-May-21

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 <sub>10</sub> (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

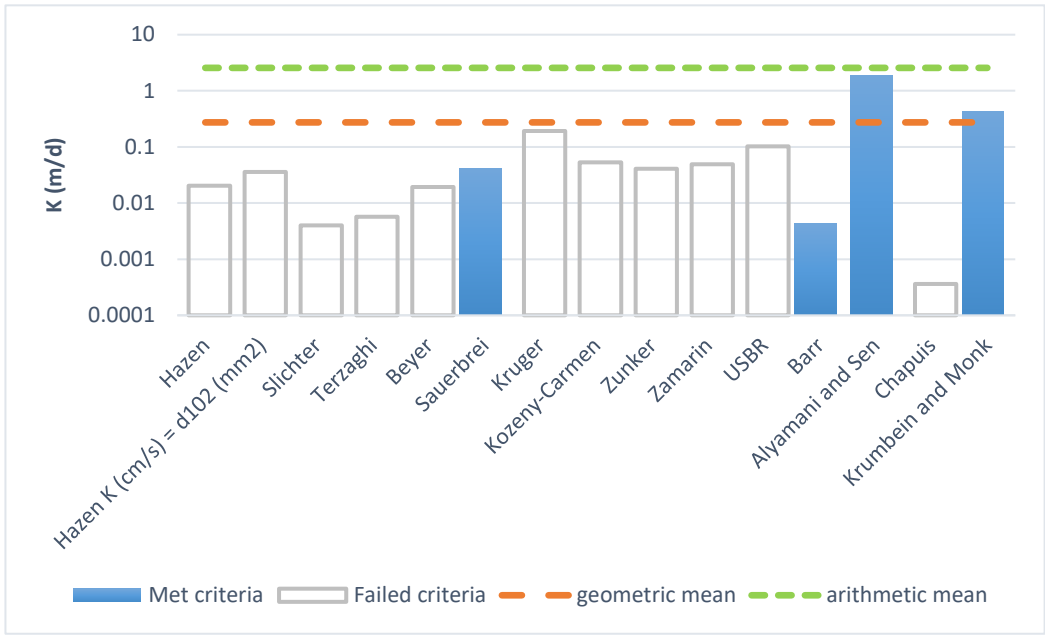
Date: 20-May-21

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 <sub>10</sub> (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

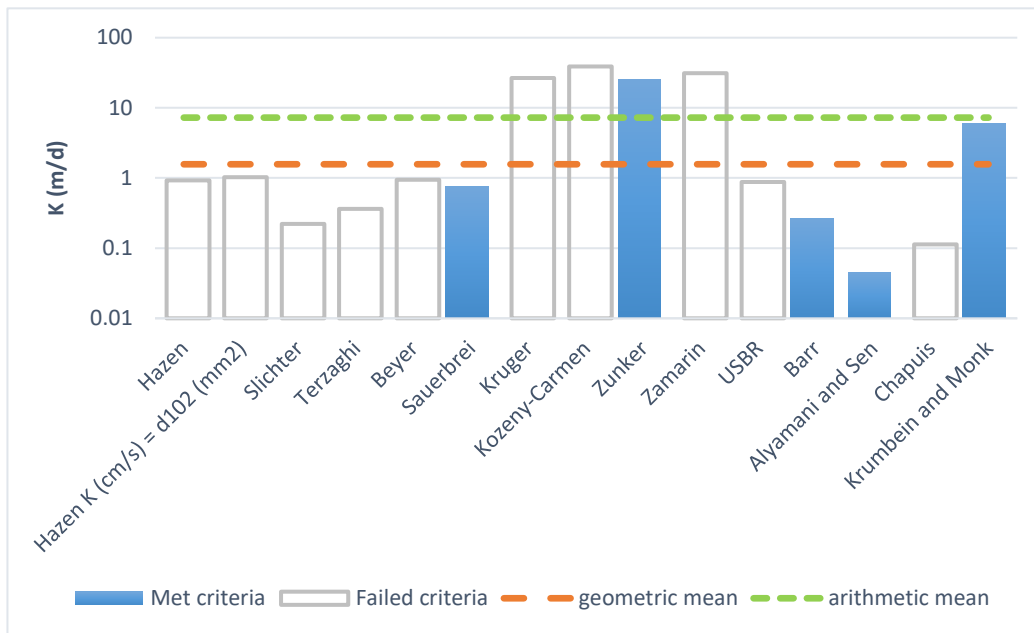
Date: 20-May-21

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 <sub>10</sub> (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

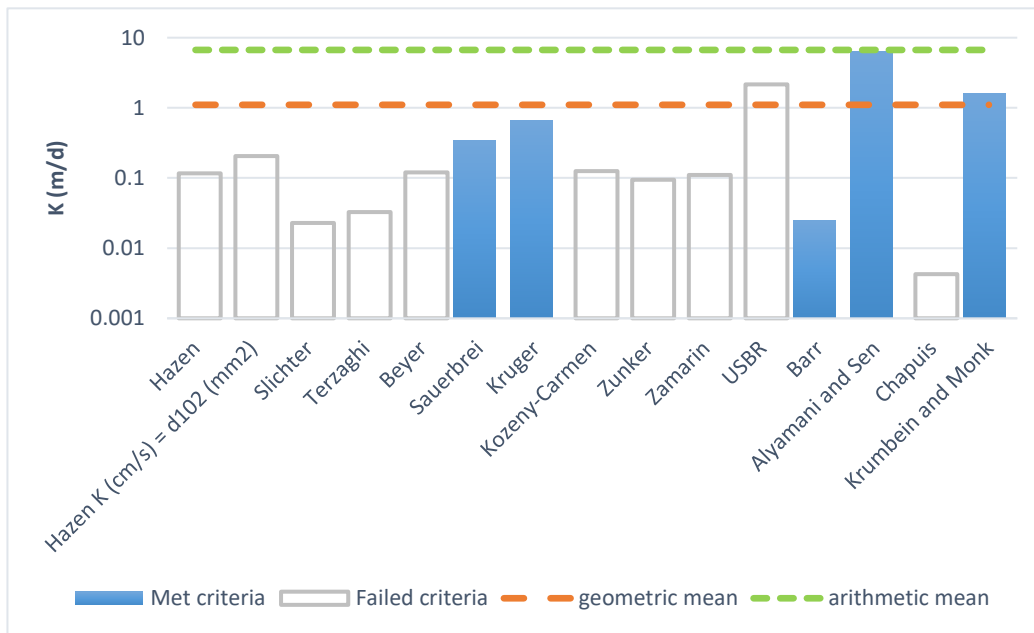
Date: 19-May-21

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 <sub>10</sub> (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

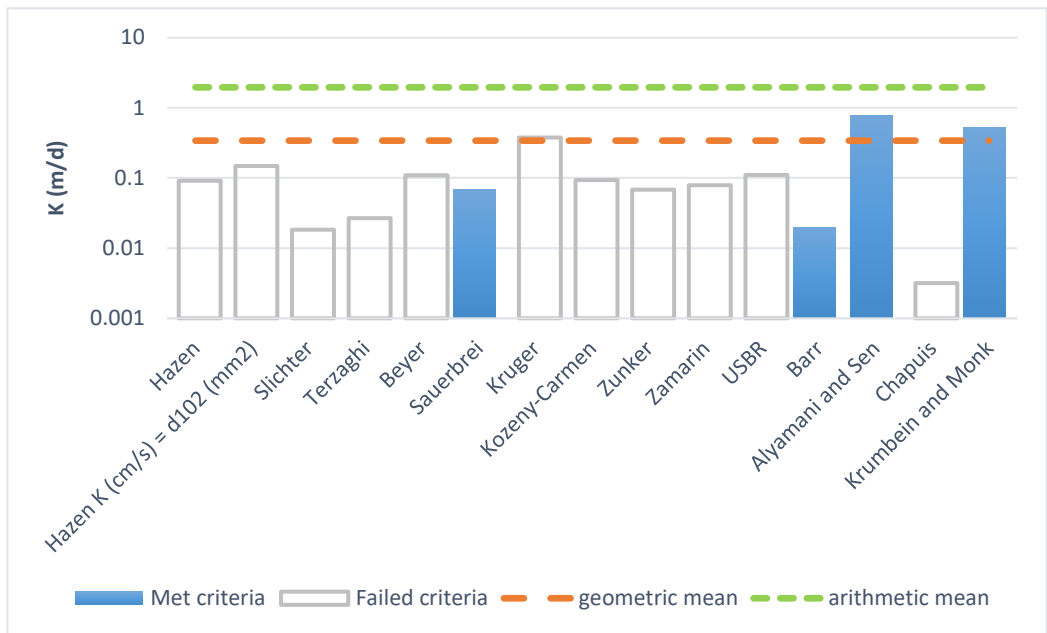
Date: 20-May-21

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 <sub>10</sub> (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	
Krumbain 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

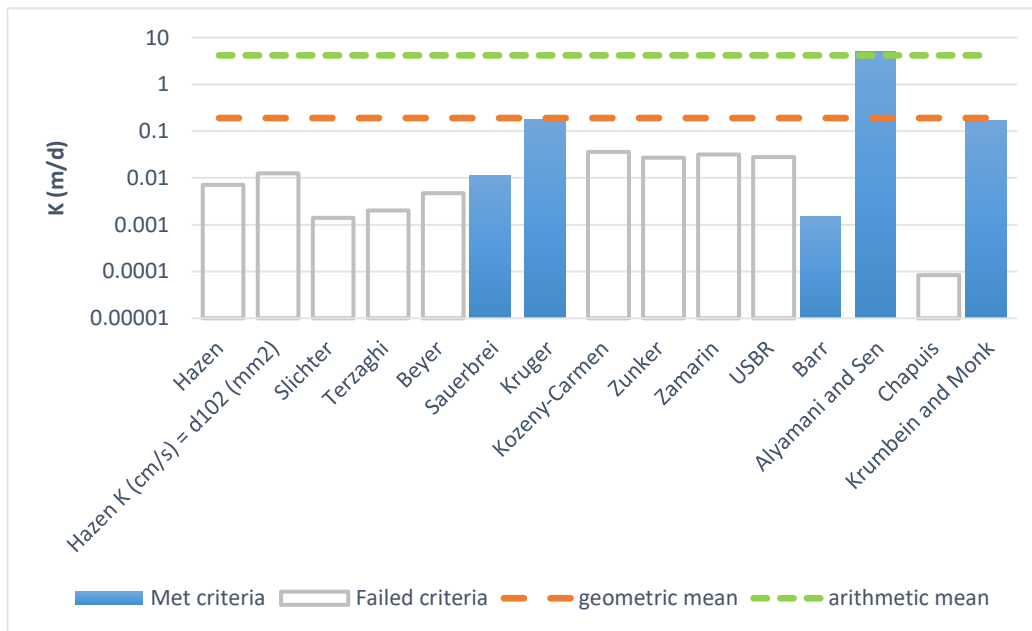
Date: 19-May-21

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 <sub>10</sub> (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

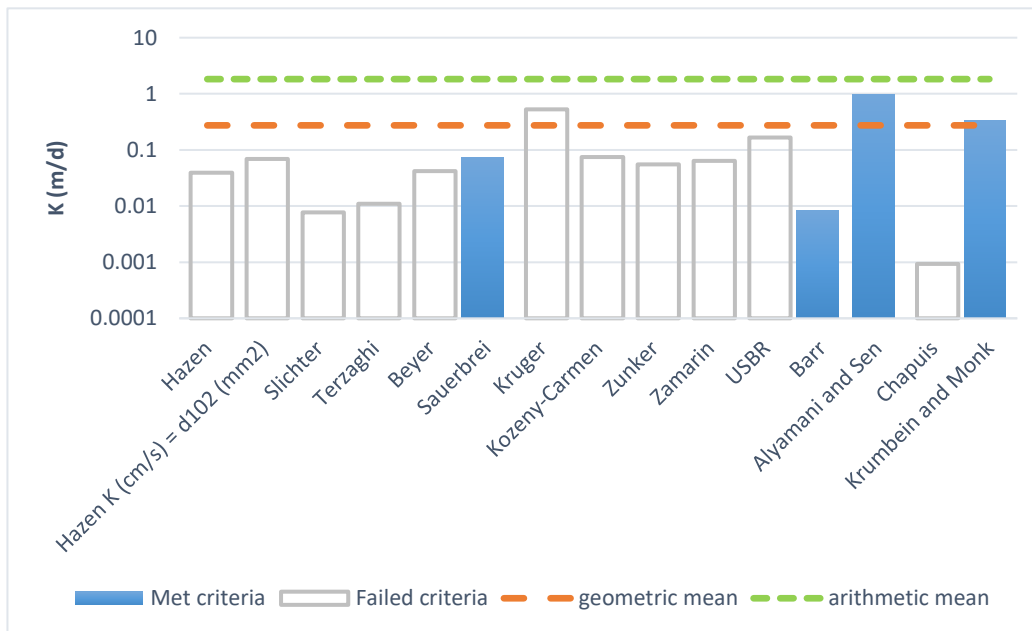
Mass Sample (g):

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 <sub>10</sub> (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

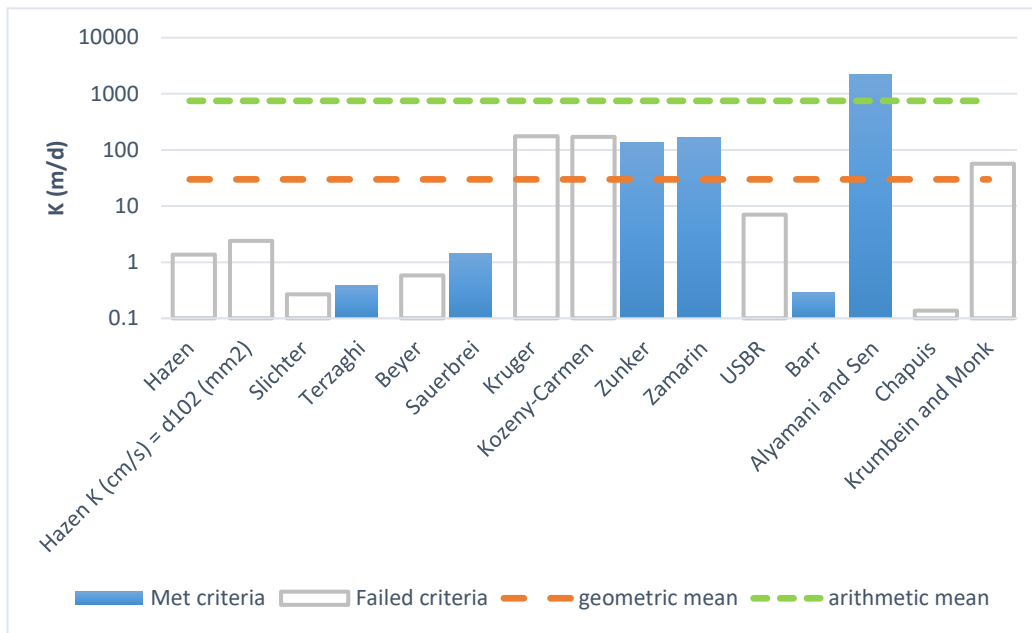
Date: 20-May-21

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 <sub>10</sub> (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

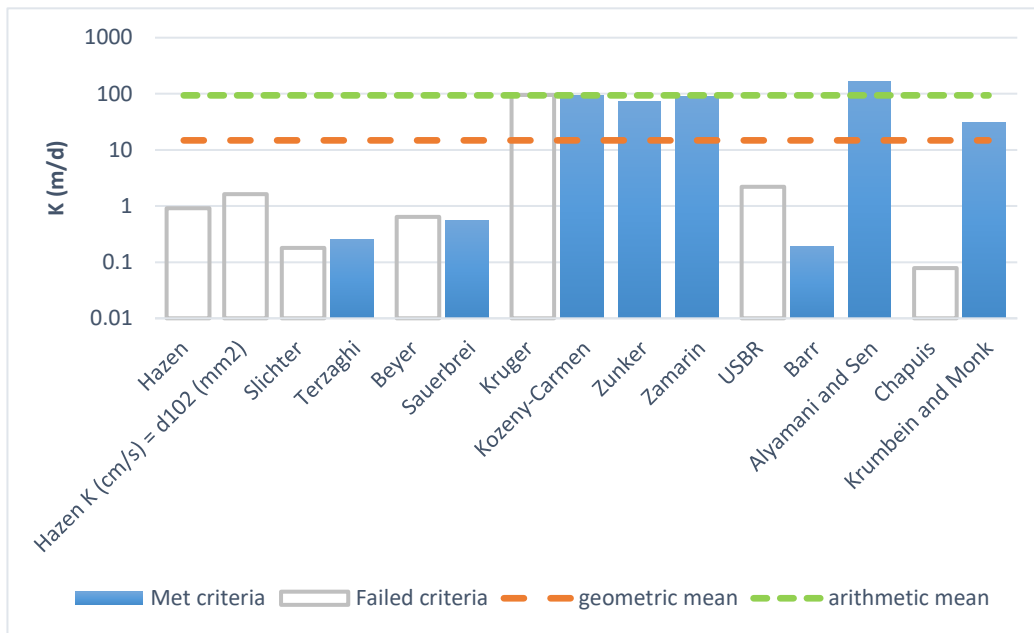
Date: 20-May-21

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 <sub>10</sub> (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

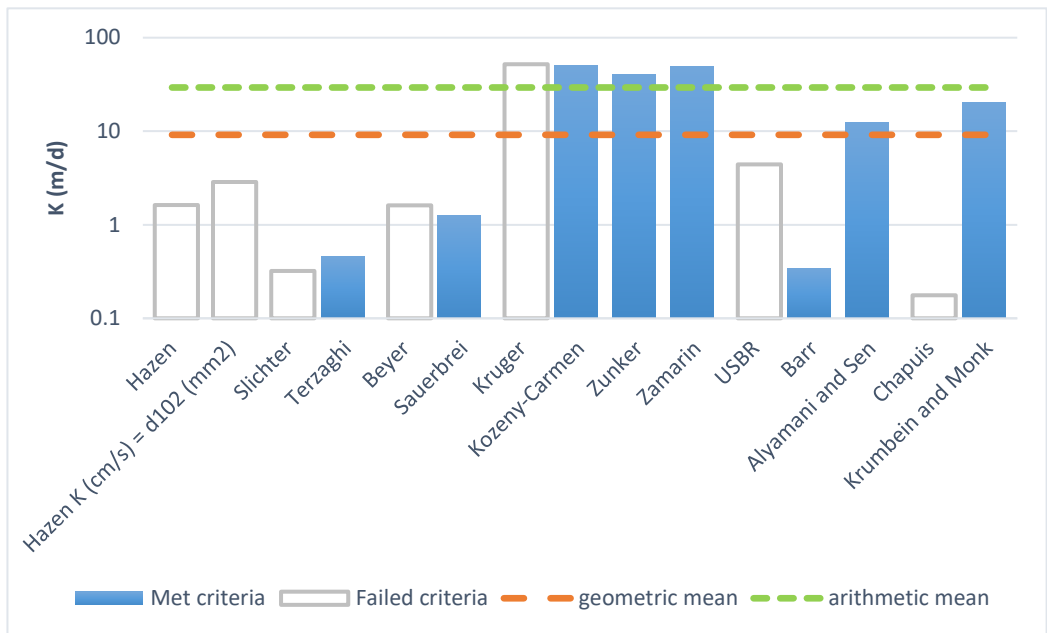
Date: 20-May-21

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 <sub>10</sub> (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

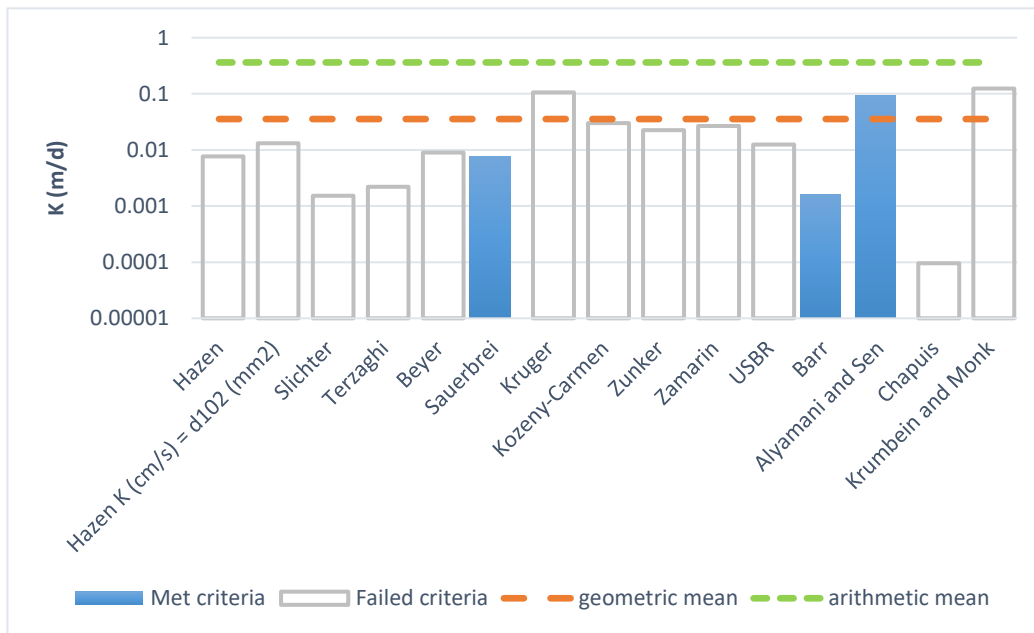
Date: 19-May-21

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 <sub>10</sub> (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

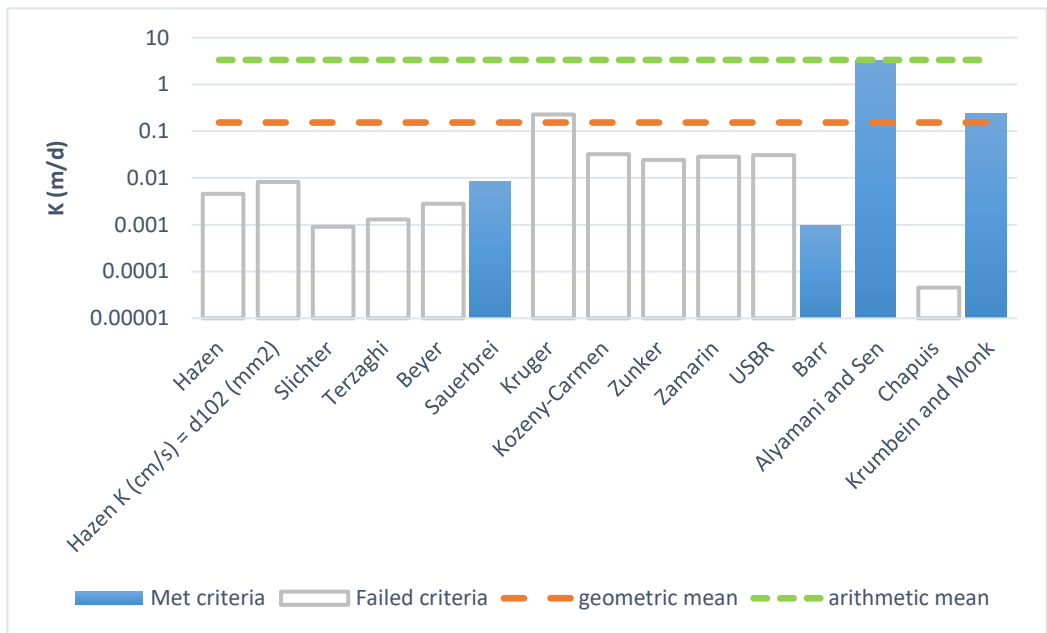
Date: 19-May-21

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 <sub>10</sub> (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

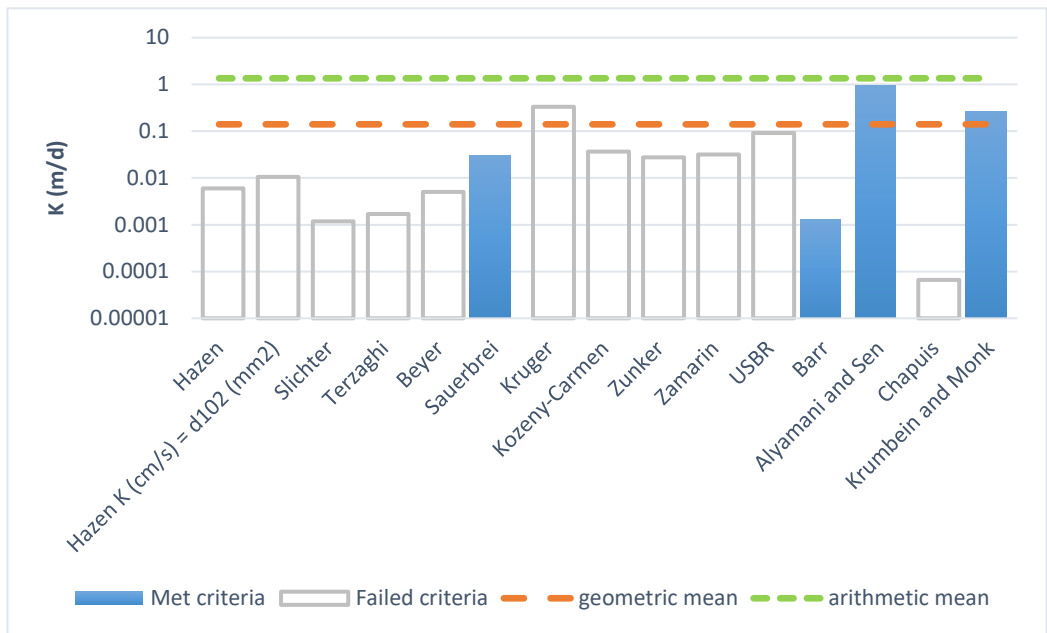
Date: 20-May-21

Sample Name: MW21-10, SS4, 2.6 mBGS, Silty Sand (above the till)

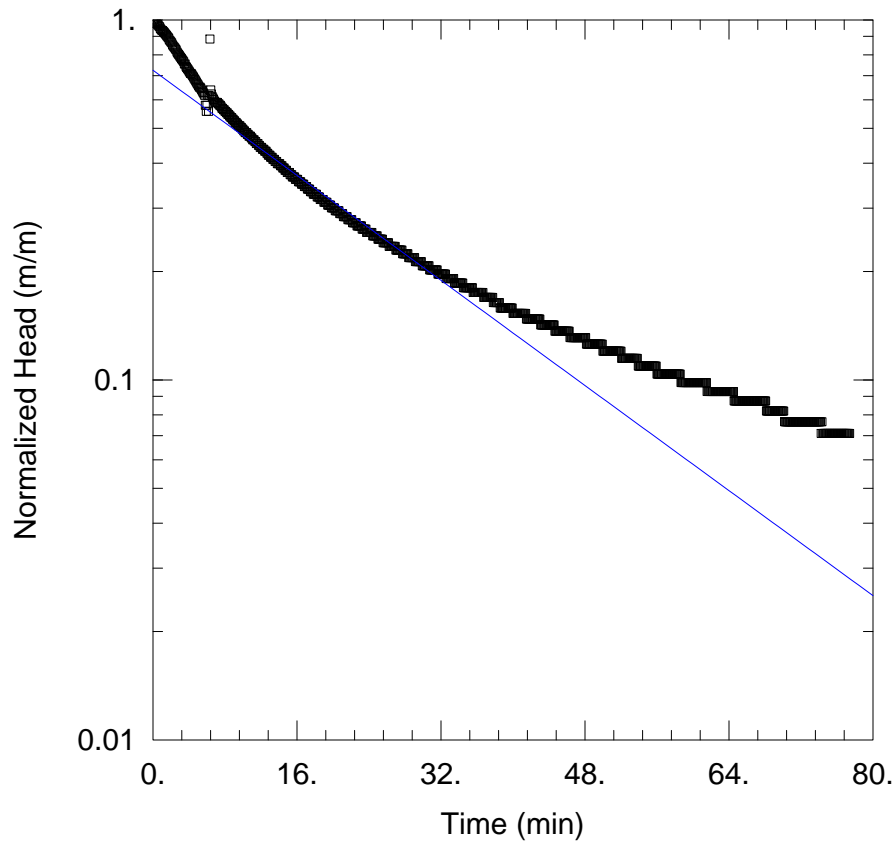
Mass Sample (g): 100

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 <sub>10</sub> (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	
Chapis	.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	



### WELL TEST ANALYSIS

Data Set: C:\...\MW21-1.aqt

Date: 08/10/23

Time: 09:31:52

### PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.

Client: EC (Erin) GP Inc.

Location: 5525 Eighth Line, Erin

Test Well: MW21-1

Test Date: August 2, 2023

### SOLUTION

Aquifer Model: Confined

Solution Method: Bower-Rice

$K = 2.22E-7$  m/sec

$y_0 = 1.326$  m

### AQUIFER DATA

Saturated Thickness: 3.05 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (MW21-1)

Initial Displacement: 1.83 m

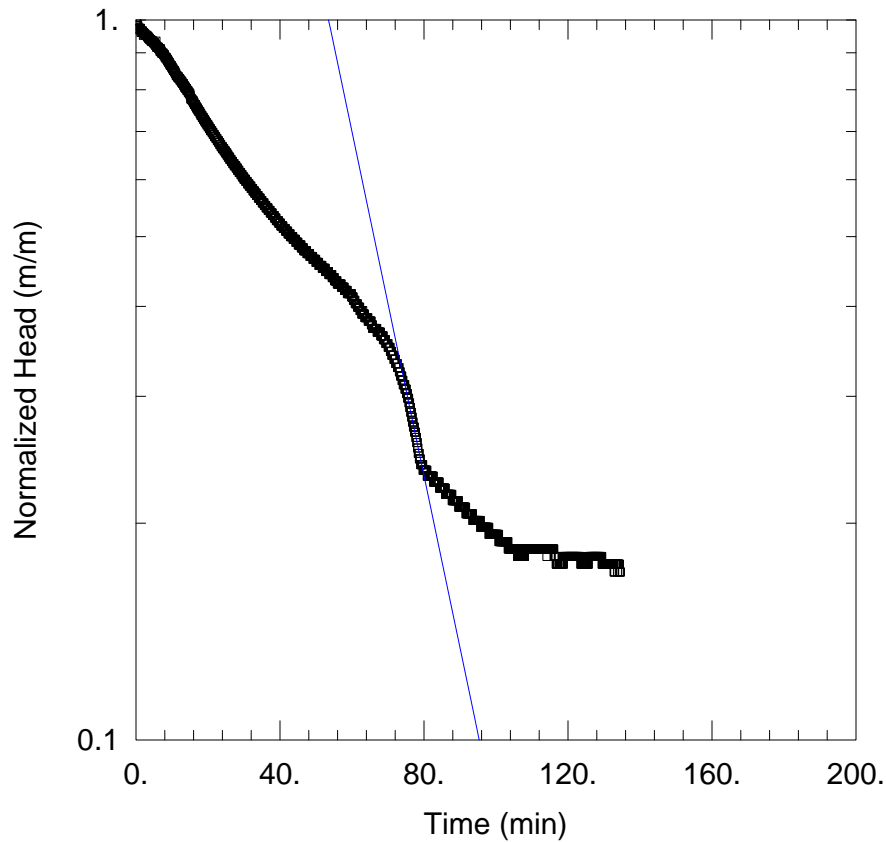
Total Well Penetration Depth: 6.03 m

Casing Radius: 0.0254 m

Static Water Column Height: 5.98 m

Screen Length: 3.05 m

Well Radius: 0.1 m



### WELL TEST ANALYSIS

Data Set: C:\...\MW21-2.aqt

Date: 08/10/23

Time: 09:49:54

### PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.

Client: EC (Erin) GP Inc.

Location: 5525 Eighth Line, Erin

Test Well: MW21-2

Test Date: August 2, 2023

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 2.881E-7$  m/sec

$y_0 = 43.29$  m

### AQUIFER DATA

Saturated Thickness: 5.7 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (MW21-2)

Initial Displacement: 2.28 m

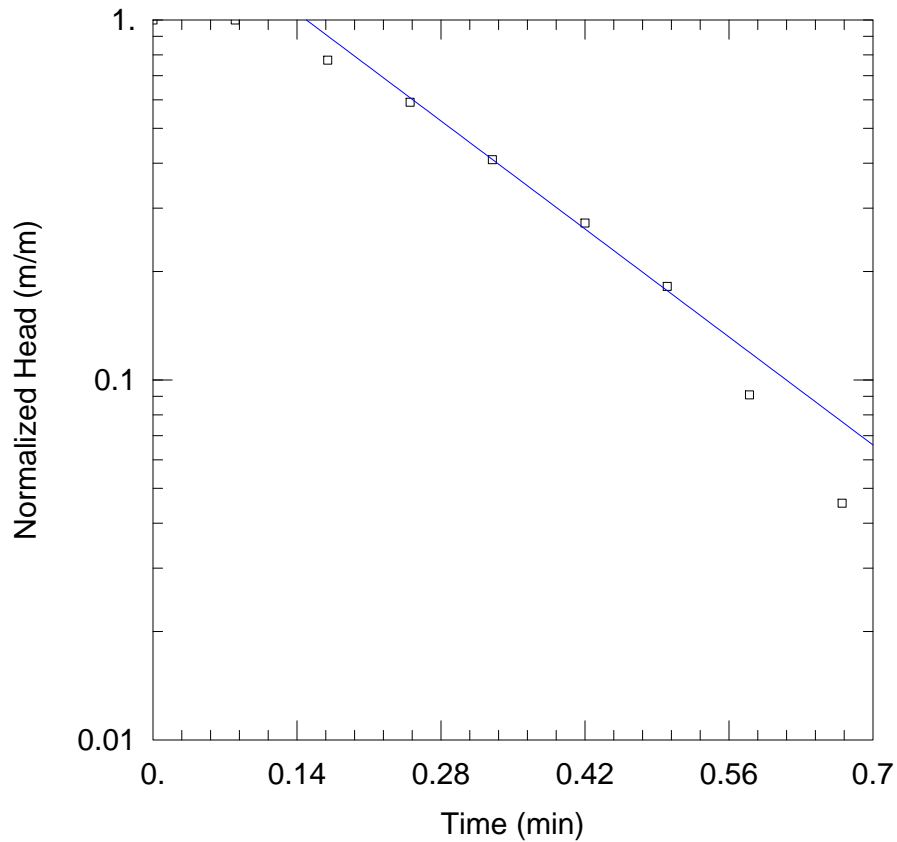
Total Well Penetration Depth: 5.75 m

Casing Radius: 0.0254 m

Static Water Column Height: 5.7 m

Screen Length: 3.05 m

Well Radius: 0.1 m



### WELL TEST ANALYSIS

Data Set: C:\...\MW21-3.aqt

Date: 08/10/23

Time: 10:03:01

### PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.

Client: EC (Erin) GP Inc.

Location: 5525 Eighth Line, Erin

Test Well: MW21-3

Test Date: August 2, 2023

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 4.613E-5$  m/sec

$y_0 = 0.4591$  m

### AQUIFER DATA

Saturated Thickness: 1.34 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (MW21-3)

Initial Displacement: 0.22 m

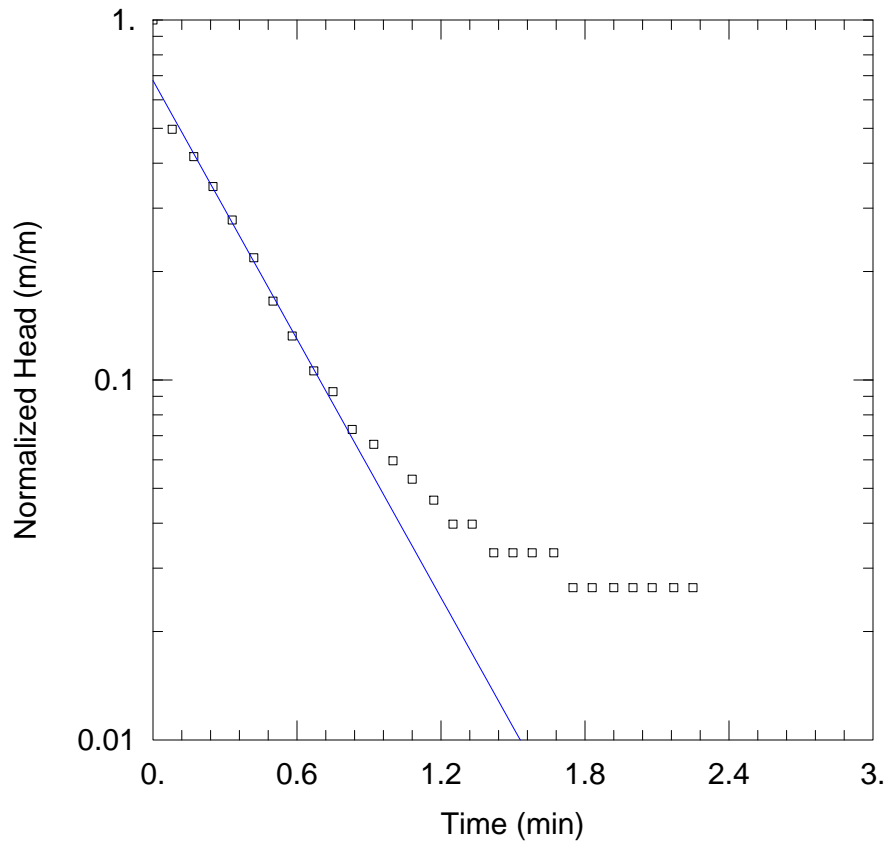
Total Well Penetration Depth: 3.05 m

Casing Radius: 0.0254 m

Static Water Column Height: 1.34 m

Screen Length: 3.05 m

Well Radius: 0.1 m



### WELL TEST ANALYSIS

Data Set: C:\...\MW21-10.aqt

Date: 08/10/23

Time: 08:36:59

### PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.

Client: EC (Erin) GP Inc.

Location: 5525 Eighth Line, Erin

Test Well: MW21-10

Test Date: August 2, 2023

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.531E-5$  m/sec

$y_0 = 1.025$  m

### AQUIFER DATA

Saturated Thickness: 2.45 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (MW21-10)

Initial Displacement: 1.51 m

Total Well Penetration Depth: 3.05 m

Casing Radius: 0.0254 m

Static Water Column Height: 2.45 m

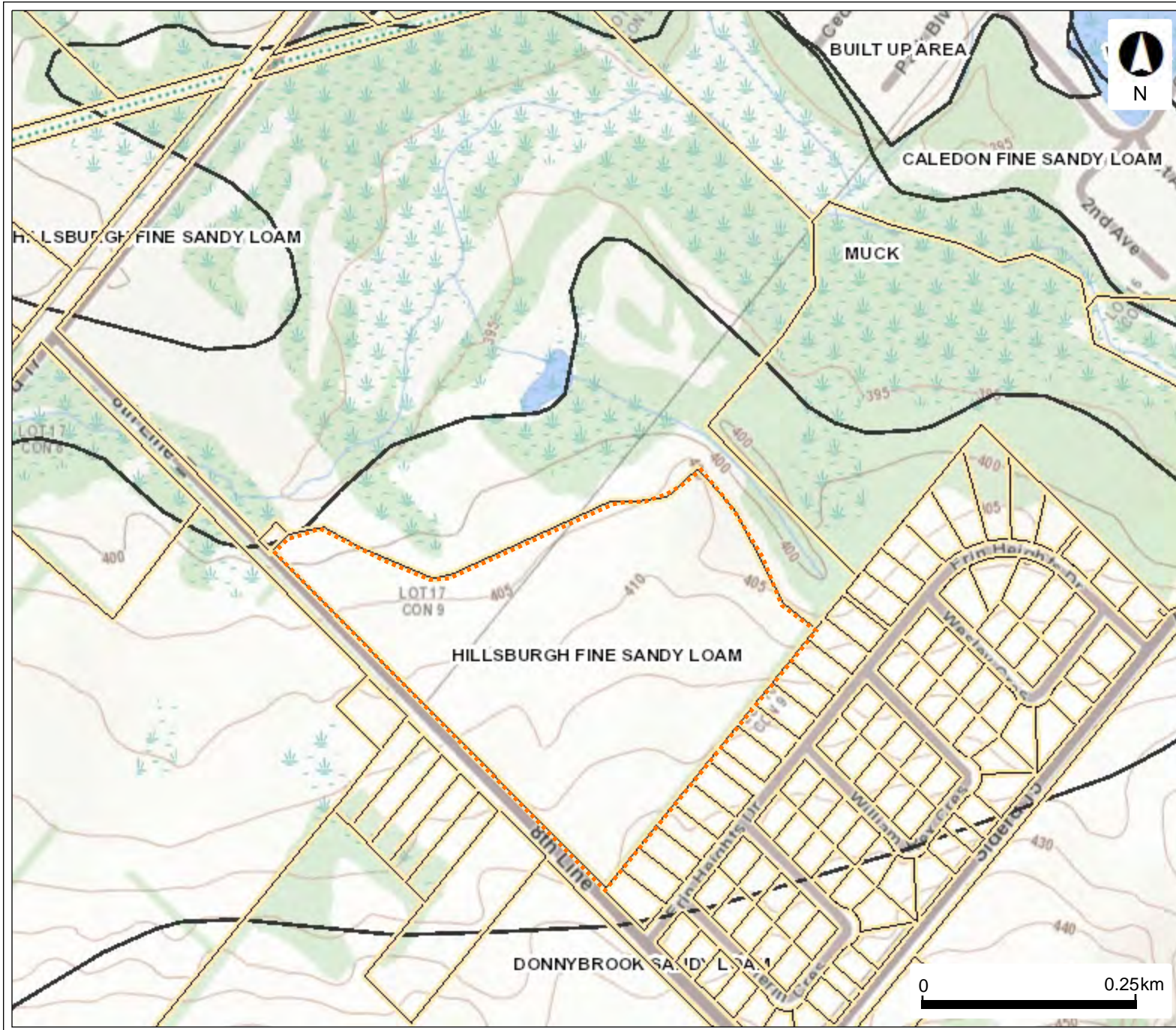
Screen Length: 3.05 m

Well Radius: 0.1 m



## **Appendix D**

### **Provincial Maps**

# OMAFRA Soil Type

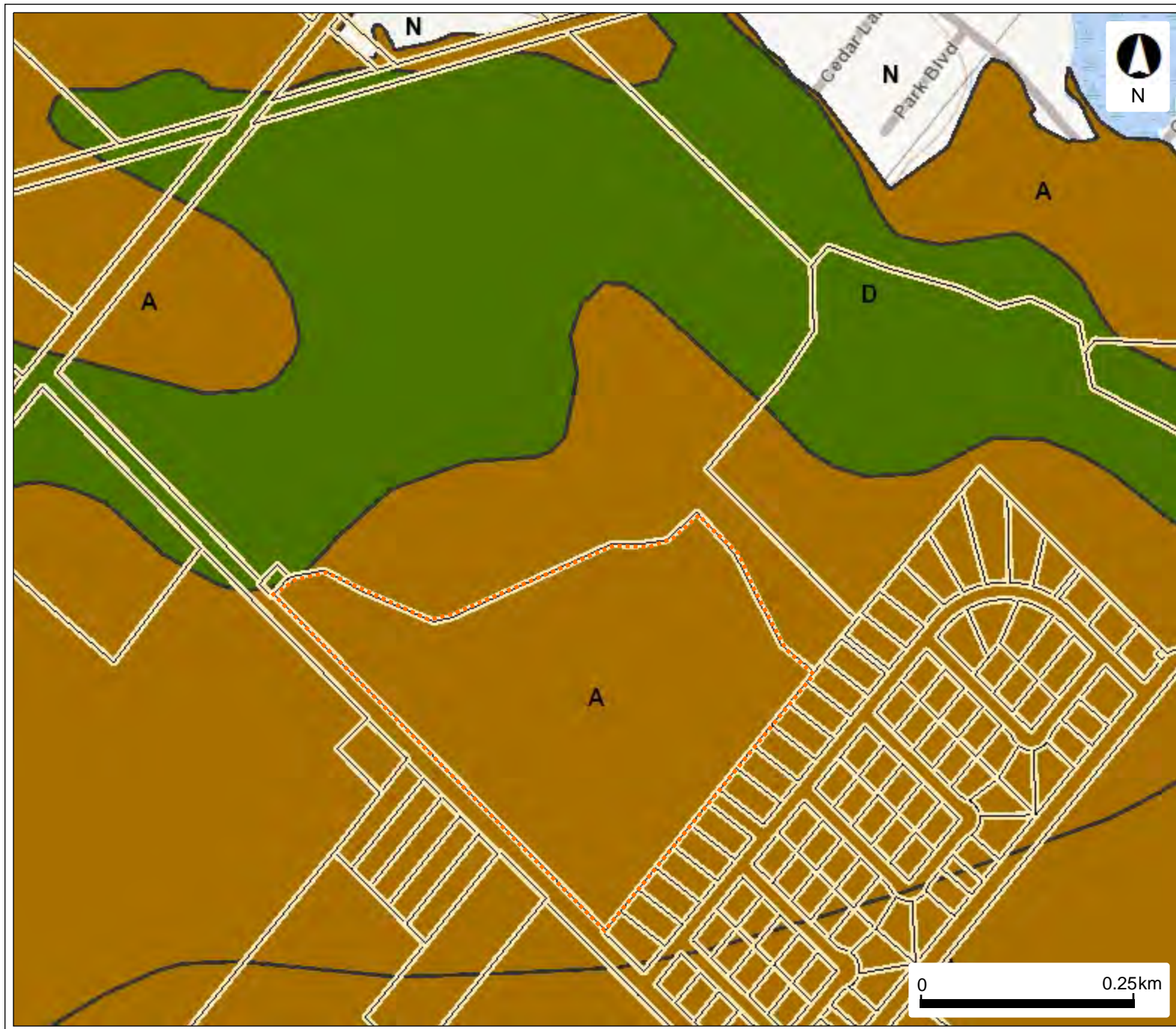


## Legend

-  Assessment Parcel
-  Soil Name Label

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

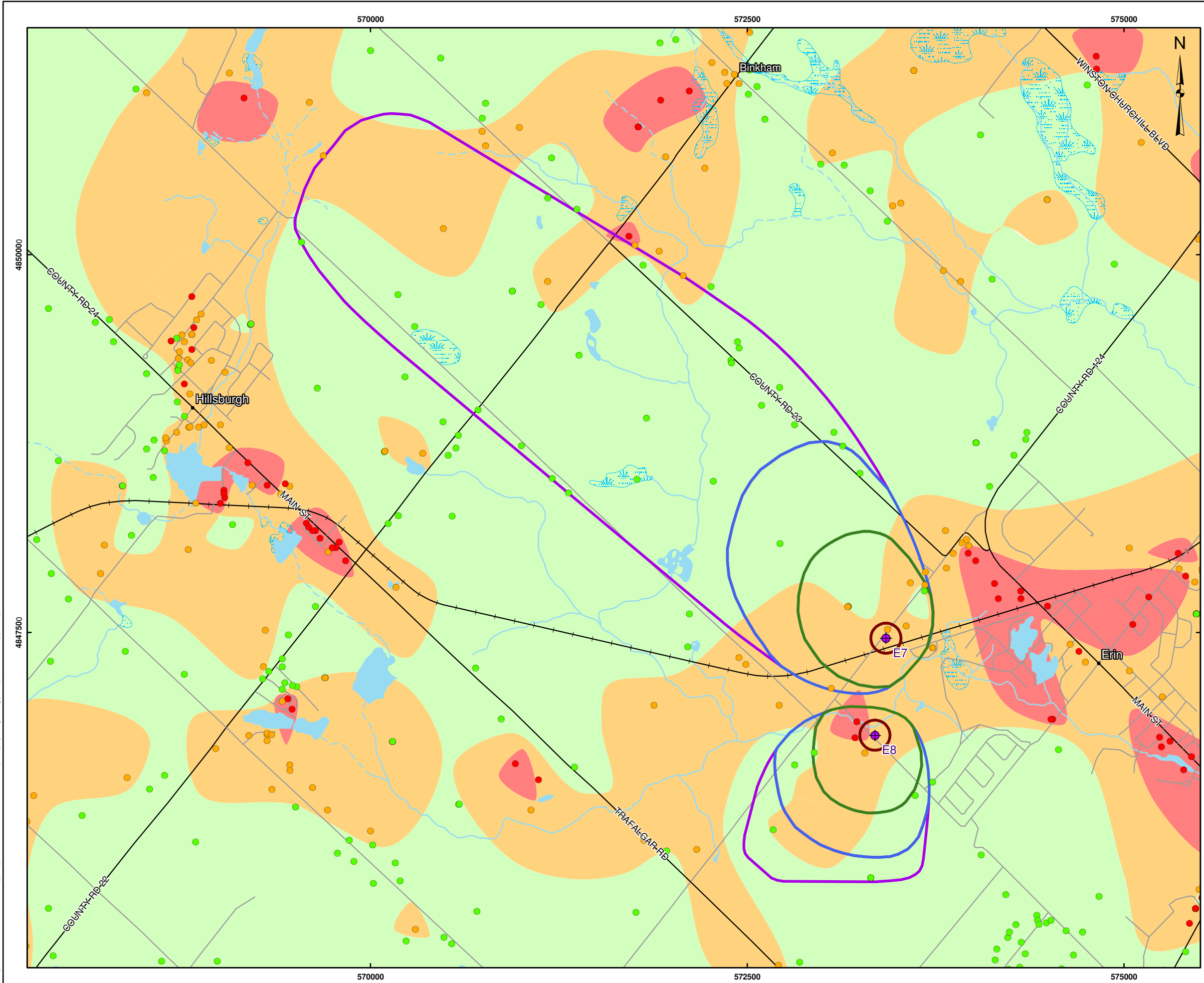
# OMAFRA Hydrologic Soil Group



## Legend

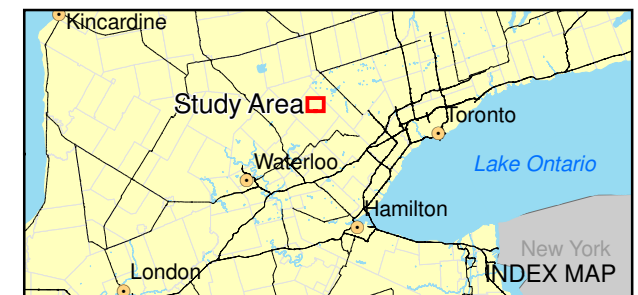
- Assessment Parcel
- Hydrologic Soil Group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

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



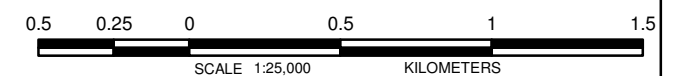
**LEGEND**

- ◆ 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**

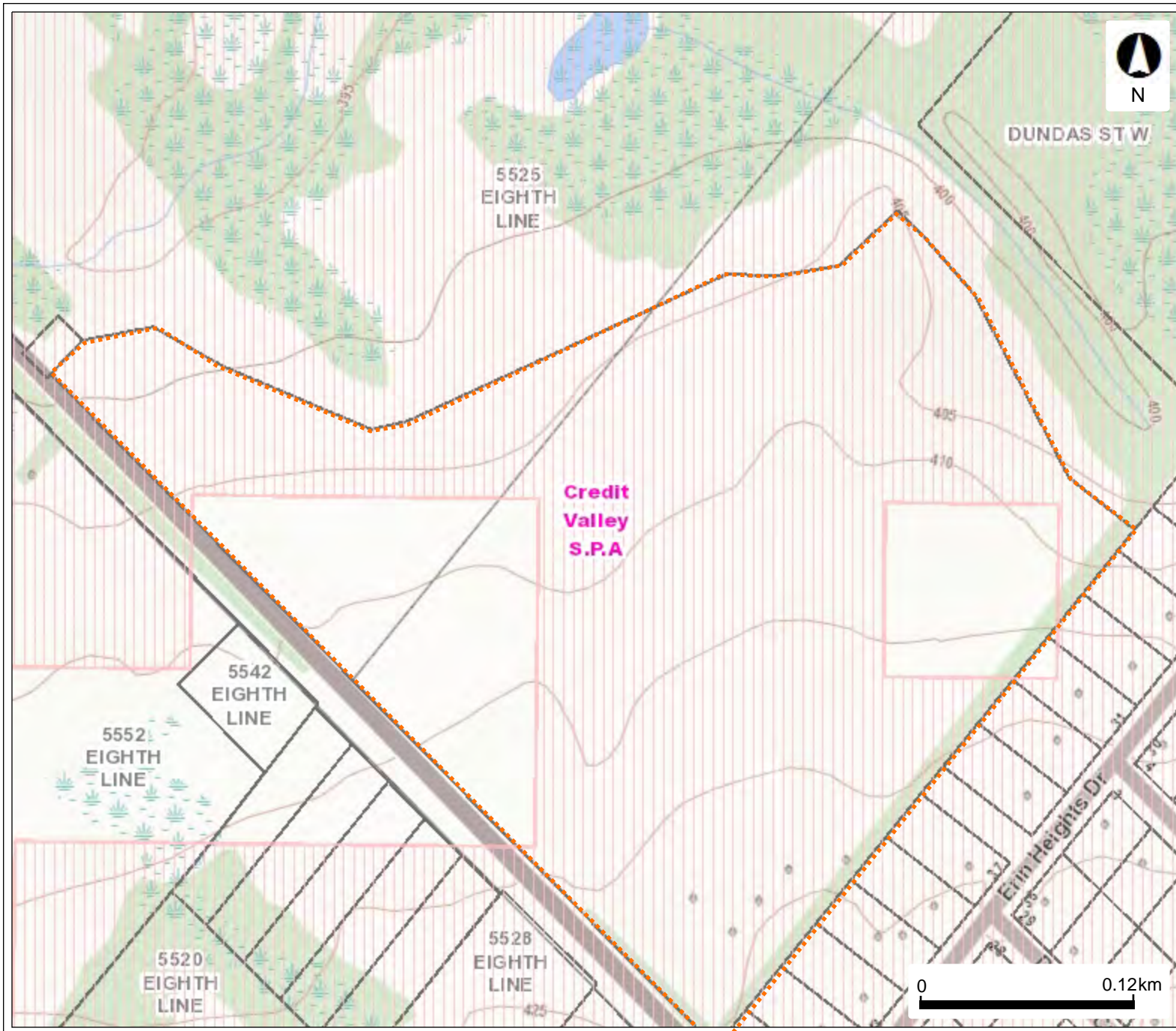
Base Data - MNR NRVIS, obtained 2004, CANMAP v2006.4  
 Produced by Golder Associates Ltd under licence from  
 Ontario Ministry of Natural Resources, © Queens Printer 2008  
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N






PROJECT			
SOURCE WATER PROTECTION - TOWN OF ERIN			
TITLE			
<b>ISI VULNERABILITY MAPPING - BEDROCK, ERIN MUNICIPAL WELLS</b>			
 Golder Associates Mississauga, Ontario	PROJECT NO.	09-1112-6139	SCALE AS SHOWN
	DESIGN	PRM 1 Apr. 2010	REV. 0.0
	GIS	PRM 1 Apr. 2010	
	CHECK	GP 1 Apr. 2010	
	REVIEW	JP 1 Apr. 2010	

**FIGURE: 5**

# Highly Vulnerable Aquifer

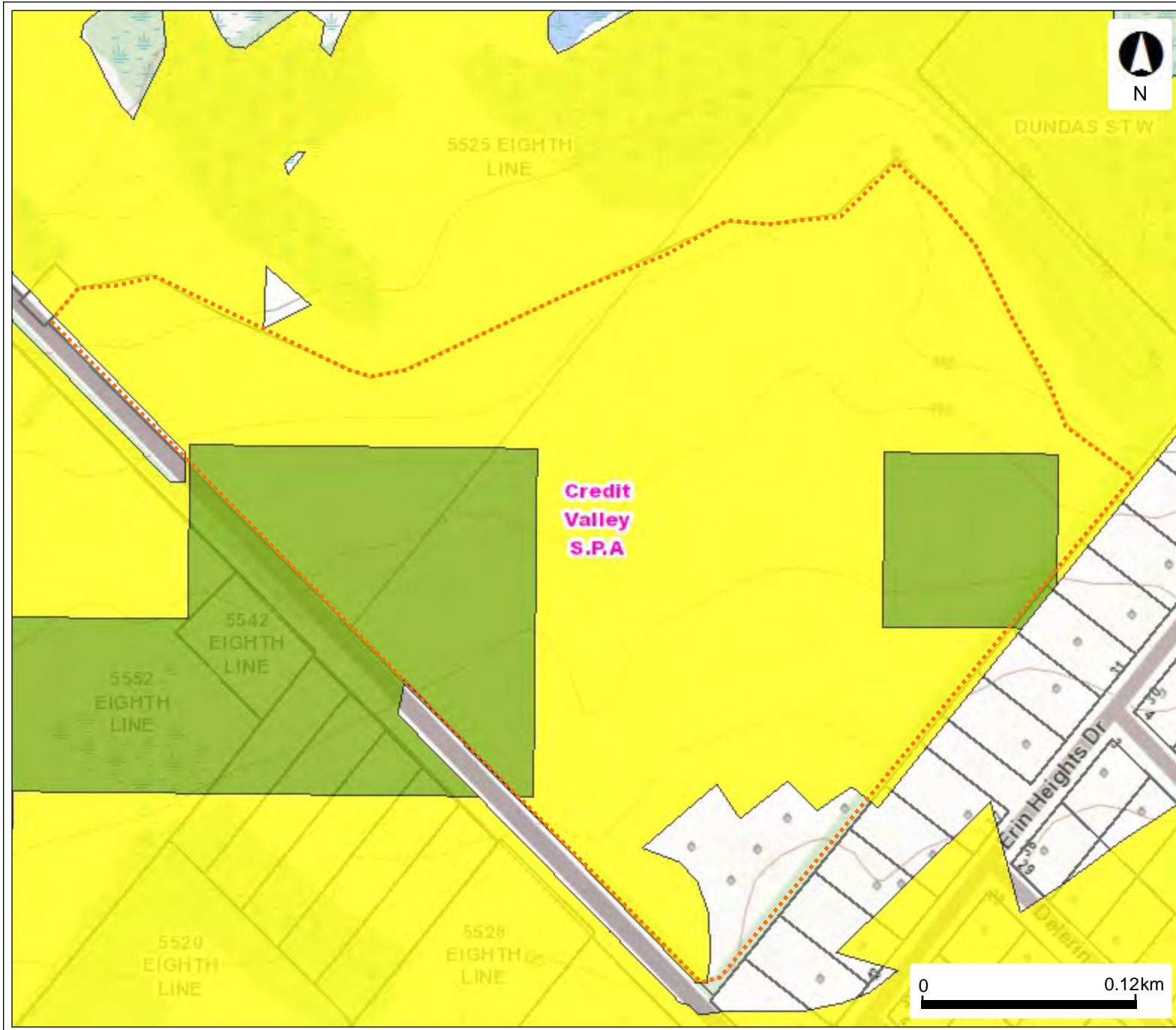


## Legend

-  Source Protection Areas
-  Highly Vulnerable Aquifers
-  Assessment Parcel with Adresse

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# Significant Groundwater Recharge Areas



## Legend

- Source Protection Areas
- Significant Groundwater Recharge Area
  - 0
  - 2
  - 4
  - 6
- Assessment Parcel with Address

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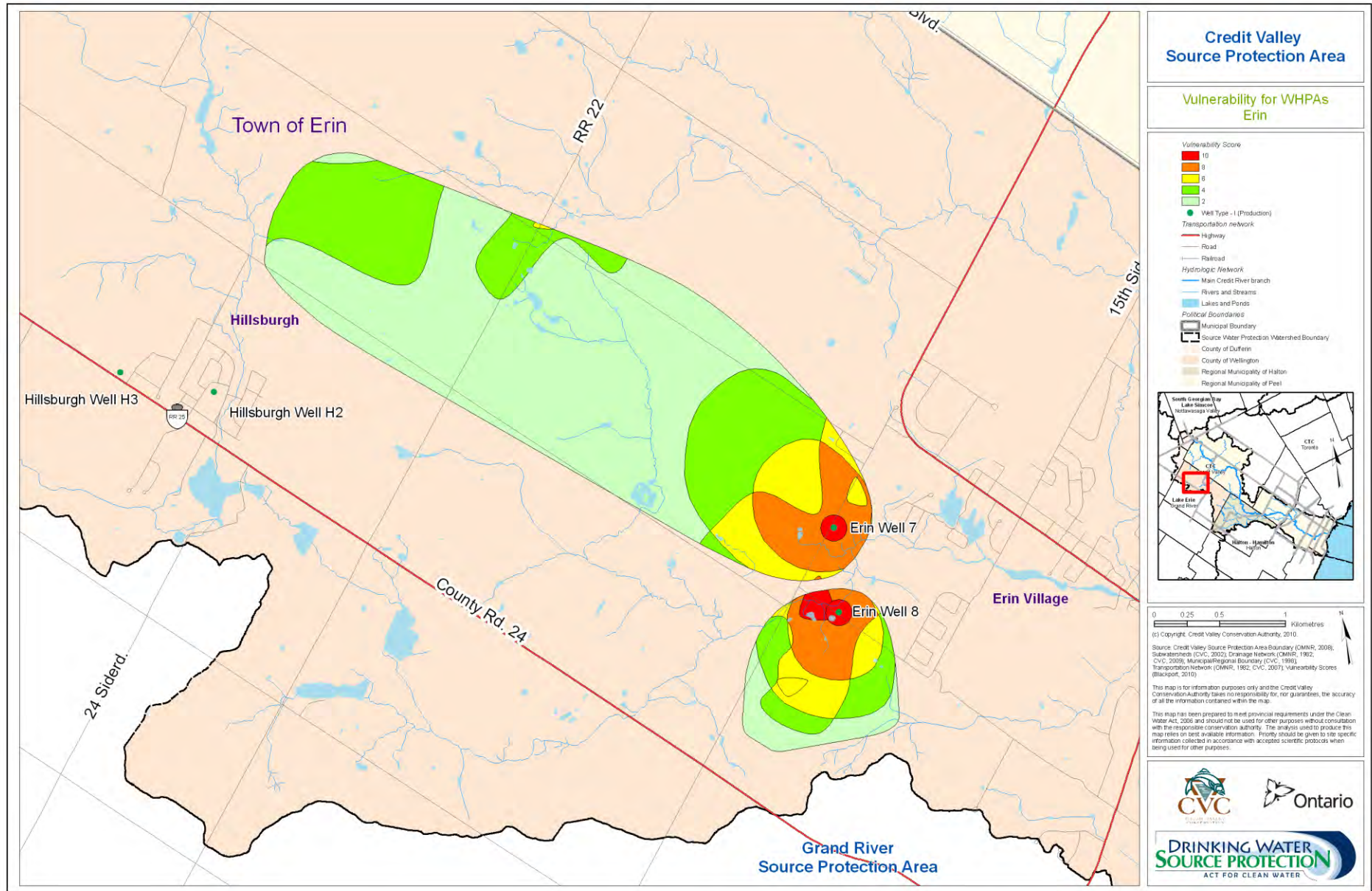
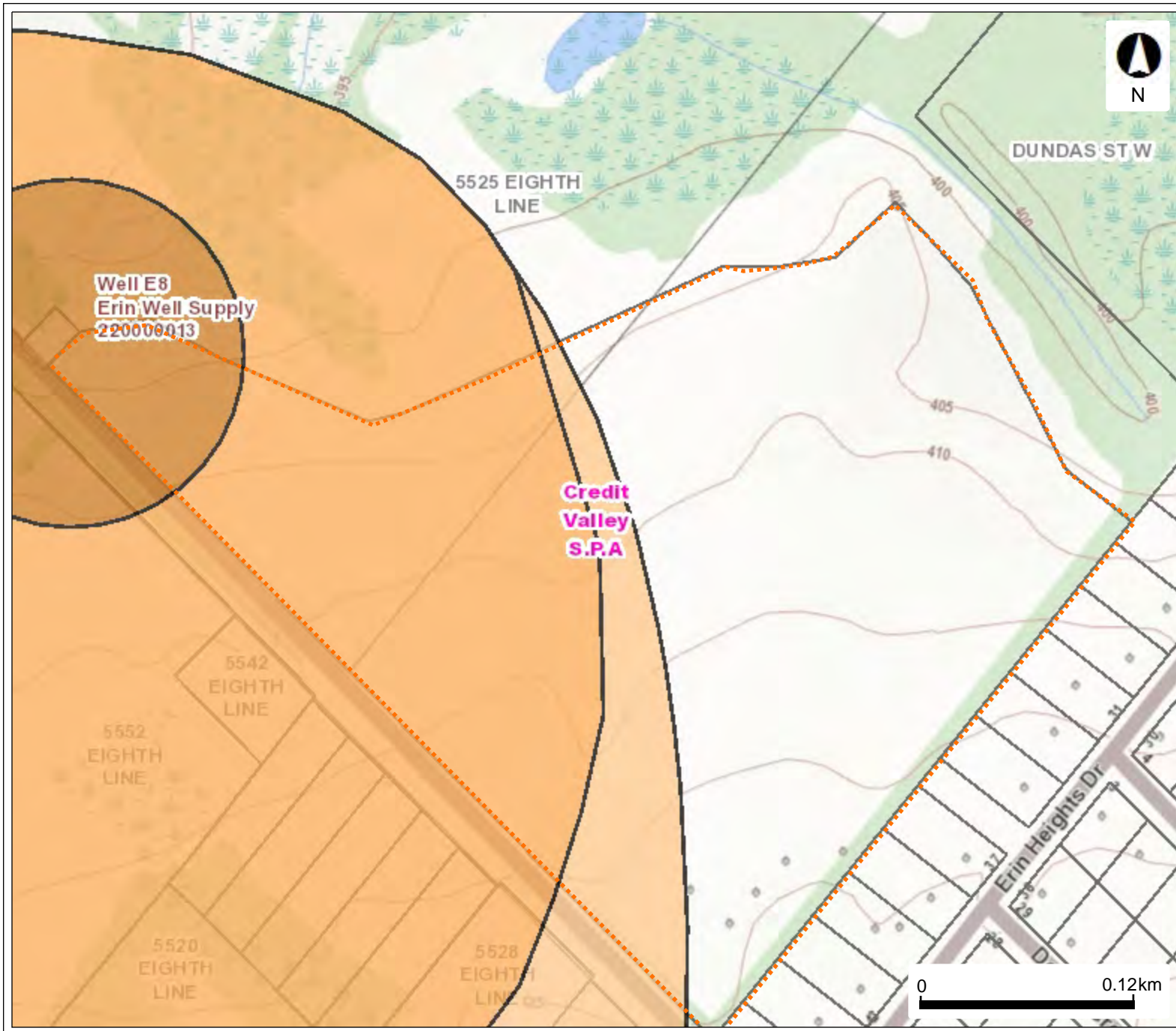


Figure 4.21: Vulnerability Scores for WHPAs – Erin

# Wellhead Protection Areas




## Legend

- Source Protection Areas
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Assessment Parcel with Address

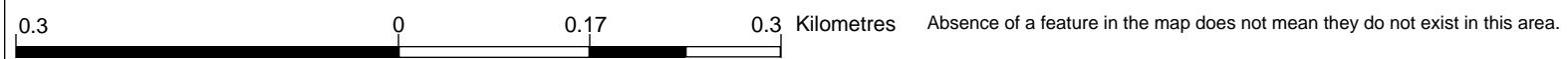
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**Legend**


-  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



Notes:

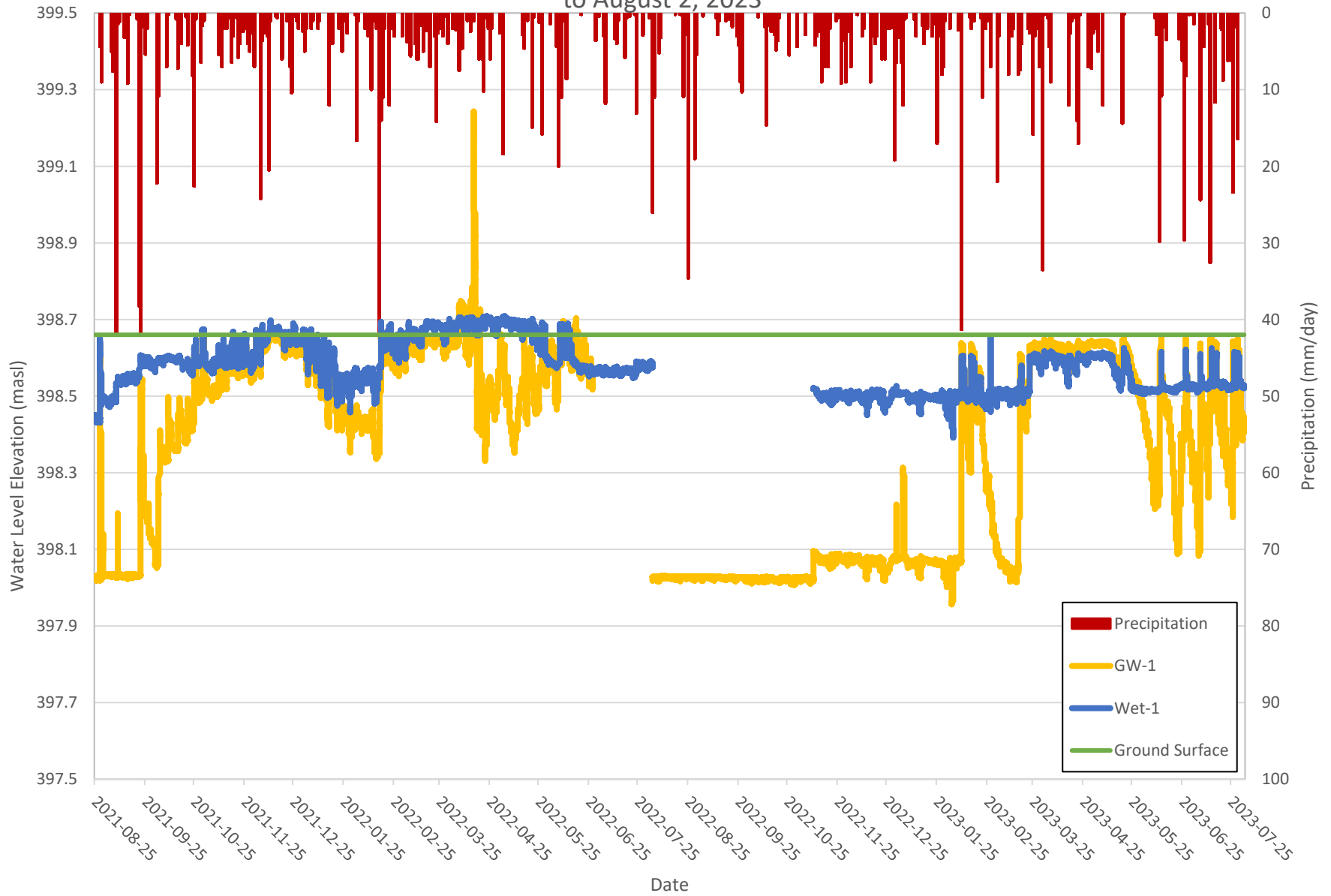


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GW-1 and Wet-1 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023



GW-2 and Wet-2 Water Level Elevation and Precipitation from August 25, 2021 to August 2, 2023

