Mansfield Ski Club Township of Mulmur

WMI 15-319 August 2020

Prepared by

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Site Servicing & Stormwater Management Report August 2020

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## 1.0 Introduction

WMI & Associates Limited has been retained by the Mansfield Ski Club (MSC) to prepare a Site Servicing & Stormwater Management Report in support of Site Plan Approval (SPA) associated with a commercial/residential re-development/expansion to the existing Mansfield Ski Club located in the Township of Mulmur, Ontario. The Site Servicing & Stormwater Management Report provided herein has been based on discussions with the Township of Mulmur staff and all proposed works are considered to be in conformance with the current engineering design standards.

The subject area of the Mansfield Ski Club property which is proposed for redevelopment is comprised of 4.02ha. The property is located north of the 15<sup>th</sup> Sideroad, south of the 17<sup>th</sup> Sideroad, east of the 5<sup>th</sup> Line and approximately 600m west of County Road 18 (Airport Road). The property address is 628213 15<sup>th</sup> Sideroad, P.O. Box 75 RPO Mansfield, Mulmur, ON. Refer to **FIG 1** in **Appendix A** for the Site Location Plan.

The proposed MSC re-development will include the existing Main Chalet Building, renovation of the existing Administration Building into commercial/retail space at ground level and 15 residential units/lofts on the second level (Building 'B', 780m²), a new building consists of commercial/retail space at ground level and 10 residential units/lofts on the second level (Building 'A', 630m²) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building 'A' which is proposed to be asphalt. This report will summarize all servicing such as stormwater management, sanitary, water and utilities as well as site grading. A separate Traffic Impact Opinion letter is provided herein as **Appendix E**.

# 2.0 Sanitary Servicing

## 2.1 Background

Considering the existing condition (private sewage treatment system located on-site) and lack of municipal services within the area of the subject lands, no sanitary servicing is currently allocated to the subject lands. A new private sanitary sewage collection and treatment system is proposed to facilitate the re-development/expansion of the MSC which will consist of the existing Main Chalet building, 1,725m² of commercial retail space and 91 residential units. The proposed sanitary services for the subject site have been designed in accordance with municipal design standards. Estimated sanitary sewage design flows have been calculated using the sewage flow design criteria set-out in the MECP's Design Guidelines for Sewage Works (2008) in conjunction with Tables 8.2.1.3.A. and 8.2.1.3.B. of the 2012 Ontario Building Code

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(OBC). Using the aforementioned tables, the total daily sewage flow rate for the proposed condition of the re-development was determined to be 132,133L/day.

Refer to **Appendix B** for the Sanitary Service Design Calculations.

## 2.2 Proposed Sanitary Sewer System

An internal sanitary sewer system is proposed within the re-development, complete with sanitary service laterals to each commercial retail unit (CRU) space/residential unit as illustrated on the General Servicing Plan North (**GENN**). The proposed sanitary sewer system will drain via gravity to the northeast corner of the subject lands, to a proposed Waterloo Biofilter surface discharge sewage treatment system.

The proposed sanitary sewer system will be been designed to accommodate the full build-out condition of the re-development.

# 2.3 Existing Treatment & Subsurface Disposal System

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current on-site sewage treatment system consists of a 150mm diameter gravity sanitary sewer which collects the on-site sewage from both the existing 2-storey administration building and the 2-storey main chalet building. The 150mm diameter sanitary sewer drains from the main chalet building, southeast to an existing sewage pump chamber. The existing Ski House and GM Office building discharge downstream of the existing sewage pump chamber directly into the existing sewage treatment system via individual forcemains due to grade constraints.

The existing pump chamber is located approximately 20m southeast of the main chalet at the east limit of the gravel parking area and just west of the top of bank of the existing slope located between the gravel parking area and the existing gravel driveway which provides access to existing chalets located northeast of the MSC's main chalet building. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2 complete with a 24-hour rated capacity of 22,700L/day, a reserve volume of 9,100L and an additional 18,000L surge tank located immediately east of the NPS system. Lastly from the GC-2 unit, the sewage is pumped southeast approximately 40m to two (2) existing filter beds located immediately east of the existing gravel driveway which provides access to the existing chalets located northeast of the MSC's main chalet building.

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Each of the original water sources (drilled well, bored well and river water) were previously metered and recorded by the MSC. This information was provided to WMI & Associates Limited in early 2016 for the months of December 2014 to March 2015 (one relatively recent full season of water usage data) and was analyzed to determine the total daily sewage flows experienced at the MSC during a full ski season in order to confirm <u>actual</u> sewage flow values experienced by the existing sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m³/day (6,600L/day) and the maximum daily sewage flow recorded was 17.8m³/day (17,800L/day). Based on the average and maximum daily sewage flows noted above, the peaking factor experienced at the MSC was 2.7.

Based on recent discussions with MSC staff, there are now two water meters located within the Main Chalet. The main meter records the total number of cubic meters (m³) of water supplied to the Main Chalet from the sole water source which is currently only PW2 since the spring/summer of 2016. A separate and smaller water meter is located in series and downstream of the main meter. This submeter only reads the amount of treated water in imperial gallons (IG).

Recently, total water usage (800.9m³) from Dec. 26, 2019 to March 15, 2020 was provided to WMI & Associates Limited along with the total number of operational days (58 days). All meter readings provided are from the main meter referenced above. From this data, it was determined that the Average Day Demand (assumed to be the same as the total daily sewage flow produced at the MSC) over last ski season was 13.8m³/day (13,800L/day). Daily water use records also indicated the following:

Table 1: 2019-2020 Ski Season Water Consumption Log

| Description                 | Date       | Meter<br>Reading<br>(m³) | Usage<br>(m³) |
|-----------------------------|------------|--------------------------|---------------|
| First Day of Meter Reading  | Dec. 26/19 | 7509.3                   |               |
| Typical Saturday            | Jan. 18/20 | 7701.5                   | 5.3           |
| Ladies Day                  | Jan. 24/20 | 7771.3                   | 21.5          |
| Men's Day                   | Feb. 7/20  | 7913.6                   | 9.7           |
| Family Day Weekend (Sunday) | Feb. 16/20 | 8035.1                   | 27.7          |
| Typical Thursday            | Feb. 27/20 | 8147.8                   | 9.4           |
| Final Day of Operation      | Mar. 15/20 | 8310.2                   | 9.7           |

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Based on the above, the Maximum Day Demand (assumed to be the maximum sewage flow) recorded was 27.7m³/day (27,700L/day) resulting in a peaking factor of 2.0 currently experienced at the MSC.

Based on **Table 1**, which accounts for all water usage from the Main Chalet, Administration Building, GM Office Building and Ski House, the existing sewage treatment system only experienced 1 day where it was slightly beyond its rated capacity. Considering the presence of the reserve volume and surge tank, this rare exceedance was handled without any issue and since the more typical daily sewage flow is considered to be in the range of 5-10m<sup>3</sup>/day as indicated by **Table 1**, the existing sewage treatment system is considered to be working well within its rated capacity.

Additional details with respect to the existing sewage treatment system and its design flow rates can be found in **Appendix F**, Ski House Development at the Mansfield Ski Club, Sewage Treatment System Analysis prepared by WMI & Associates Limited, dated January 20, 2016.

# 2.4 Temporary Sanitary Servicing for Phase 1A (Block 1)

The proposed re-development has been broken up into construction phases in order to decrease the amount of upfront cost associated with the re-development. Block 1 is proposed be built in Phase 1A prior to the construction/need for the proposed Sewage Treatment, Water Treatment and Distribution Systems.

As detailed in **Appendix F**, the existing sewage treatment system consists of a total daily design flow capacity of 22,700L/day, a 9,100L reserve tank and an 18,000L surge tank and it currently services the Main Chalet, Administration Building, GM office building and Ski House.

Phase 1A consists of building Block 1 which is a 12 unit Townhouse complete with 2 bedrooms per unit. Based on a density of 2 people per bedroom, the total number of people that will occupy Block 1 is 48 resulting in a total daily design flow 13,200L/day (275L/cap/day x 48 people).

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Block 1 will be serviced by installing the sanitary sewer and associated services to each of its 6 first floor units. To accommodate this, manholes C, B and A along with the proposed pump station will be installed as part of Phase 1A. A temporary gravity sewer connection from MH A will discharge into the proposed pump station during Phase 1A. This temporary sewer will later be removed during Phase 1B when the proposed Waterloo Biofilter system is installed. From the pump station, the proposed forcemain will extend to the existing sewage treatment system located between the Main Chalet and Block 1 in Phase 1A. Once the proposed Waterloo Biofilter system is installed the forcemain will be disconnected from the existing sewage treatment system and it will be extended further north to MH 1 located northwest of the Main Chalet where it will discharge via a gravity storm sewer to the ultimately outlet at the Pine River.

As noted in **Section 2.3** above, the existing sewage treatment system generally operates in the 5000-10,000L/day range. Considering the total daily design flow of 13,200L/day for proposed Block 1 and the fact that those using the MSC's existing facilities are likely to be the same ones occupying Block 1, it is reasonable to assume that the existing sewage system will be capable of accommodating Phase 1A in the interim until future phases develop warranting the construction of the proposed Waterloo Biofilter system. During less frequent maximum day use conditions, the available reserve volume and surge tank will aid in reducing the peak inflows to allow the existing sewage treatment system to batch feed the existing filter beds at their current rated capacities. As a contingency plan, the surge tank can be used as a holding tank from which sewage can be pumped out of and disposed of off-site by a licensed contractor to sufficient disposal facility during rare peak flow conditions.

Refer to the Phasing Plan (**PHA**), the General Servicing Plan North (**GENN**) and the Site Servicing Outlet Plan (**SSOP**) of the engineering drawing set.

# 2.5 Proposed Treatment & Surface Disposal System

Due to the larger footprint required by a typical leaching bed system, the limited space available on-site that is under 4:1 (H:V) slope and the numerous existing residential dwellings located down gradient which are all individually serviced by private wells and subsurface septic systems, a Waterloo Biofilter system complete with surface discharge is proposed to treat and ultimately discharge the effluent via a proposed storm sewer system running down the Chalet Ski run immediately north of the redevelopment, to the Pine River which is located approximately 500m northeast of the proposed re-development. Refer to the Site Servicing Outlet Plan provided in **Appendix A** for additional details.

The Total Daily Sanitary Design Flow Calculations and Sanitary Sewer Design Sheet are provided in **Appendix B** for reference. Refer to the General Servicing Plans (**GENN & GENS**) for additional details.

## 2.5.1 Waterloo Biofilter System (Surface Disposal)

The associated collection, transmission, treatment and disposal of domestic sewage from the MSC re-development has been designed based on a *Rated Capacity* of **1.46L/s** (126,503L/day) total daily design flow. Approximately one (0.95) days' worth of storage has been built into the design of the Waterloo Biofilter system which is considered to balance out any peaking of sewage inflows (2 x 60,000L Balancing Tanks for a total of 120,000L) The following outlines the components of the proposed Waterloo Biofilter treatment system:

#### Grease Interceptor (by others and external to the Main Chalet building)

One (1) exterior oil/grease interceptor, having a capacity of approximately 6,600 L
(3353 mm(L) x 2134 mm(W) x 1638 mm(H) + riser), to receive all kitchen sink
wastewater from the main chalet, discharging into the trash tank. Any other
restaurant type uses proposed on-site will also be required to install individual
oil/grease interceptors prior to discharging to the proposed sanitary sewage
treatment system;

#### Trash Tank

 One (1) single compartment trash tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet and outlet equipped with a baffle, discharging into anaerobic digester tank #1;

## Anaerobic Digester Tanks #1 and #2

Two (2) single compartment anaerobic digester tanks, operating in series, each
having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550
mm(H) +riser), with the inlets equipped with an InnerTube and the outlets equipped
with a baffle, discharging into the aeration tank;

#### Aeration Tank

One (1) double-compartment aeration tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with two (2) aerators, and the outlet equipped with a baffle, discharging into anaerobic digester tank #3;

#### Anaerobic Digester Tank #3

 One (1) single compartment anaerobic digester tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with a return pump to the trash tank, and the outlet equipped with six (6) effluent filters, discharging into balance tank #1;

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#### **Balance Tanks**

Two (2) single compartment balance tanks, each having a capacity of approximately 66,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), connected by bottom drains, balance tank #2 is equipped with two (2) pairs of pumps, with each pair discharging to two (2) Waterloo Biofilter bulk-filled treatment tanks;

#### Waterloo Biofilter Bulk-filled Tanks

Four (4) single compartment Waterloo Biofilter bulk-filled tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), housing approximately 55 m3 of Biofilter medium; connected by bottom drains, draining into Waterloo Biofilter basket Biofilter tank #1;

#### Waterloo Biofilter Basket Tanks

• Two (2) single compartment Waterloo Biofilter basket tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), each housing three (3) baskets with approximately 10 m3 of Biofilter medium per basket (60 m3 total); tank #1 with two (2) simplex pumps and two (2) duplex pumps, simplex pump #1 recirculating to the trash tank, simplex pump #2 dosing Waterloo Biofilter basket tanks #1 and #2 on a closed loop, duplex pumps discharging to the UV disinfection units;

#### **UV Disinfection Units**

 Four (4) UV disinfection units; discharging to the effluent sampling and disposal chamber;

## Effluent Sampling & Outfall

- One (1) sodium aluminate dosing system located in the above ground control building, metering sodium aluminate chemical into the trash tank; One (1) alkalinity dosing system located in the above ground control building, metering alkalinity into anaerobic digester tank #3;
  - One (1) bacteria dosing system located in the above ground control building, metering bacteria into balance tank #1;
  - All new pumps in the system are run by a Waterloo Smart Panel. The Waterloo Smart Panel provides remote monitoring, control, and data logging over a stable wireless cellular network. This functionality allows for real time operational adjustments to optimize system performance. The Waterloo Smart Panel also immediately notifies the operator of a pump failure or high-level alarm, providing them with vital information to limit site visits while keeping the system running properly;
  - One (1) disposal tank (pump station) complete with on-demand duplex pumps will be provided downstream of the UV disinfection units which will be used for both effluent sampling and disposal. The pumps will discharge via a 136.5m long forcemain from the pump station, northwest to the proposed outlet storm sewer system located northwest of the Main Chalet.

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## **Effluent Objectives**

• The Owner shall use best efforts to design, construct and operate the Works with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the Works.

| Table 2 – Effluent Objectives                                       |                                   |  |  |  |
|---|-----------------------------------|--|--|--|
| Effluent Parameter  | Concentration Objective           |  |  |  |
| Lilidelit Farallietei   | (mg/L unless otherwise indicated) |  |  |  |
| cB0D5   | 10.0                              |  |  |  |
| Total Suspended Solids  | 10.0                              |  |  |  |
| Total Phosphorus  | 0.5                               |  |  |  |
| Total Ammonia Nitrogen  | 3.0                               |  |  |  |
| E. Coli*  | 100 organisms/100 mL              |  |  |  |
| E. Con  | (Geometric Mean Density)          |  |  |  |
| pH of the effluent maintained between 6.5 to 8.5, inclusive, at all |                                   |  |  |  |
| times   |                                   |  |  |  |

<sup>\*</sup> Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 2 above.

#### **Effluent Limits**

 The Owner shall design and construct the proposed Works and operate and maintain the Works such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the Works.

| Table 3 – Effluent Limits   |                                   |  |  |  |
|---|-----------------------------------|--|--|--|
| Effluent Parameter  | Concentration Limit               |  |  |  |
| Emuent Parameter  | (mg/L unless otherwise indicated) |  |  |  |
| cB0D5   | 15.0                              |  |  |  |
| Total Suspended Solids  | 15.0                              |  |  |  |
| Total Phosphorus  | 1.0                               |  |  |  |
| Total Ammonia Nitrogen  | 5.0                               |  |  |  |
| E. Coli*  | 200 organisms/100 mL              |  |  |  |
| E. Coli   | (Geometric Mean Density)          |  |  |  |
| pH of the effluent maintained between 6.0 to 9.0, inclusive, at all |                                   |  |  |  |
| times   |                                   |  |  |  |

<sup>\*</sup> Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 3 above.

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#### **Effluent Loading Limits**

 The Owner shall design and construct the proposed Works and operate and maintain the Works such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the Works.

| Table 4 – Effluent Loading Limits |                                     |  |  |
|-----------------------------------|-------------------------------------|--|--|
| Effluent Parameter                | Concentration Loading Limit         |  |  |
| Elliuent Parameter                | (kg/day unless otherwise indicated) |  |  |
| cB0D5                             | 1.8                                 |  |  |
| Total Suspended Solids            | 1.8                                 |  |  |
| Total Phosphorus                  | 0.12                                |  |  |
| Total Ammonia Nitrogen            | 0.6                                 |  |  |

#### **Monitoring & Recording**

The *Owner* shall, upon commencement of operation of the *Works*, carry out the following monitoring program:

- 1) All samples and measurements taken for the purposes of this *Approval* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.
- For the purposes of this condition, bi-weekly means once every two weeks.
- Samples shall be collected at the locations and frequencies as specified below, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

## **Raw Sewage Monitoring**

Sampling Location: Trash Tank Sampling Type: Grab

Sampling Frequency: Bi-Weekly

Sampling Parameters: BOD<sub>5</sub>, Total Suspended Solids, Total Kjeldahl Nitrogen

(TKN), Total Phosphorus, Temperature, pH, and Alkalinity

**Effluent Monitoring** 

Sampling Location: Above Ground Control Building/Pump Station

Sampling Type: Grab
Sampling Frequency: Bi-Weekly

Sampling Parameters: cBOD<sub>5</sub>, Total Suspended Solids, Total Ammonia Nitrogen,

Total Phosphorus, E. Coli, Temperature, pH, and Alkalinity

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## Ministry of the Environment, Conservation and Parks (MECP) Pre-Consultation

A pre-consultation meeting with the MECP was conducted on August 9, 2016 at the Guelph District Office to review the proposed sewage treatment and disposal options for the re-development as well as the MECP's requirements with respect to a surface discharge outlet to the Pine River and the associated Assimilative Capacity Study (ACS) that is required to be undertaken in support of such effluent disposal.

In addition to the pre-consultation meeting noted above, a conference call with the MECP was undertaken on April 4, 2017 to further investigate/discuss the proposed Work Plan for the Assimilative Capacity Study which was being completed at the time by Hutchison Environmental Sciences Ltd (dated September 20, 2016).

Refer to **Appendix G** for the aforementioned correspondence with the MECP as well as a copy of their comments related to the ACS works received on July 14, 2017 and their final approval of the ACS received on January 31, 2019.

# 3.0 Water Servicing

## 3.1 General

There are no municipal water services within the subject area. As a result, the two (2) existing drilled wells (PW1 and PW2) as well as two (2) additional wells (PW3 and PW4) will ultimately be utilized to supply the necessary domestic water for the proposed commercial retail and residential re-development. Based on the Ministry of the Environments classification provided under the Drinking-Water Systems (DWS) Regulation (O. Reg. 170/03) mandated under the Safe Drinking Water Act (SDWA), the existing and proposed DWS's are classified as a "Small Non-Municipal Non-Residential" system and a "Non-Municipal Year Round Residential" system respectively. The proposed re-developments drinking water system will ultimately be detailed in an Engineers Evaluation Report (EER) upon the completion of construction of the system as regulated under O. Reg. 170/03 Schedule 21. The supply and distribution system external to the proposed water treatment system are detailed in the following sections of this report.

## 3.2 Existing Water Supply

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records during times of operation, the water consumption for each of its sources of water that service the existing Main Chalet which also feeds 3 other standalone structures (i.e. Administration Building, GM Office and Ski House). The MSC primary domestic water supply was previously a 150mm diameter drilled well located just west of the southwest corner of Block 2. The drilled well consists of highly mineralized water quality (poor) and a low yield of approximately 27.3L/min. One other source of potable water which was rarely used, was an existing bored well located just northeast of the Main Chalet building on the Chalet Run ski slope. The bored well consisted of good quality water but was low yielding (4.5-9L/min). Lastly, the remaining water source which was previously used to supply all existing water closets and urinals (non-potable) within the Main Chalet, was the Pine River located immediately northeast of the MSC.

Since May of 2016 the MSC has serviced the Main Chalet and the Administration Building, GM Office and Ski House, which are all service from the Main Chalet, from a 150mm diameter drilled well referred to as PW2 located immediately east of the MSC property entrance off of the 17<sup>th</sup> Sideroad. An additional 150mm diameter well was also installed that the same time but has not been connected to the existing system to date.

As per the recommendations outlined within the Hydrogeology and Test Drilling Report dated June 2016 and its addendum dated May 2, 2019 both prepared by Morrison Environmental Limited (under separate cover), the existing dug well has since been decommissioned in accordance with the Ontario Regulation 903. Based on our understanding and discussions with MSC staff, the existing drilled well adjacent to Block 2 has been disconnected from existing water system and will be decommissioned during Phase 1C.

Refer to the documents noted above for detailed information related to the existing wells/water supply for the subject site.

From PW2 the water is currently supplied to an existing 2500gal holding tank buried immediately north of the Main Chalet via a Gould's 13GS10 well pump and existing 38mm water line. From the holding tank an existing Gould's 65GS30 submersible pump complete with a constant pressure controller supplies raw water to the existing mechanical room within the Main Chalet.

## 3.3 Proposed Water Supply

Due to the low yields of the original drilled and dug wells located on-site, two new drilled wells consisting of 150mmø (6 inch nominal) casings, have been extended to a depth of 13.1m and are located at the northeast corner of MSC property immediately east of the property entrance off of the 17<sup>th</sup> Sideroad. PW1 is located closest to the 17<sup>th</sup> Sideroad with PW2 53.4m directly south of PW1. The new test wells are located at the base of the escarpment approximately 650m north of the proposed redevelopment area. Refer to the Proposed Snow Making Pond & Well Location Plan (SMPLP) for the well locations.

Based on discussions with Morrison Environmental Limited, a total of four (4) individual drilled wells each capable of yielding 20igpm (91L/min), as per the existing two (2) drilled wells (PW1 and PW2) pump test results, are proposed to adequately service the re-development at the MSC. As per MECP requirements, the four (4) wells will be capable of supplying the re-developments full build-out condition Maximum Day Demand (MDD) of 270L/min.

Two (2) of the drilled wells (PW1 and PW3) will alternate duty once PW3 is constructed. Assuming PW3 will have a similar yield as PW1, Gould's 13GS10 well pumps will supply water individually via an existing 38mm water line to an existing 2500gal holding tank buried immediately north of the Main Chalet. Based on the pump test for PW1 and the existing well pump and system-head curve, 16USGPM will be supplied from PW1 to the existing holding tank. Similarly, the other two (2) drilled wells (PW2 and PW4) will alternate duty and supply water via a proposed 50mm water line to the existing 2500gal holding tank. Based on the pump test for PW2 and the proposed well pump and system-head curve, 29USGPM will be supplied from PW2 to the existing holding tank using a Gould's 25GS20 well pump. Based on the above, a total of 45USGPM can be supplied to the holding tank from two individual wells using individual water lines. This is consistent with the 24/7 combined pump test for PW1 and PW2 which was completed by Morrison Environmental Limited (37.4IGPM or 45USGPM) and will allow for a duplex well supply system that will not only provide contingency but also limit loading on each of the wells and their respective pumping/supply infrastructure.

From the existing 2500gal holding tank raw water will be supplied to the proposed water treatment system located within the proposed mechanical room in the Main Chalets building addition via the existing Gould's 65GS30 submersible pump complete with a constant pressure controller. An additional and identical pump will be installed within the existing holding tank for contingency purposes.

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The proposed water treatment building will house all of the necessary equipment to provide both primary and secondary disinfection of the raw water prior to pumping it through the proposed potable water distribution system. The proposed water treatment system will consist of a treatment skid complete with filtration and UV treatment, an Ozone skid, water softening equipment, two (2) 7300IG (33,142L) Day Tanks connected in series which will store chlorinated water and supply it to a Booster skid which will ultimately supply the proposed water distribution system. The Day Tanks have been sized (66,284L) to accommodate both the MDD (270L/min) for a period of 8-hours (57,168L which governs) and PHD (425L/min) for a period of 1-hour (16,446L) based on the proposed treatment systems capacity of 40USGPM (151L/min).

As previously noted, upon completion of construction of the water treatment system an Engineers Evaluation Report will be prepared and submitted to the MECP to confirm the DWS's compliance with O. Reg. 170/03.

## 3.4 Design

Based on the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines dated 2008 and Tables 8.2.1.3.A. and 8.2.1.3.B. of the 2012 Ontario Building Code (OBC), the total daily domestic water supply flow rates were calculated for each of the buildings proposed within the re-development. The Average Daily Demand (ADD) for each unit was determined to be 132,133L/day (91.8L/min), the Maximum Daily Demand (MDD) was determined to be 389,283L/day (270.3L/min) and the Peak Hourly Demand (PHD) was determined to be 612,400L/day (425.3L/min).

The Water Supply Design Calculations are provided in **Appendix B** for reference. Refer to the General Servicing Plan North (**GENN**), Water Treatment Facility Plan (**WF**), Site Servicing Outlet Plan (**SSOP**) and the Proposed Snow Making Pond & Well Location Plan (**SMPLP**) for additional details.

## 3.5 Fire Protection

As a result of the sites absence of an accessible municipal water supply for fire protection and based on Subsections 3.2.5.7. and A-3.2.5.7. of the 2012 Ontario Building Code (OBC), Division B, Part 3, the proposed re-development is required to provide on-site Fire Protection Water Storage. Each of the existing and proposed buildings were analysed individually to determine an associated fire protection water storage volume and flow rate based on the guidelines listed above.

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The largest of the proposed buildings (Building 'B') governed the fire storage volume requirement with a total volume of 279,279L. Based on Table 2 provided in the OBC A.3.2.5.7., the required minimum water supply flow rate is 9000L/min and is to be provided within and unobstructed distance of 90m from the nearest hydrant to the buildings main entrance. Considering the total storage volume of 279,279L and the minimum water supply flow rate of 9000L/min, the minimum 30-minute duration can be provided as required by the OBC.

In order to provide the necessary fire protection water storage on-site, six (6) 50,000L concrete water storage tanks (or approved equivalent) are proposed. In an effort to reduce the potential for stagnation and the associated water quality impacts within the domestic water distribution system as well as to eliminate the need for standby power for the fire supply system, the fire supply system is proposed to be a standalone system which will be gravity fed. The fire storage tanks are proposed west of the redevelopment area, up the ski hill at a minimum ground grade of 342.50m. Based on the elevated 300,000L of fire storage water and the proposed 250mmø and 150mmø fire supply mains complete with three (3) proposed fire hydrants, the required flow rates will be provided within the required distance of each building at the minimum allowable pressure of 20psi.

The Water Supply Design Calculations and Fire Protection Water Storage Design Calculations are provided in **Appendix B**. Refer to the General Servicing Plan North (**GENN**) and Fire Water Storage Plan (**FWS**) for additional details.

## 3.6 Temporary Water Servicing for Phase 1A (Block 1)

As noted above, the proposed re-development has been broken up into construction phases. Phase 1A consists of the construction of Block 1 which is a 12 unit Townhouse complete with 2 bedrooms per unit resulting in an average day demand (ADD) design flow of 13,200L/day based on 275L/cap/day. The average day demand (ADD) for the existing condition at the MSC which was confirmed to be 13,800L/day based on 2019-2020 ski season water meter reading records, for an interim condition total ADD of 27,000L/day.

Based on the existing well pump and supply line configuration, 16USGPM (87,216L/day) is able to be supplied to the existing 2500gal (9450L) holding tank providing sufficient flow to accommodate a MDD peaking factor of 3.2 which is greater than the peaking factor of 2.0 as suggested by the last ski seasons water meter records. The holding tank will provide storage and the existing Gould's 65GS30 well pump will accommodate any instantaneous peaks throughout any given day.

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To service Block 1 with water in Phase 1A, a 50mmø water service will be extended from the Main Chalet's water system between the existing Ski House and proposed Block 1 building to the northeast corner of the Block 1. To avoid further servicing conflicts in this area during future phases of construction, the existing water service to the Ski House will be connected into the proposed 50mmø water service at this service will ultimately be used to loop the water distribution system in the full build-out condition. When the complete water distribution system in constructed during future phases, the section of the proposed 50mmø water service closest to the Main Chalet will be removed to eliminate the existing connection to the Main Chalet and the service will be extended west into the proposed 100mmø watermain. Similar, the east limit of the proposed 50mmø water service in Phase 1A will ultimately be extended further east during future phases to connect into the proposed 100mmø watermain.

Primary disinfection of the water supply for Block 1 will be provided within the Main Chalet via the existing water treatment system. The water service for Block 1 will need to be distributed to unit internally from the single 50mmø water service connection while having consideration for the ultimately build-out conditions (i.e. individual water service connection locations). A mechanical room/space within Block 1 at the water services entrance location will be required to facilitate the installation of a UV unit (NSF 55 standard) for secondary treatment purposes. Ultimately when the 100mmø watermain is installed along the frontage of Block 1, the individual service connections will be installed and the UV unit can be removed leaving the existing 50mmø water service line to service the most northern unit.

Refer to the General Servicing Plan North (**GENN**) for additional details.

# 4.0 Stormwater Management

# 4.1 Design Criteria Guidelines

The stormwater management features that have been designed for this site include grass filter strips, enhanced grass swales (Low Impact Development (LID) controls), storm sewer, and a dry detention basin which will form an integrated treatment train approach for providing both stormwater quality and quantity control.

The stormwater management design for the site will incorporate the policies and criteria of a number of agencies, including the Ministry of the Environment, Conservation and Parks (MECP), Nottawasaga Valley Conservation Authority (NVCA) and the Township of Mulmur (Township). Considering the size and type of redevelopment proposed and the desire to provide both water balance and stormwater quality control for the site runoff, additional design guidance has been provided based on the Low Impact Development Stormwater Management Planning & Design Guide (LID Manual) prepared by the Credit Valley Conservation (CVC) and the Toronto and Region Conservation Authority (TRCA), Version 1.0, dated 2010. The above noted

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agencies stormwater design criteria for the proposed re-development are summarized below:

- Stormwater quality controls will be provided based on the guidelines described in the Ministry of the Environment, Stormwater Management Planning and Design Manual dated March 2003 and the LID Manual. Following the MOE and LID Guidelines noted above, the stormwater management design utilized for the site will provide water quality control at an Enhanced Level of Protection (minimum of 80% Total Suspended Solids removal efficiency). NVCA Guidelines will be used as a reference for the design of the stormwater management system.
- The Ontario Ministry of Transportation (MTO) rainfall intensity-duration-frequency (IDF) curve lookup tool was used to confirm the rainfall IDF data for the site which was ultimately utilized to determine the peak flow rates and runoff volumes generated both on and off-site (external drainage area).
- Stormwater quality control will be provided via the use of enhanced grass swales complete with grass filter strips upstream for pre-treatment as well as a dry detention basin located downstream. Additionally, the storm sewer's inlet structures will have deep sumps that will allow sedimentation of particulates upstream of the dry detention basin. The proposed treatment train approach is premised on the stormwater being both filtrated as well as infiltrated into the in-situ soils where possible.
- Stormwater quantity control will be provided via the use of a dry detention basin to attenuate the post-development peak flows for each of the analyzed design storm events to their respective pre-development target rates, including extended detention of the 25mm runoff volume.
- Erosion and sediment control shall be provided during the construction phase and until the site is fully stabilized.

## 4.2 Pre-Development Condition

## 4.2.1. General

The subject lands (site/re-development area) for all intents and purposes of this stormwater management report has been considered as the 4.02ha area comprised of the MSC's existing infrastructure (Main Chalet, Administration Building, Ski House and GM Office building) and the gravel parking lot.

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The majority of the site is considered to be gravel and unimproved lands consisting of small trees and shrubs along with heavy grass cover. Runoff from the majority of the site (south portion, PRE1 drainage area) is considered to concentrate via overland flow at the predominant drainage feature located at the southeast corner of the site. The aforementioned drainage feature is an existing swale traversing the adjacent lands to the east of the site which outlets at an existing 800mmø CSP cross culvert located under the 15<sup>th</sup> Sideroad. The runoff from the residual site area (north portion, PRE2 drainage area) is considered to also concrete via overland flow at the northeast corner of the subject lands. The topography of the subject lands can be described as having a moderate slope, with an average grade in the range of approximately 5.6% and 9.3% in a west to east direction for the PRE1 and PRE2 areas respectively.

Refer to the Pre-Development Drainage Plan, **FIG 2** provided in **Appendix A** for additional details.

## 4.2.2. External Drainage

The subject lands are considered to be self-contained with no external drainage contributing runoff as a result of the existing ditch and culvert by-pass system presently in-place along the west and southern limits of the site. All external drainage is captured and conveyed via an existing network of swales located along the west property boundary. Immediately west of the southwest corner of the existing Administration Building, an inlet structure and pipe system are used to capture the runoff generated by a localized section of the existing Kids Ski Run. The drainage pipe then discharges into an existing ditch which runs north to south along the west limit of the gravel parking lot. The existing ditch intercepts all external runoff directed to the west limit of the subject lands. At the southwest corner of the site, both the runoff from the north side of the 15th Sideroad municipal right-of-way as well as the discharge from the adjacent detention basin located immediately west of the subject lands, is conveyed via existing swales to the aforementioned perimeter ditch located on-site. At the southwest limit of the site the converged swale network discharges into an existing CSP culvert which traverses the gravel parking lot in a west to east direction. Lastly, from the east limit of the site at the outlet of the existing CSP culvert, the external runoff is discharged into an existing swale and is conveyed along with the site runoff, across the neighbouring property, east to an 800mmø CSP cross culvert located under the 15th Sideroad. From the 15th Sideroad cross culvert the runoff is conveyed downstream through a series of grass covered road side ditches, swales as well as two existing dry ponds/basins prior to reaching the ultimate receiver, the Pine River which is located approximately 1050m downstream of the site.

Refer to the Downstream Drainage Outlet Plan, **FIG 5** provided in **Appendix A** for additional details.

The external drainage area is bound to the south by the 15<sup>th</sup> Sideroad, to the west by top of the escarpment and to the north by a natural split in the existing topography.

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The topographic relief over the 11.71ha external drainage area is approximately 80m which falls in a west-east direction towards the site. The external drainage area consists of a portion of the estate lot subdivision (Lloyd's Traverse Crescent) located at the top of the escarpment, a portion of the 15th Sideroad and 5th Line right-of-way's, as well as some pasture, treed and unimproved lands. The majority of the external runoff is captured by the existing dry pond/basin located immediately west of the southwest corner of the subject lands where the runoff is attenuated prior to being released to the site. The hydrologic modelling and stormwater management design provided herein has conservatively <u>not</u> accounted for the peak flow attenuation/storage provided upstream of the site within the existing dry pond/basin.

Refer to the External Drainage Plan, **FIG 4** provided in **Appendix A** for additional details.

## 4.2.3. Soil Conditions

According to the Soils Map of Dufferin County, Ontario, Soil Survey Report No. 38 prepared for the Department of Agriculture, the site and external drainage areas consist of Dunedin clay which is described as having good drainage characteristics. Dunedin clay belongs to Hydrologic Soil Group 'D'.

The Runoff Coefficients and Curve Numbers associated with the site and external drainage area were computed by calculating weighted values based on corresponding land uses and soil type. The Hydrologic Soil Group was determined in accordance with the Ontario Ministry of Transportation (MTO) Soil Classification System. It should be noted that, in an effort to be conservative the peak flows and runoff volumes calculated for the site are based on the native soils (Dunedin Clay) although it is assumed that the majority of the site area is comprised of fill material having improved drainage characteristics over the native clay soils.

A Geotechnical Investigation conducted in May 2018 by Shad & Associates Inc. (Preliminary Geotechnical Investigation June 21, 2018) consisting of the drilling and sampling of eight (8) boreholes as well as their further sample analyses completed to further define the existing site soil conditions. A supplementary letter provided by Shad & Associates dated March 20, 2020 was provided to support the construction of the fire route. Lastly, an Addendum to the Geotechnical Investigation (Shad & Associates, April 22, 2020) was also provided to support the construction of the asphalt areas, dry detention basin, site services, snow making pond, etc.

Refer to **Appendix H** for each of the documents referenced above.

## 4.3 Post-Development Conditions

#### 4.3.1. General

The proposed site works include the existing Main Chalet Building, renovation of the existing Administration Building into commercial/retail space at ground level and 15 residential units/lofts above (Building 'B', 780m²), a new building consisting of commercial/retail space at ground level and 10 residential units/lofts above (Building 'A', 630m²) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building 'A' which is proposed to be asphalt. The runoff generated from the site area will be directed west to east across the subject lands as in the existing condition.

Refer to **FIG 3** in **Appendix A** for the Post-Development Drainage Plan and the stormwater management design calculations provided in **Appendix C** for additional details.

## 4.3.2. Post-Development Drainage

Post-development drainage patterns on-site will be generally consistent with that of the existing condition.

The proposed re-development will consist of overland sheet flow drainage as in the existing condition and will concentrate at the northeast and southeast corners of the subject lands similar to the existing condition. Although the proposed parking lot surface will remain as gravel, as per the NVCA design standards this area has been conservatively considered as asphalt (impervious surface) in the post-development condition hydrologic modelling and associated design calculations.

Due to the lack of a sufficient drainage outlet at the northeast corner of the site and in an effort to mitigate any adverse impacts the proposed re-development may have on the adjacent lands to the northeast of the site (down gradient along the escarpment), the site has been graded such that the drainage area directed to the northeast corner has been reduced in magnitude relative to that of the pre-development condition thereby resulting in reduced peak flows and runoff volumes released off-site in the post-development condition. The post-development drainage area directed to the northeast corner of the site will be reduced from 1.36ha (PRE2) to 0.85ha (POST2) and will be graded such that flows are in the form of overland sheet flow leaving the site rather than concentrated flow in order to resemble that of the existing condition.

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The residual site area (2.94ha, POST1) will be directed to the southeast corner of the site via a combination of both storm sewer and overland sheet flow over a series of grassed filter strips, and an enhanced grass swale prior to discharging into a proposed dry detention basin. The proposed dry detention basin will be used to attenuate the post-development peak flows to the corresponding pre-development target rates (or less) for each of the 2-100 year design storm events. Each of the aforementioned stormwater management features will be used as part of a treatment train approach for the purposes of providing stormwater quality control for the contributing drainage area at an Enhanced Level of Protection (80% Total Suspended Solids Removal Efficiency), phosphorus reduction benefits and at source groundwater recharge (water balance) benefits.

External drainage patterns on-site will be generally consistent with that of the existing condition. A proposed 'cut-off' (grass) swale will be constructed along the west and southwest limits of the site to capture and convey the external runoff to a proposed ditch inlet catchbasin (DICB) which will ultimately convey the runoff through the proposed storm sewer system into the dry detention basin. In the event of a storm that generates a peak flow greater than the storm sewer capacity (25-year or less frequent storm event), the excess runoff will spill onto the parking lot to the north and will be conveyed overland to the proposed (south) enhanced grass swale along the eastern property line and ultimately into the proposed dry detention basin.

The attenuated peak flows from the dry detention basin will discharge to the existing drainage feature located immediately east of the basin which will ultimately convey all site and external runoff downstream to the existing 800mmø CSP cross culvert located under the 15<sup>th</sup> Sideroad. The proposed drainage patterns described above are consistent with the existing condition.

## 4.3.3. Rainfall Data

The 6, 12 and 24-hour SCS Type-II and the 4-hour Chicago Storm rainfall distributions were used for the 1:2, 1:5, 1:25 and 1:100 year design storm event hydrologic modelling. The SCS and Chicago storms were developed from the recorded rainfall data obtained from the MTO IDF Curve Lookup website.

## 4.4 Pre-Development Condition Modelling Results

Using the site and external drainage areas as illustrated on **FIG 2** and **FIG 4** and the program SWMHYMO, the total flows were determined for the 2-year, 5-year, 25-year and 100-year design storm events. These flows are summarized in **Tables 1a** and **1b** below. The hydrologic model runs for the pre-development 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions can be found in **Appendix D**.

Table 1a: Pre-Development Peak Flows – Site

| Catchment | Area<br>(ha) |       | -     | Peak Flows (m³/s)<br>Il Storm Distribution | )      |
|-----------|--------------|-------|-------|--|--------|
| (IIa)     |              | 2-yr  | 5-yr  | 25-yr                                      | 100-yr |
| PRE1      | 2.66         | 0.166 | 0.282 | 0.482                                      | 0.647  |
| PRE2      | 1.36         | 0.097 | 0.160 | 0.272                                      | 0.362  |
| EXT       | 11.71        | 0.592 | 0.948 | 1.529                                      | 2.025  |

Due to the more conservative values calculated for the peak flows, the design of all conveyance features (i.e. by-pass swale and storm sewer from it to the basin) were based on the 24-hour SCS Type-II storm distribution.

Table 1b: Pre-Development Peak Flow Target Rates – PRE1 & EXT Combined

| Catchment<br>PRE1 + EXT | Area<br>(ha) | Pre-Development Peak Flows (m³/s)<br>(24-hour SCS Type-II Storm Distribution)<br>(Post-Development Dry Detention Basin Target Rates) |       |       |        |  |
|-------------------------|--------------|--|-------|-------|--------|--|
|                         | (114)        | 2-yr   | 5-yr  | 25-yr | 100-yr |  |
| TOTAL                   | 14.37        | 0.756  | 1.213 | 1.947 | 2.580  |  |

In the post-development condition, catchments POST-1 & EXT will both be routed through the stormwater management facility. To determine the pre-development target rates for these catchments, the combined peak flows for catchments PRE1 & EXT were modelled.

## 4.5 Post-Development Condition Modelling Results

The post-development peak flows are summarized in **Tables 2a** and **b** below.

Table 2a: Post-Development Uncontrolled Peak Flows - Site

|           |              |       |       | •  |        |
|-----------|--------------|-------|-------|--|--------|
| Catchment | Area<br>(ha) |       |       | ent Peak Flows (m³/s<br>e-II Storm Distributio |        |
|           | ` '          | 2-yr  | 5-yr  | 25-yr  | 100-yr |
| POST1     | 2.94         | 0.406 | 0.564 | 0.815  | 1.018  |
| POST2     | 0.85         | 0.070 | 0.111 | 0.183  | 0.240  |
| EXT       | 11.94        | 0.604 | 0.966 | 1.559  | 2.065  |

Table 2b: Post-Development Uncontrolled Peak Flows – POST1 & EXT Combined

| Catchment<br>POST1 + EXT | Area<br>(ha) |       | •     | ent Peak Flows (m³/s<br>e-II Storm Distributio | ` ,    |  |  |
|--------------------------|--------------|-------|-------|--|--------|--|--|
|                          | ()           | 2-yr  | 5-yr  | 25-yr  | 100-yr |  |  |
| TOTAL                    | 14.88        | 0.887 | 1.350 | 2.068  | 2.695  |  |  |

By comparing **Tables 1a and Table 1b** with **Table 2a and Table 2b respectively**, it is evident that the total uncontrolled post-development peak flows for the POST1 drainage area exceeds the pre-development targets (PRE1) and thus peak flow attenuation is required before releasing the site's runoff to the existing swale located east of the site. The proposed dry detention basin will be designed to incorporate the necessary quantity control for the runoff generated on-site.

Due to the reduced drainage area of the POST2 catchment relative to the PRE2 catchment, the corresponding post-development peak flows as well as runoff volumes, do <u>not</u> exceed the pre-development target values and as a result <u>no</u> stormwater attenuation is proposed within the POST2 catchment. Refer to **Table 3b** below for additional information. The absence of any stormwater management feature/facility aids in maintaining the overall drainage in the form of overland sheet flow similar to that of the existing condition. Considering the absence of a sufficient drainage outlet at the northeast corner of the site and the presence of the existing development downstream, it is was determined that reducing the overall peak flows and volumes as well as maintaining overland sheet flow drainage from this area of the site would be the preferred design approach.

## 4.6 Stormwater Quantity Control

A comparison between the 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions was completed to determine which storm distribution would be used for sizing the proposed stormwater management facility (dry detention basin). The design storms based on the 24-hour SCS Type-II storm distribution required greater storage volumes than the same design storms based on the other three (3) storm distributions when modelled using SWMHYMO. Therefore, the 24-hour SCS Type-II storm distribution was used to size the proposed stormwater management facility (dry detention basin).

**Table 3a** below summarizes the storage-storage-discharge characteristics for the dry detention basin and the corresponding uncontrolled and controlled post-development peak flows and pre-development target rates.

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Table 3a: SWM Facility Characteristics

| Storm Event (Year) | Area<br>(ha) | Basin Inflow Post- Development Uncontrolled Peak Flow (m³/s) (per Table 2b) | Basin Outflow Post- Development Controlled Peak Flow (m³/s) | Storage<br>Provided<br>(m³) | Estimated<br>Water Levels<br>(m) |
|--------------------|--------------|---|---|-----------------------------|----------------------------------|
| 2                  |              | 0.887   | 0.722   | 863                         | 296.02                           |
| 5                  | 14.88        | 1.350   | 1.158   | 1037                        | 296.20                           |
| 25                 |              | 2.068   | 1.807   | 1279                        | 296.42                           |
| 100                |              | 2.695   | 2.389   | 1463                        | 296.57                           |

**Table 3b** below summarizes the pre- and post-development peak flows and runoff volumes generated by the uncontrolled northeast portion of the re-development (Catchments PRE2 and POST2).

Table 3b: Uncontrolled Catchments (PRE2 & POST2)

| Storm Event<br>(Year) | Area (ha)                   | Pre- Development Uncontrolled Peak Flow (m³/s) (per Table 1a) | Pre-<br>Development<br>Runoff Volume<br>(m³) | Post- Development Uncontrolled Peak Flow (m³/s) (per Table 2a) | Post-<br>Development<br>Runoff<br>Volume<br>(m³) |
|-----------------------|-----------------------------|---|--|--|--|
| 2                     |                             | 0.097   | 344  | 0.070  | 254  |
| 5                     | 1.36 (PRE2)<br>0.85 (POST2) | 0.160   | 534  | 0.111  | 378  |
| 25                    |                             | 0.272   | 844  | 0.183  | 578  |
| 100                   |                             | 0.362   | 1110   | 0.240  | 747  |

The erosion control volume (25mm runoff volume of 493m³) can easily be accommodated within the basin. The 48-hour draw down of the 25mm runoff volume was targeted, but could not be achieved even using the MOE's minimum orifice size (75mmø). The drawdown time using a 75mmø orifice is 16.2 hours. As recommended in the MOE SWM Manual (2003), since the minimum orifice size will be used, a draw down time >12hrs is considered acceptable.

Refer to **Section 4.8** for the Dry Detention Basin Details.

## 4.7 Stormwater Quality Control

The stormwater management requirements for this site were determined based on the NVCA Design Guidelines. The appropriate level of quality control was determined to be an 'Enhanced' Level of Protection as defined by the MOE's Stormwater Management Planning & Design Manual (2003), which equates to the provision of 80% total suspended solids (TSS) removal efficiency.

In determining the stormwater management practices to implement for the proposed re-development, various methods were considered. During the review, the main factors considered were as follows:

- Existing land characteristics and uses (soils, topography, location, etc.);
- Local requirements and maintenance considerations with regard to quality control;
- Facility feasibility & proximity to a suitable stormwater outlet and the receiving watercourse (Pine River).
- Utilizing an 'integrated treatment train' approach to treat stormwater runoff;
- Ability to utilize landscaped areas and providing water balance and nutrient uptake benefits;

Based on the above noted factors, the application of a low impact enhanced grass swales complete with upstream grass filter strips (buffers) and a downstream dry detention basin, has been chosen as the preferred means of providing a complete treatment train approach for the treatment of contaminated stormwater runoff generated on-site.

Long shallow sloped enhanced grass swales are proposed to capture and convey all stormwater runoff prior to reaching the dry detention basin. Enhanced grass swales are considered advantageous as they can be integrated into the various landscape features proposed throughout the site. From a performance perspective they are beneficial in that they can function adequately when graded into areas of varying slope and will provide exceptional capture due to the longitudinal dimension and location of the swales with respect to the overland runoff's perpendicular direction of flow. The design of the enhanced grass swales is highly conducive to providing optimal capture of the site's stormwater runoff while facilitating a reduction in flow velocity as the runoff is conveyed downstream towards the proposed dry detention basin, and ultimately the site outlet. The enhanced grass swales will provide additional pre-treatment of the stormwater by means of vegetative filtration, infiltration, nutrient uptake and evapotranspiration.

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The enhanced grass swales are proposed to be integrated into the site's landscaped area located at the eastern limit of the site's parking area. The enhanced grass swales will run parallel to the parking area boundary, capturing all contaminated runoff from the re-development. Based upon guidance from the LID Manual, the enhanced grass swales will consist of a 0.75 bottom width (minimum), 3:1 (H:V) side slopes, longitudinal slopes 1.0% or less, and flow velocities less than 0.5m/s during a 25mm design storm event. The site grading is such that runoff from all impervious area not captured by the storm sewer is directed to the enhanced grass swales before entering the dry detention basin.

Based on the information provided in the LID Guide, the median TSS removal rate for an enhanced grass swale is considered to be 76%. Considering the dry detention basins design is functionally similar to an enhanced grass swale, it has also been considered to have a median TSS removal rate of 76%. Based on the proposed treatment train which consists of a storm sewer with deep sumps/grass filter strips for pre-treatment in conjunction with the enhanced grass swales and dry detention basin, a minimum of 80% Total Suspended Solids (TSS) removal efficiency is considered to be achievable on-site.

With respect to overall water balance for the subject lands, the proposed SWM design is considered to have made every feasible effort to maintain the pre-development infiltration and evapo-transpiration rates. All proposed pervious surfaces have been kept to a maximum with respect to overall magnitude and are proposed to be landscaped as per the Landscape Plans (provided by others). The presence of the proposed grass filter strips, enhanced grass swales and the dry detention basin will inherently provide extended opportunity for nutrient uptake and evapotranspiration through the vegetative cover and extended detention (ponding) storage, prior to the site's stormwater runoff being released off-site.

Refer to the Site Grading Plan North (**SGRN**), Site Grading Plan South (**SGRS**), Site Servicing Plan North (**GENN**), Site Servicing Plan South (**GENS**) and the Stormwater Management Facility Plan (**SWM**) for additional details.

## 4.8 Total Phosphorus Removal Initiatives

Phosphorus removal initiatives are also proposed for the subject site, in accordance with the requirements of the NVCA.

Each of the on-site stormwater management features noted above will retain pollutants and nutrients (such as phosphorus). The proposed Best Management Practices (BMPs) have been designed as a treatment train to provide filtration, evapotranspiration, infiltration, and nutrient uptake.

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Each proposed BMP (i.e. grass filter strips, enhanced grass swales and the dry detention basin) have been designed based on the runoff volume generated by a 25mm rainfall event. Considering this, the "first flush" of any rainfall event, which consists of the vast majority of pollutants and contaminants including phosphorus, will be captured, conveyed and retained on-site prior to be discharged downstream.

Using the NVCA PLDv2 Tool, the proposed re-development and associated stormwater management BMPs were modelled to determine the total post-development phosphorus export from the site. Based on the calculations, the total pre-development phosphorus export from the site is **0.85kg/yr**, and the total post-development phosphorus export from the site is **0.91kg/yr** with the proposed BMPs. Based on the above, the increase in phosphorus loading in the post-development condition through the implementation of the proposed BMPs is considered negligible relative to the pre-development condition.

For supporting calculations, refer to the NVCA PLDv2 Tool output summary located in **Appendix B**.

## 4.9 Dry Detention Basin Details

Details of the proposed Dry Detention Basin are summarized below:

- The proposed dry detention basin is designed to attenuate the stormwater runoff generated by the majority of the re-development (POST1 catchment) prior to releasing it off-site. Quantity control will be provided to attenuate each of the 2-100 year design storm post-development peak flows to the corresponding pre-development target rates. The first flush (25mm design storm runoff volume (erosion control volume)) of 493m³ will be drawn down through a 75mmø orifice over a period of 16.2 hours which is consistent with the allowable 12 hour minimum for the minimum orifice size as specified in the MOE guidelines. This form of stormwater attenuation will provide inherent water balance benefits through both infiltration and evapotranspiration, suspended solids removal capabilities, and nutrient uptake through the vegetation provided within the basin.
- The proposed dry detention basin will include both an overland inlet swale located at the northeast limit of the basin and a piped inlet at the northwest limit of the basin. The proposed piped inlet will convey all design storm peak flows up to and including the 5-year design storm from the POST1 catchment area, as well as peak flows up to and including the 25-year design storm from the external lands located west of the site (EXT catchment area). The proposed overland inlet will convey all remaining design storm peak flows up to and including the 100-year design storm from both the POST1 & EXT catchment area into the dry detention basin. Both the basin's inlets will be lined with filter cloth and rip-rap for erosion protection and are located as far away as possible from the basin's outlet structure to prevent short circuiting of the runoff through the dry detention basin.

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- The dry detention basin has been designed to have 4:1 (H:V) side slopes, a maximum depth of 2.55m, a large flat base area of 182m<sup>2</sup>, and a total storage capacity of 1904.9m<sup>3</sup>.
- A 3.0m wide Maintenance Access will be constructed around the majority of the basin providing opportunity for vehicular access to the basin and its outlet structures. The Maintenance Access will begin at the proposed parking area north of the basin and extend around the western & southern perimeter of the basin terminating at the Overflow Spillway Weir.
- The basin's outlet structure will consist of a combination of an orifice plate and rectangular/triangular weir configured into a 600mm x 1200mm ditch inlet catchbasin (DICB) located at the basin's southeast limit. The 25mm design storm runoff volume will enter the outlet structure through and be attenuated by a 75mmø orifice plate (Invert Elevation = 294.35m) located within the DICB via a 150mmø a hickenbottom perforated pipe connection from the base of the basin. This extended detention volume (493m³) will draw down over a period of 16.2hrs. In conjunction with the proposed orifice plate, a sharp-crested rectangular weir (1.2m wide, weir crest elevation = 295.55) cut into the face of DICB outlet structure, in combination with the sloped portion of the DICB (which will function as a triangular-shaped weir with 2:1 side slopes) is proposed to attenuate the peak flows of the remaining storm events within the dry detention basin. This outlet structure configuration will provide sufficient stormwater attenuation within the dry detention basin to control the postdevelopment peak flows to the corresponding pre-development target rates for each of the 2-100 year design storm events. A proposed 900mmø outlet pipe from the control structure (DICB) will convey all of the 2-100 year design storm events to the existing site outlet.
- In the event of a partial blockage in the outlet structure or during a storm event less frequent than the 100-year design storm, the proposed Overflow Spillway Weir (broad-crested weir) will safely convey the flows to the existing site outlet. The Overflow Spillway Weir will be trapezoidal in shape, have a 4.0m bottom width and 10:1 side slopes. The Overflow Spillway weir will be lined with Turfstone Pavers to armour the weir against erosion and allow vehicular access over the weir if necessary. An Overflow Spillway will be constructed from the Overflow Spillway Weir to the site outlet at the eastern property line. The Overflow Spillway is sized to convey flows from the Overflow Spillway Weir (peak flows less frequent than the 100-year design storm). The Overflow Spillway will have a 2.0m bottom width, 4:1 side slopes, and be lined with filter cloth and rip-rap for erosion protection. Both the Overflow Spillway Weir and Overflow Spillway will be capable of safely conveying post-development peak flows generated by storm events less frequent than the 100-year design storm without any restriction in order to prevent any potential flood hazards associated with larger peak flows/runoff volumes.

Refer to **Appendix C** for supporting calculations.

#### 4.10 Erosion & Sediment Controls

In accordance with NVCA policies, effective erosion and sediment control must be established prior to construction commencement and maintained until the site has been stabilized. Exposure of the soil during construction should be minimized to avoid erosion and sedimentation. The sites erosion potential may be mitigated through the use of sound erosion and sedimentation control measures. The following measures shall be carried out prior to construction and maintained until disturbed areas have been sufficiently stabilized/established:

<u>Topsoil Stripping:</u> Topsoil stripping will be reduced as much as possible on-site. Where grading is necessary, the exposed soil will be stabilized by seeding immediately upon being set to grade. Should topsoil stockpiling be required, the stockpiles will be kept at manageable levels for grass/weed cutting purposes.

<u>Silt Fence</u>: Silt fence will be placed along the down slope of all excavated material and along the perimeter of the site where grading is directed towards the property line to prevent sediment transport onto adjacent lands. Periodic inspections and repairs to the silt fence should be performed regularly, as well as after every rainfall event.

<u>Vegetated Buffers:</u> Existing grassland vegetation, wooded and/or lawn areas along the development limits are to be maintained wherever possible. These areas will provide a natural barrier to filter potentially sediment-laden overland flow before it is released from the site.

<u>Conveyance Protection:</u> Straw bale check dams will be placed within all swales immediately after being constructed, and should be removed only after the area has been fully stabilized.

Finally, the Site Engineer will be responsible for completing routine inspections of the sediment and erosion control structures throughout the construction phase of the redevelopment, particularly after rainfall events. All damaged or clogged control devices or fencing must be repaired immediately.

Refer to the Erosion and Sediment Control Plan (ESC) for additional details.

# 5.0 Grading

The proposed grading will meet the requirements of the site layout and stormwater management strategy. In order to achieve these goals the following design criteria were used;

- Grading of internal driveways, parking and landscaped areas to be completed according to current engineering design standards.
- Minimize earthworks operations on-site (i.e. minimize cut/fill) where possible.
- Provide overland conveyance of as much stormwater runoff as possible to the site outlet at the southeast limit of the property. Where existing topography does not allow for positive grading to the southeast corner, any uncontrolled runoff peak flows and volumes are to be less than or equal to that of the predevelopment condition and in the form of overland sheet flow (not concentrated flow).
- Minimize the need for steep slopes and retaining walls where practical.

# 6.0 Traffic Impact Opinion

A separate Traffic Impact Opinion letter has been completed to ensure that no negative impacts to traffic flow will result from the proposed re-development of the subject lands. Refer to **Appendix E** for the Traffic Impact Opinion letter.

# 7.0 Summary and Conclusions

In conclusion, this Site Servicing and Stormwater Management Report demonstrates how the proposed commercial/residential re-development can be serviced and integrated into the existing Mansfield Ski Club (MSC), without imposing any adverse impacts to the surrounding lands/environment. Specifically, we note the following:

• The commercial/residential re-development can be accommodated with private potable drinking water system consisting of four (4) drilled wells (2 existing and 2 proposed) located at the north limit of the property adjacent to the 17<sup>th</sup> Sideroad site entrance, two (2) separate raw water supply lines from the wells to the existing holding tank buried northeast of the Main Chalet and a proposed water treatment system located within the basement of the Main Chalet's building addition. The proposed water treatment system will consist of the equipment necessary to treat the raw water in order to meet the requirements of O. Reg. 170/03 and will provide sufficient storage of treated water (day tanks) to accommodate the required domestic water supply during maximum day and peak hour demands. Secondary disinfection will be provided by means of chlorination for the proposed domestic water distribution system.

Site Servicing & Stormwater Management Report August 2020

- Fire supply will be provided for the re-development by means of a gravity fed standalone fire supply distribution system complete with three (3) fire hydrants. Sufficient fire storage volume and flow will be provide by means of 6-50,000L concrete tanks connected in parallel and located west of the re-development up the existing ski hill at an elevation capable of providing the required fire flows and 20psi pressure at each of the proposed hydrants. A proposed connection to the snow making supply line in the vicinity of the storage tanks will be used to fill the tanks with water from the proposed snow making pond when necessary.
- Sanitary drainage will be provided via a proposed sanitary sewer system which will discharge the re-developments influent into an on-site sewage treatment system (surface discharge Waterloo Biofilter system). The proposed on-site sewage treatment system will discharge the treated effluent safely back into the environment as determined by the previously completed and MECP approved Assimilative Capacity Study completed for the Pine River. The treated effluent will discharge into a proposed storm sewer system running down the Chalet Ski run immediately north of the Main Chalet, to base of the ski run where it will drain further east into the Pine River.
- Stormwater quantity control will be provided to attenuate the post-development 2-100 year design storm peak flows to their corresponding pre-development target rates for the site via the use a dry detention basin complete with an outlet structure consisting of a combination of weirs and an orifice plate located within ditch inlet catchbasin. An Overflow Spillway Weir and Overflow Spillway built into the southeast corner of the basin will convey peak flows to the site outlet in the event of a blockage of the outlet structure. Areas that are not able to be directed into the proposed dry detention basin have been reduced as much as possible through proposed re-grading, to ensure that all peak flows and runoff volumes in the post-development condition are equal to or less than those of the pre-development condition.
- Stormwater quality control, phosphorus reduction and overall water balance as per NVCA standards will be provided via the use of an integrated treatment train approach which will help minimize any negative impacts the proposed redevelopment may have on the existing quality of stormwater runoff. An 'Enhanced' Level of Protection, as defined in the MOE's Stormwater Management Planning & Design Manual, will be provided through the use of grass buffers (grass filter strips) for pre-treatment of the runoff, and enhanced grass swales in conjunction with a dry detention basin for their inherent water balance, phosphorus loading reduction and TSS removal efficiency benefits. Inlet structures within the proposed storm sewer on-site will consist of deep sumps to aid in TSS removal upstream of the dry detention basin. In addition to the treatment train approach noted above, all pervious surfaces have been maximized (gravel parking and landscaped areas) as per the Landscaping Plans (by others), to match as closely as possible the post-to pre-development water balance (evapo-transpiration and infiltration) volumes on-site.

Site Servicing & Stormwater Management Report August 2020

- The proposed grading scheme for the site can be achieved while maintaining existing overall drainage patterns. The site will consist of sufficient topographic relief to provide adequate overland sheet flow conveyance for the majority of the site's runoff in a northwest-southeast direction towards the proposed dry detention basin which will discharge to the sites existing outlet at the southeast corner of the property. Considering this, it is anticipated that the proposed re-development will not adversely affect existing major and/or minor system stormwater flow routes.
- A separate Traffic Impact Opinion letter has been completed to ensure that no negative impacts to traffic flow will result from the proposed re-development of the subject lands.
- The use of silt fence, straw bale check dams, and existing vegetated buffers will ensure downstream stormwater quality is maintained during construction.

The site servicing design as described above is considered to be capable of adequately servicing the proposed re-development and the stormwater management system can be constructed and maintained as a feasible method of treating, controlling and discharging all stormwater run-off generated on-site safely to existing outlets. This Site Servicing and Stormwater Management Report and the associated engineering design drawings are based on information provided at the time of their preparation and are considered only applicable to the proposed works as described in this report. Any changes subsequent to the report and drawings date of issuance should be reviewed by WMI & Associates Ltd. to ensure applicability of the design contained within the documents.

Based on the above, we request that this report be received by the Township of Mulmur and the NVCA in support of the construction of the proposed re-development submitted on behalf of the MSC.

Respectfully submitted,

WMI & Associates Limited

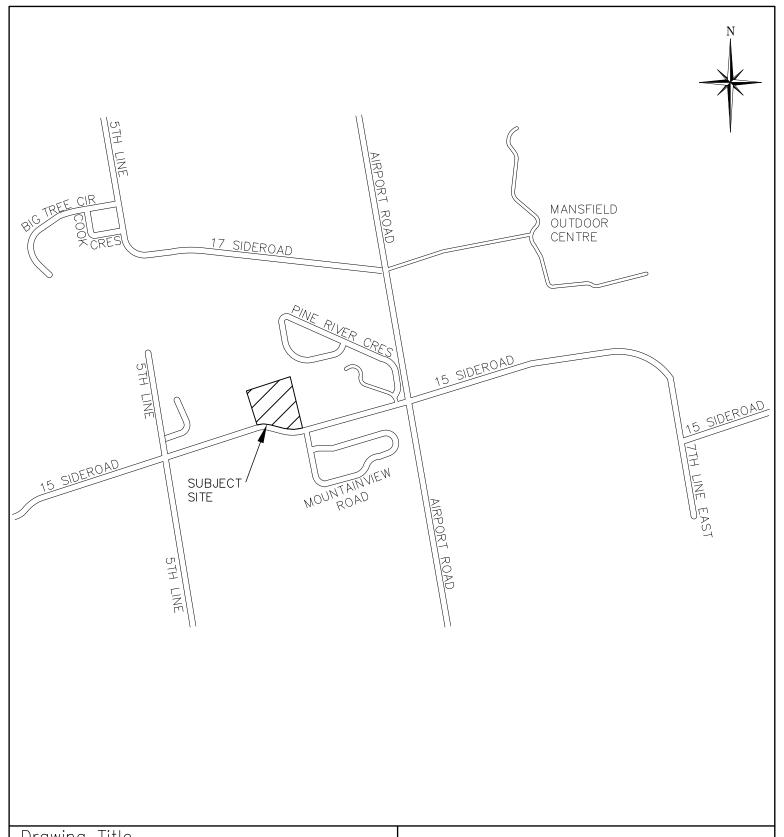
Ben Daniels

Benjamin Daniels, B. Eng.

Jeremy W. Lightheart, P. Eng.

**APPENDIX A** 

**FIGURES** 



Drawing Title

SITE LOCATION PLAN

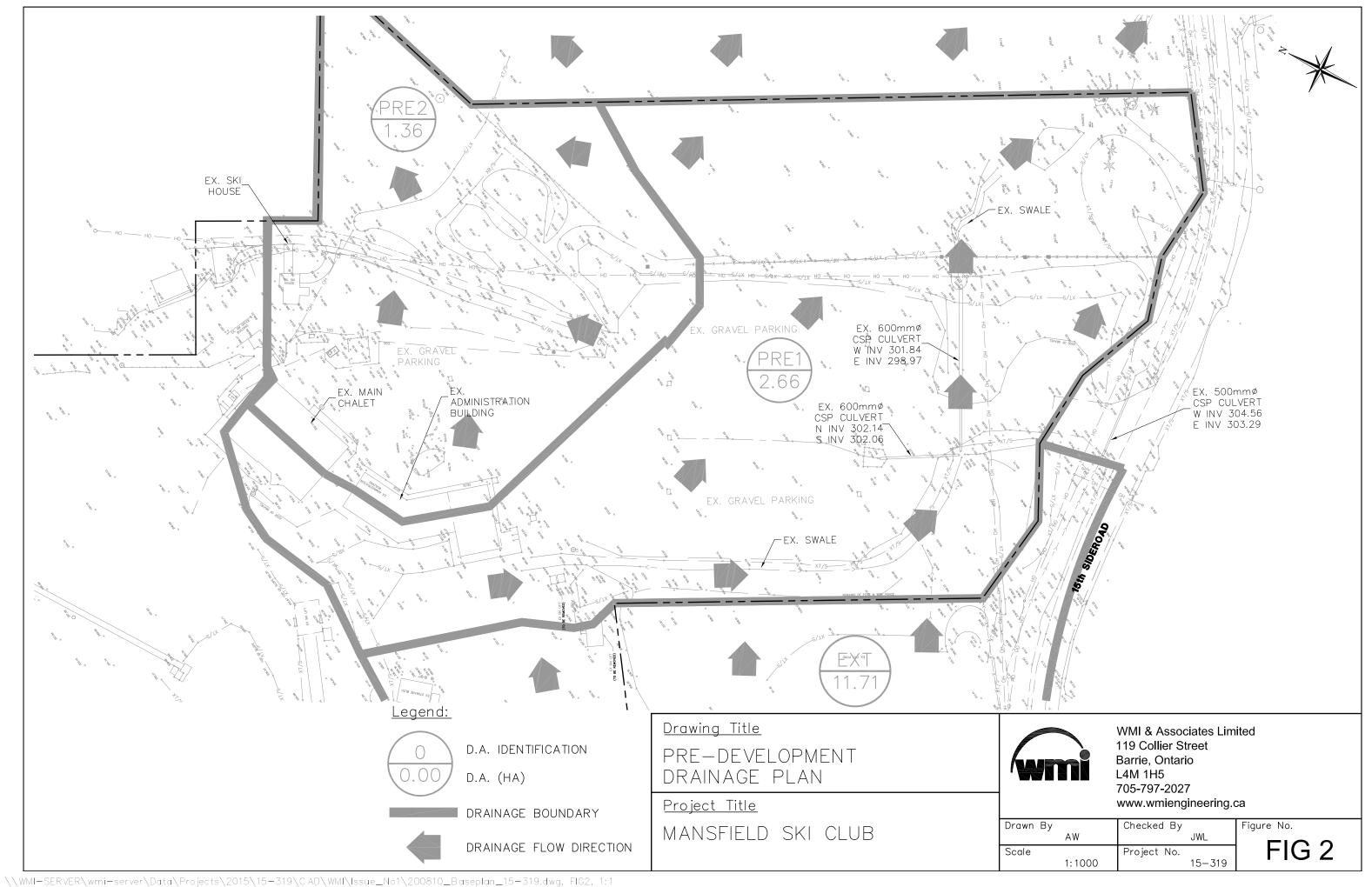
Project Title

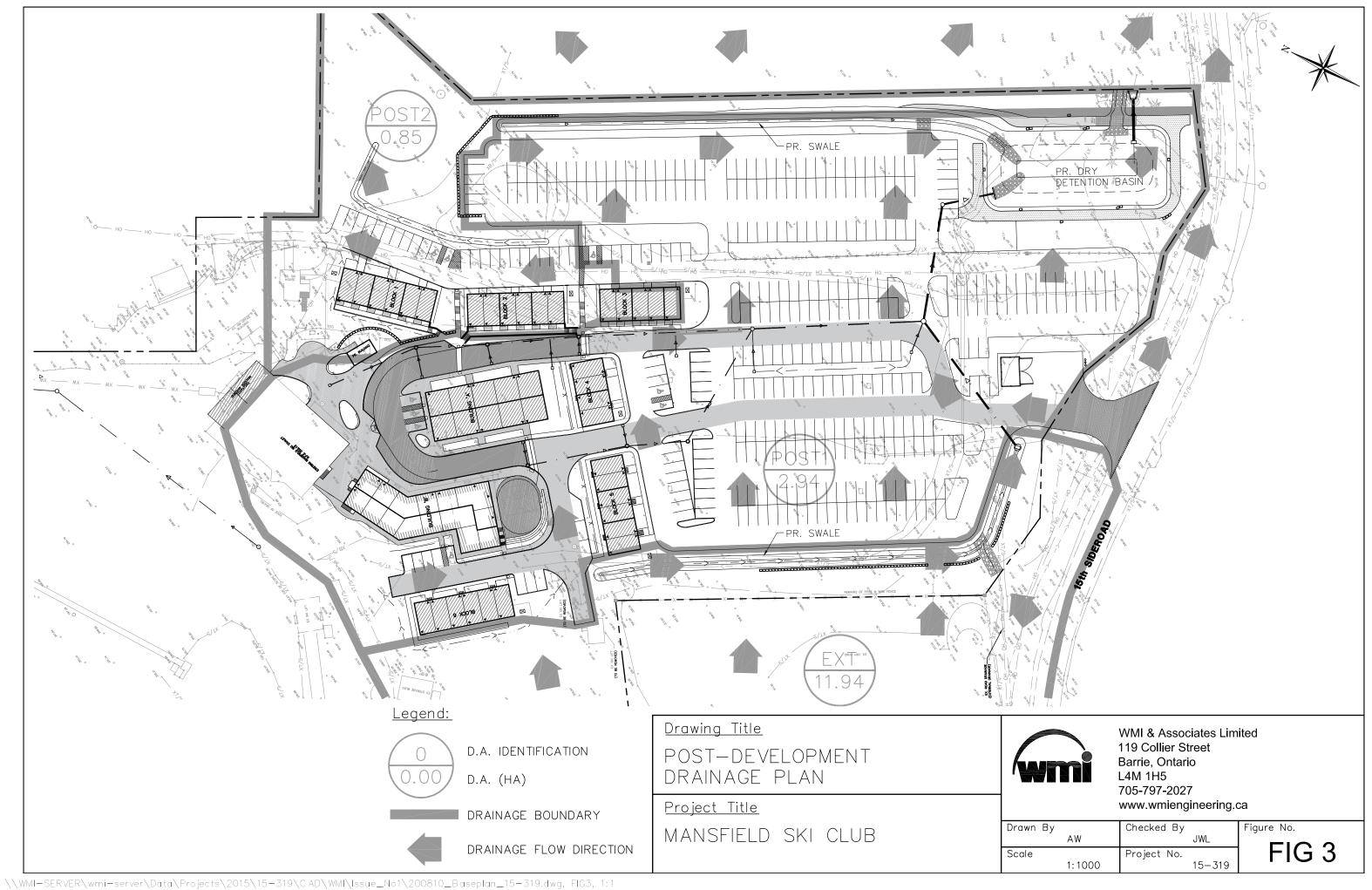
MANSFIELD SKI CLUB



WMI & Associates Limited 119 Collier Street Barrie, Ontario L4M 1H5 705-797-2027 www.wmiengineering.ca

| Drawn By |        | Checked By  | Figure No. |
|----------|--------|-------------|------------|
|          | AW     | JWL         |            |
| Scale    |        | Project No. | ∃ FIG1     |
|          | N.T.S. | 15-3        | 19         |











D.A. IDENTIFICATION

D.A. (HA)

DRAINAGE BOUNDARY



DRAINAGE FLOW DIRECTION

<u>Drawing Title</u>

EXTERNAL DRAINAGE PLAN

<u>Project Title</u>

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| Drawn By |         | Checked By  |        | Figure No. |
|----------|---------|-------------|--------|------------|
|          | AW      | J           | JWL    |            |
| Scale    |         | Project No. |        |            |
|          | 1: 3000 | 1           | 15-319 |            |



<u>Drawing Title</u>

DOWNSTREAM DRAINAGE OUTLET PLAN

<u>Project Title</u>

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| Drawn By | AW      | Checked By  | JWL    | Figure No. |
|----------|---------|-------------|--------|------------|
| Scale    | 1: 4000 | Project No. | 15-319 | FIG 5      |

**APPENDIX B** 

WATER & SANITARY SEWAGE CALCULATIONS



# TOTAL DAILY DOMESTIC WATER SUPPLY FLOW CALCULATIONS Mansfield Ski Club

**Date:** 14-Aug-20 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: JWL

Elements Requiring Input Information

#### **Total Daily Design Flow Calculations**

References: - Ontario Building Code (OBC), 2012, Division B, Part 8, Table 8.2.1.3.A. Residential Occupancy & Table 8.2.1.3.B. Other Occupancies

- Ministry of the Environment (MOE), Design Guidelines for Drinking-Water Systems (2008), Chapter 3

#### **Proposed Condition:**

| Establishment:   |                  | of water closets | # of<br>fuel outlets | # of<br>seats | Gross Floor<br>Area (m²) | Land<br>Area (ha)  | Total Daily Design<br>Volume |                       | Avg Day Demand<br>ADD (L/day) | Max Day Demand<br>MDD (L/day) | Peak Hourly Demand<br>PHD (L/day) |
|--|------------------|------------------|----------------------|---------------|--------------------------|--------------------|------------------------------|-----------------------|-------------------------------|-------------------------------|-----------------------------------|
| Existing Main Chalet, Admin Bldg, GM                   |                  |                  |                      |               |                          |                    |                              |                       |                               |                               |                                   |
| Office and Ski House                                   |                  |                  |                      |               |                          |                    | 13800                        | L/day                 | 13800                         | 27600                         | 55200                             |
| Subtotal =   |                  |                  |                      |               |                          |                    |                              |                       | 13800                         | 27600                         | 55200                             |
|  |                  |                  |                      |               |                          |                    |                              |                       | Peaking Factor =              | 2                             | 4                                 |
| Peaking factor for the ADD and MDD are based on the wa | ater log consump | tion records     | from the 2019-       | -2020 ski s   | eason. Peaking fa        | ctor for the PHD v | vas assumed to               | be double that        | of the MDD factor.            |                               |                                   |
| Commercial/Institutional & Industrial Uses:            |                  |                  |                      |               |                          |                    |                              |                       |                               |                               |                                   |
| Building A & B - Restaurant (not 24 hour)              |                  |                  |                      | 96            |                          |                    | 125                          | L / 1.0m <sup>2</sup> | 12000                         | 18000                         | 36000                             |
| Building A & B - Retail Stores                         |                  |                  |                      |               | 1246.5                   |                    | 5                            | L / 1.0m <sup>2</sup> | 6233                          | 9349                          | 18698                             |
| Subtotal =   |                  |                  |                      | 96            | 1246.5                   |                    |                              |                       | 18233                         | 27349                         | 54698                             |
|  |                  |                  |                      |               |                          |                    |                              |                       | Peaking Factor =              | 1.5                           | 3                                 |

\_ . . \_ . \_ .

Assumed approx. 3/4 of Building A & B (total is 1662m²) is Retail Store space and the remaining 1/4 (approx. 4 units per building) is occupied by Restaurants (not 24 hour) at 12 seats per unit.

#### Residential Uses

| Residential Uses:  |  |     |          |                  |        |        |
|--|--|-----|----------|------------------|--------|--------|
| Building A - Lofts (10 Units - Two (2) Bedrooms/Unit)    | 40   | 275 | L/person | 11000            | 36740  | 55220  |
| Building B - Lofts (15 Units - Two (2 Bedroom/Unit)      | 60   | 275 | L/person | 16500            | 55110  | 82830  |
| Staked Houses (66 Units - Two (2) Bedrooms/Unit)         | 264  | 275 | L/person | 72600            | 242484 | 364452 |
|  |  |     |          |                  |        |        |
| Subtotal =   | 364  |     |          | 100100           | 334334 | 502502 |
| Refer to Table 3-1 and/or Table 3.3 of the MOE Design Gu | idelines for Drinking-Water Systems (2008) >>> |     |          | Peaking Factor = | 3.34   | 5.02   |
|  |  |     |          |                  |        |        |
|  |  |     |          |                  |        |        |

| TOTAL SITE WATER DEMAND (L/day) = | 132133 | 389283 | 612400 |
|-----------------------------------|--------|--------|--------|
| (L/min) =                         | 91.8   | 270.3  | 425.3  |

#### Flow Deficit during the Peak Hourly/Instantaneous Demand Rate:

Flow Deficit = Peak Hourly Demand Rate - Maximum Treatment Rate

= 425.3 L/min - 151.2 L/min

274.1 L/min

Required Inline Domestic Storage = Draw Down for Peak Hourly Demand Rate (1hr) x Flow Deficit

60 min x 274.1 L/min

16445 L

#### Flow Deficit during the Max Day Demand Rate:

Flow Deficit = May Day Demand Rate - Maximum Treatment Rate

270.3 L/min - 151.2 L/min

= 119.1 L/min

Required Inline Domestic Storage = Draw Down for Max Day Demand Rate (1hr) x Flow Deficit

= 480 min x 119.1 L/min

57185 L

Therefore, the Max Day Demand Rate governs. Within the domestic water treatment system there are two day tanks proposed to provided a total of 66,284L of storage.

#### Notes:

- Number of bedrooms and commercial retail area are approximate and the information was provided by the architect and is subject to change.
- # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x # of bedrooms x 2 people per bedroom.
- Residential flow is based on Apartments, Condos, Other Multi-family Dwellings (275L/day).



# FIRE PROTECTION WATER STORAGE DESIGN CALCULATIONS BUILDING B - Supplied to Fire Hydrant 1 & 2

**Date**: 14-Aug-20 **Project No.**: 15-319

Project: Mansfield Ski Club Prepared By: AW

Elements Requiring Input Information

#### Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code

(OBC), October 1999

Subsection 3.2.2 of the Ontario Building Code, 2012

#### **Building Classification:**

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C, D or E and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 31 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient for group E classification.

- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

K = 31 (see notes above)

### Calculate Q=KVS<sub>TOTAL</sub>

K = 31 (see Step 1 above)

Approximate Building Volume:

V = Area x Height + Roof Volume

V = 8190.0 m<sup>3</sup> (see notes above, Building B is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

| ximate Exposure Distance | e From Pro | posea | Bullaings To: |                  |              |           |
|--------------------------|------------|-------|---------------|------------------|--------------|-----------|
|                          |            | _     |               | from Figur       | e 1 (OBC, A. | 3.2.5.7.) |
| West to Block 6 =        | 12.0       | m     | > > > > >     | S <sub>W</sub> = | 0            |           |
| North to Main Chalet =   | 8.8        | m     | > > > > >     | S <sub>N</sub> = | 0.1          |           |
| East to Building 'A' =   | 14.0       | m     | > > > > >     | S <sub>E</sub> = | 0            |           |
| South to Block 5 =       | 31.5       | m     | > > > > >     | S <sub>S</sub> = | 0            |           |

$$S_{TOTAL} = 1 + (S_W + S_N + S_E + S_S)$$
  
= 1 + 0.1  
 $S_{TOTAL} = 1.1$ 

Minimum Water Supply,

$$Q = KVS_{TOTAL} \\ = 31 & x \\ \hline Q = 279,279 & L$$
 8190.0 x 1.1 where,  $Q = Minimum Water Supply (L)$   $K = Water Supply Coefficient \\ V = Building Volume  $(m^3)$   $S_{TOTAL} = Total Spatial Coefficient$$ 

Therefore, 6 x 50,000L fire storage tanks will be sufficient to provide the necessary Fire Protection Water Supply for the proposed development.

#### Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 9000 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:







#### FIRE PROTECTION WATER STORAGE DESIGN CALCULATIONS Block 2 - Supplied to Fire Hydrant 3

Date: 14-Aug-20 **Project No.: 15-319** 

Project: Mansfield Ski Club Prepared By: AW

**Elements Requiring Input Information** 

#### Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code

(OBC), October 1999

Subsection 3.2.2 of the Ontario Building Code, 2012

#### **Building Classification:**

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C or D and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 18 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient.
- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

(see notes above)

### Calculate Q=KVS<sub>TOTAL</sub>

K= 18 (see Step 1 above)

Approximate Building Volume:

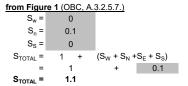
Height Area

+ Roof Volume  $V = 4095.0 \text{ m}^3$ 

(see notes above, Blcok 2 is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

| West to Building A = | 14.0 | m | > | > | > | > | > | > |
|----------------------|------|---|---|---|---|---|---|---|
| North to Block 1 =   | 9.0  | m |   |   |   |   |   |   |
| South to Block 3 =   | 11.0 | m |   |   |   |   |   |   |



Minimum Water Supply,

Q = Minimum Water Supply (L) where,

K = Water Supply Coefficient V = Building Volume (m<sup>3</sup>)

S<sub>TOTAL</sub> = Total Spatial Coefficient

Building 'B' is the governing building for the fire storage requirments.

#### Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 2700 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:





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# Watermaim & Fire Supply Headloss Calculations Mansfield Ski Club

**Elements Requiring Input Information** 

Velocity, V = (m/s)

> $Q = Flow (m^3/s)$ where,

> > A = Cross-Sectional Area (m<sup>2</sup>)

Minor Head Loss,  $H_L = (K_1 + K_2 + K_3...) \times V^2/2g$ 

 $(K_1+K_2+K_3...)$ 

- Loss Coeffeciant:

mean velocity (m/s)

9.81 (acceleration due to gravity, m/s<sup>2</sup>)

Hazen -Williams Equation (re-arranged for Friction Slope)

(Friction Head Loss Calculation) Friction Slope, S =

 $(V)^{1/0.54}$ x 100 (m/100m)  $(0.85CR^{0.63})^{1/0.54}$ 

V = mean velocity (m/s) where,

> k = 0.85 for SI units C = Roughness Coefficient R = hydraulic radius (m)

Total Head Loss = Friction Head Loss + Minor Head Loss

Pressure (psi) = Pressure Head (m) x 1.422

Total HGL = Ground Elev. + Pressure Head

Date: 14-Aug-20

Project No: 15-319

Prepared by: AW

| Description                           | Pipe Design |           |            |              | Forcemain          |                 |               | Sum of Minor | Minor Head   | Total Head    | Total Pressure | Pressure   | Pressure Head | Ground Elev.     | Total HGL        | Ground Elev.     | Total HGL        | Pressure Head  | Pressur        |
|---------------------------------------|-------------|-----------|------------|--------------|--------------------|-----------------|---------------|--------------|--------------|---------------|----------------|------------|---------------|------------------|------------------|------------------|------------------|----------------|----------------|
|                                       | Coefficient | Flow      | Diameter   | Velocity     | Unit Friction Head | Distance        | Friction Head | Loss Coeff.  | Loss         | Loss          | Loss           | @ Pt. A    | @ Pt. A       | @ Pt. A          | @ Pt. A          | @ Pt. B          | @ Pt. B          | @ Pt. B        | @ Pt. E        |
|                                       | С           | (L/s)     | (mm)       | (m/s)        | Loss (m/100m)      | (m)             | Loss (m)      | ∑K=          | (m)          | (m)           | (psi)          | (psi)      | (m)           | (m)              | (m)              | (m)              | (m)              | (m)            | (psi)          |
| Fire Supply                           |             |           |            |              |                    |                 |               |              |              |               |                |            |               |                  |                  |                  |                  |                |                |
| Hydrant 1 (at Block 6)                | 110         | 150       | 250        | 3.06         | 4.50               | 225.60          | 10.16         | 0.40         | 0.19         | 10.35         | 14.72          | 0          | 0.00          | 339.45           | 339.45           | 305.50           | 329.10           | 23.60          | 33.56          |
|                                       | 110         | 150       | 250        | 3.06         | 4.50               | 16.30           | 0.73          | 2.12         | 1.01         | 1.74          | 2.48           | 33.56      | 23.60         | 305.50           | 329.10           | 305.90           | 327.36           | 21.46          | 30.51          |
| Hydrant 2 (at Building B)             | 110         | 150       | 250        | 3.06         | 4.50               | 275.00          | 12.38         | 3.32         | 1.58         | 13.96         | 19.86          | 0          | 0.00          | 339.45           | 339.45           | 302.84           | 325.49           | 22.65          | 32.20          |
| Hydrant 3 (at Block 2)                | 110<br>100  | 150<br>45 | 250<br>150 | 3.06<br>2.55 | 4.50<br>6.96       | 271.70<br>24.80 | 12.24<br>1.73 | 2.32<br>2.12 | 1.10<br>0.70 | 13.34<br>2.43 | 18.97<br>3.45  | 0<br>33.29 | 0.00<br>23.41 | 339.45<br>302.70 | 339.45<br>326.11 | 302.70<br>298.15 | 326.11<br>323.68 | 23.41<br>25.53 | 33.29<br>36.31 |
| Domestic Supply                       |             |           |            |              | 0.00               |                 |               |              | 00           | 20            |                | 00.20      | _0            | 0020             | 020              |                  | 020.00           |                | 00.01          |
| (Located at the SE corner of block 6) | 100         | 7.1       | 100        | 0.90         | 1.64               | 107.00          | 1.76          | 2.16         | 0.09         | 1.85          | 2.62           | 55         | 38.68         | 302.00           | 340.68           | 306.00           | 338.83           | 32.83          | 46.69          |

NOTES:

Hydrant #1

Total

1 - 45° Bends @ K=0.4 2 - 90° Bends @ K=1

1 - Valves @ K=0.12

Hydrant #2

3 - 45° Bends @ K=0.4 2 - 90° Bends @ K=1

1 - Valves @ K=0.12 Total 3.32 Hydrant #3

6 - 45° Bends @ K=0.4 3 - 90° Bends @ K=1

2 - Valves @ K=0.12 Total 5.64 **Domestic Watermain** 

2-45° Bends @ K=0.4 1 - 90° Bends @ K=1

2 - Valves @ K=0.12

Total 2.16

- The governing fire flow is based on Building 'B' which requires a flow of 150L/s. Hydrants 1 & 2 fire supply lines are based on this flow and hydrant 3 is based on the reugired flow of 45L/s for block 2.
- Assumed a starting pressure of 0 at the fire storage tanks located up the ski hill.

2.52

- Assumed a conservative starting elevation of 339.45 (342.15 2.70m = 339.45) as this is the lowest invert elevation of the 6 fire storage tanks.
- The worst case scenrio for the doesmetic watermain was located at the south east corner of Block 6 as this is the highest elevation of the domestic supply.



# **TECHNICAL BROCHURE**

B5-25GS R8

## **FEATURES**

**Powered for Continuous Operation:** All ratings are within the working limits of the motor as recommended by the motor manufacturer. Pump can be operated continuously without damage to the motor.

Field Serviceable: Units have left hand threads and are field serviceable with common tools and readily available repair parts.

Sand Handling Design: Our face clearance, floating impeller stack has proven itself for over 50 years as a superior sand handling, durable pump design.

**FDA Compliant Non-Metallic Parts:** Impellers, diffusers and bearing spiders are constructed of glass filled engineered composites. They are corrosion resistant and non-toxic.

Discharge Head/Check Valve: Cast 303 stainless steel for strength and durability. Two cast-in safety line loops for installer convenience. The built-in check valve is constructed of stainless steel and FDA compliant BUNA rubber for abrasion resistance and quiet operation.

Motor Adapter: Cast 303 stainless steel for rigid, accurate alignment of pump and motor. Easy access to motor mounting nuts using standard open end wrench.

Stainless Steel Casing: Polished stainless steel is strong and corrosion resistant.

Hex Shaft Design: Six sided shafts for positive impeller drive.

Engineered Polymer Bearings: The proprietary, engineered polymer bearing material is strong and resistant to abrasion and wear. The enclosed upper bearing is mounted in a durable Noryl\* bearing spider for excellent abrasion resistance.

# 5GS, 7GS, 10GS, 13GS, 18GS & 25GS

5-25 GPM, ½ - 5 HP, 60 HZ, SUBMERSIBLE PUMPS





# Residential Water Systems

## **WATER END DATA**

| Series | Model    | Required<br>HP | Stages | Length<br>(in) | Weight<br>(lbs) |
|--------|----------|----------------|--------|----------------|-----------------|
|        | 5GS05R   | .5             | 9      | 12.9           | 8               |
|        | 5GS05    | .5             | 12     | 15.0           | 9               |
| 5GS    | 5GS07    | .75            | 15     | 17.0           | 11              |
| 303    | 5GS10    | 1              | 20     | 21.7           | 13              |
|        | 5GS15    | 1.5            | 26     | 25.8           | 15              |
|        | 5GS20    | 2              | 33     | 31.6           | 19              |
|        | 7GS05R   | .5             | 7      | 11.7           | 6               |
|        | 7GS05    | .5             | 10     | 13.8           | 7               |
|        | 7GS07    | .75            | 13     | 16.0           | 8               |
| 7GS    | 7GS10    | 1              | 17     | 18.8           | 9               |
|        | 7GS15    | 1.5            | 22     | 23.6           | 12              |
|        | 7GS20    | 2              | 27     | 27.2           | 13              |
|        | 7GS30    | 3              | 34     | 33.2           | 18              |
|        | 10GS05R* | 0.5            | 8      | 12.2           | 7               |
|        | 10GS05*  | 0.5            | 10     | 13.6           | 8               |
|        | 10GS07*  | 0.75           | 14     | 16.4           | 9               |
|        | 10GS10*  | 1              | 16     | 17.7           | 11              |
| 10GS   | 10GS15   | 1.5            | 17     | 18.4           | 12              |
|        | 10GS20   | 2              | 20     | 21.7           | 13              |
|        | 10GS30   | 3              | 27     | 27.5           | 18              |
|        | 10GS50R  | 5              | 35     | 33             | 21              |
|        | 10GS50   | 5              | 42     | 40.2           | 24              |
|        | 13GS05   | .5             | 5      | 10.1           | 6               |
|        | 13GS07   | .75            | 7      | 11.5           | 7               |
| _      | 13GS10   | STREET         | 10     | 13.6           | 8               |
| 13GS   | 13GS15   | 1.5            | 12     | 15.0           | 9               |
|        | 13GS20   | 2              | 17     | 18.4           | 12              |
|        | 13GS30   | 3              | 21     | 22.3           | 15              |
|        | 18GS07   | .75            | 6      | 11.8           | 7               |
|        | 18GS10   | 1              | 8      | 13.5           | 8               |
|        | 18GS15   | 1.5            | 11     | 16.1           | 10              |
| 18GS   | 18GS20   | 2              | 14     | 18.6           | 11              |
|        | 18GS30   | 3              | 19     | 24.1           | 15              |
|        | 18GS50R  | 5              | 24     | 28.3           | 17              |
|        | 18GS50   | 5              | 30     | 34.4           | 21              |
|        | 25GS10   | 1              | 7      | 13.4           | 8               |
|        | 25GS15   | 1.5            | 9      | 15.3           | 9               |
|        | 25GS20   | 2              | 11     | 17.2           | 10              |
| 25GS   | 25GS30   | 3              | 15     | 20.9           | 14              |
|        | 25GS50R  | 5              | 22     | 28.7           | 17              |
|        | 25GS50K  | 5              | 26     | 33.4           | 21              |

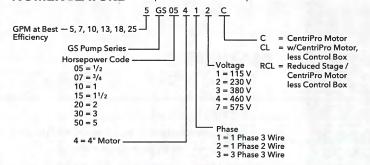
\*New High Head Hydraulic Design for models manufactured starting 8/2017

## **SPECIFICATIONS**

| Model | Flow<br>Range<br>GPM | Horsepower<br>Range | Best<br>Efficiency<br>GPM | Discharge<br>Connection | Minimum<br>Well Size | Rotation 1 |
|-------|----------------------|---------------------|---------------------------|-------------------------|----------------------|------------|
| 5GS   | 1.2 - 7.5            | 1/2 - 2             | 5                         | 11/4                    | 4"                   | CCW        |
| 7GS   | 1.5 - 10             | 1/2 - 3             | 7 /                       | 11/4                    | 4"                   | CCW        |
| 10GS  | 3-16                 | 1/2 - 5             | 10 /                      | 11/4                    | 4"                   | CCW        |
| 13GS  | 4 - 20               | 1/2 - 3             | 13                        | 11/4                    | 4"                   | CCW        |
| 18GS  | 6-28                 | 3/4 - 5             | 18                        | 11/4                    | 4"                   | CCW        |
| 25GS  | 8 - 33               | 1 - 5               | 25                        | 11/4                    | 4"                   | CCW        |

① Rotation is counterclockwise when observed from pump discharge end.

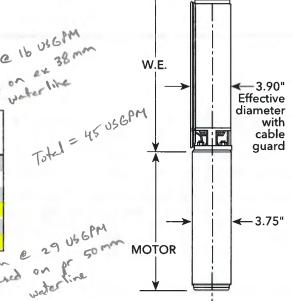
## **NOMENCLATURE** See price book for complete order numbers.



# "GS" SERIES MATERIALS OF CONSTRUCTION

| Part Name                     | Material                          |
|-------------------------------|-----------------------------------|
| Discharge Head                | AISI 303 SS                       |
| Check Valve Poppet            | AISI 304 SS                       |
| Check Valve Seal              | BUNA, FDA compliant               |
| Check Valve Seat              | AISI 304 SS                       |
| Check Valve Retaining Ring    | AISI 302 SS                       |
| Bearing Spider - Upper        | Noryl® GFN2                       |
| Bearing                       | Proprietary Engineered Polymer    |
| Klipring                      | AISI 301 SS                       |
| Diffuser                      | Lexan®                            |
| Impeller                      | Noryl®                            |
| Bowl                          | AISI 304 SS                       |
| Intermediate Sleeve *         | AISI 304 SS, Powder Metal         |
| Intermediate Shaft Coupling * | AISI 304 SS, Powder Metal         |
| Intermediate Bearing Spider * | Glass Filled Engineered Composite |
| Intermediate Bearing Spider * | AISI 303 SS                       |
| Shim                          | AISI 304 SS                       |
| Screws - Cable Guard          | AISI 304 SS                       |
| Motor Adapter                 | AISI 303 SS                       |
| Casing                        | AICL 20A CC                       |
| Shaft                         | AISI 304 SS                       |
| Coupling                      | AISI 304 SS, Powder Metal         |
| Cable Guard                   | AISI 304 SS                       |
| Suction Screen                | AISI 304 SS                       |

\*See repair parts for where used.



DISCHARGE 11/4" NPT

## **CENTRIPRO 4" SINGLE-PHASE MOTORS**

| Order No. | Туре   | HP  | Volts | Length<br>in. (mm) | Weight lb.<br>(kg.) |
|-----------|--------|-----|-------|--------------------|---------------------|
| M05421    |        | 1/2 | 115   | 11.0 (279)         | 20 (9.1)            |
| M05422    | 2      | 1/2 |       | 11.0 (279)         | 20 (9.1)            |
| M07422    | 2-wire | 3/4 | 220   | 12.4 (314)         | 23 (10.4)           |
| M10422    | PSC    | 1   | 230   | 13.3 (337)         | 25 (11.3)           |
| M15422    |        | 1.5 |       | 14.9 (378)         | 29 (13.2)           |
| M05411    |        | 1/2 | 115   | 10.0 (253)         | 19 (8.6)            |
| M05412    |        | 1/2 |       | 9.7 (246)          | 18 (8.2)            |
| M07412    |        | 3/4 |       | 10.8 (275)         | 22 (10)             |
| M10412    | 3-wire | 1   |       | 11.7 (297)         | 23 (10.4)           |
| M15412    | 3-wire | 1.5 | 230   | 13.6 (345)         | 28 (12.7)           |
| M20412    |        | 2   |       | 15.1 (383)         | 31 (14.1)           |
| M30412    |        | 3   |       | 18.3 (466)         | 40 (18.1)           |
| M50412    |        | 5   |       | 27.7 (703)         | 70 (31.8)           |

### **NEMA MOTOR**

- Corrosion resistant stainless steel construction.
- Built-in surge arrestor is provided on single phase motors through 5 HP.
- Stainless steel splined shaft.
- Hermetically sealed windings.
- Replaceable motor lead assembly.
- NEMA mounting dimensions.
- Control box is required with 3 wire single phase units.
- Three phase units require a magnetic starter with three leg Class 10 overload protection.

# **CENTRIPRO 4" THREE-PHASE MOTORS**

| Orde   | r No. by Vo | ltage  |     | Length     | Weight    |
|--------|-------------|--------|-----|------------|-----------|
| 200V   | 230V        | 460V   | HP  | in. (mm)   | lb. (kg.) |
| M05430 | M05432      | M05434 | 1/2 | 10.8 (275) | 22 (9.7)  |
| M07430 | M07432      | M07434 | 3/4 | 10.8 (275) | 22 (9.7)  |
| M10430 | M10432      | M10434 | 1   | 11.7 (297) | 23 (10.4) |
| M15430 | M15432      | M15434 | 1.5 | 11.7 (297) | 23 (10.4) |
| M20430 | M20432      | M20434 | 2   | 13.8 (351) | 28 (12.7) |
| M30430 | M30432      | M30434 | 3   | 15.3 (389) | 32 (14.5) |
| M50430 | M50432      | M50434 | 5   | 21.7 (550) | 55 (24.9) |
| M75430 | M75432      | M75434 | 7.5 | 27.7 (703) | 70 (1.8)  |

| Order No. | HP  | Volts | Length in. (mm) | Weight lb. (kg.) |
|-----------|-----|-------|-----------------|------------------|
| M15437    | 1.5 |       | 11.7 (297)      | 23 (10.4)        |
| M20437    | 2   |       | 15.3 (389)      | 32 (14.5)        |
| M30437    | 3   | 575   | 15.3 (389)      | 32 (14.5)        |
| M50437    | 5   | 100   | 27.7 (703)      | 70 (31.8)        |
| M75437    | 7.5 |       | 27.7 (703)      | 70 (31.8)        |

## **AGENCY LISTINGS**



Pump/Water End and CentriPro Motor - tested to UL778 and CAN 22.2 by CSA International (Canadian Standards Association)



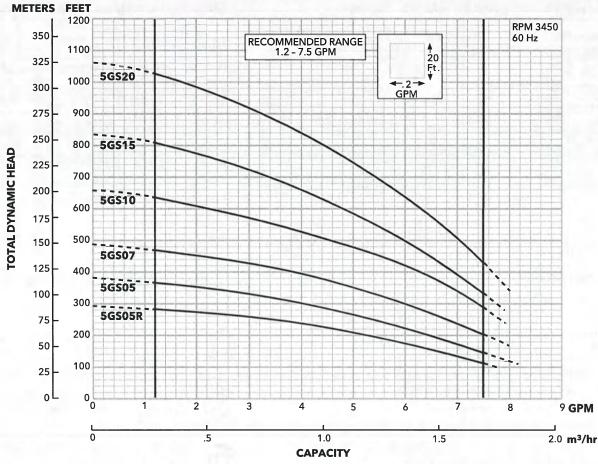
CentriPro Motor - Certified to NSF/ANSI 61, Annex G, Drinking Water System Components 4P49



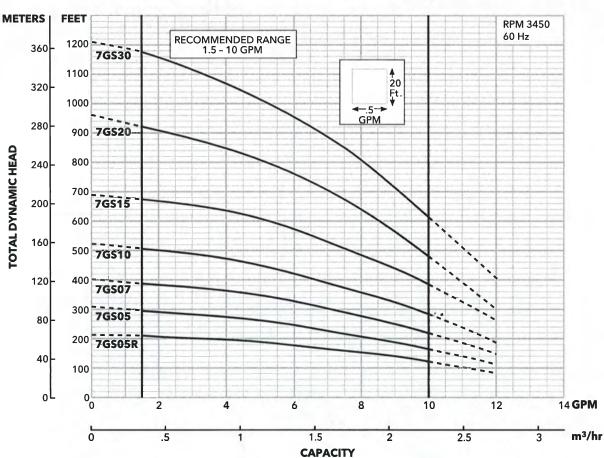
NSF/ANSI 372 - Drinking Water System Components - Lead Content

**CLASS 6853 01** - Low Lead Content Certification Program - - Plumbing Products

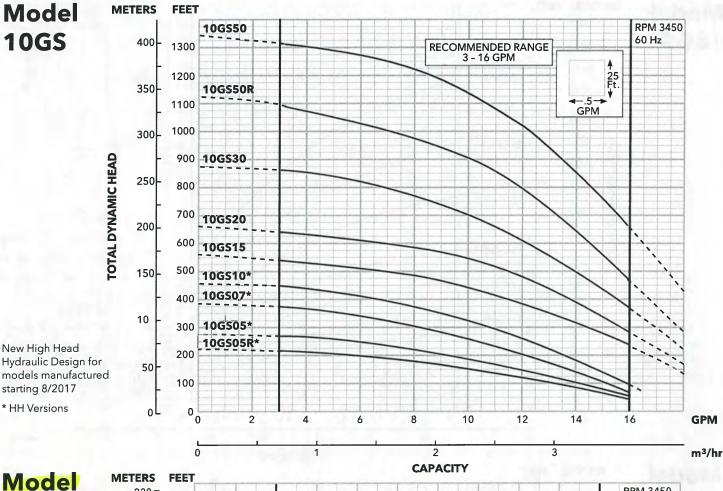
# Model 5GS



# Model 7GS





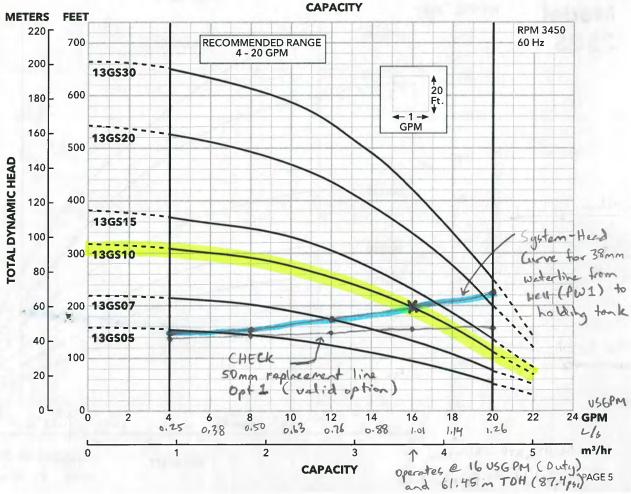


# Model **13GS**

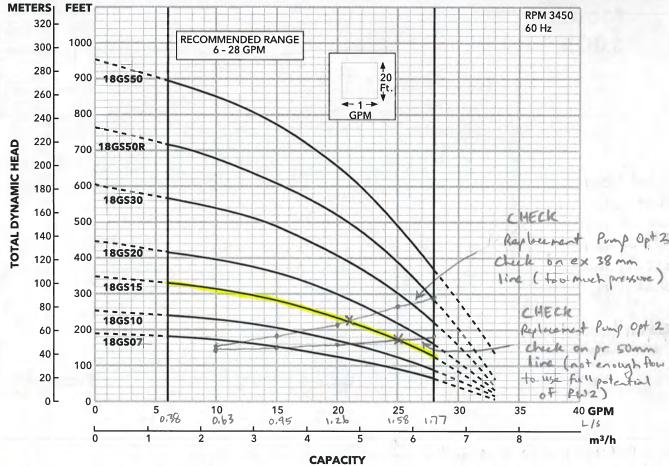
New High Head

starting 8/2017

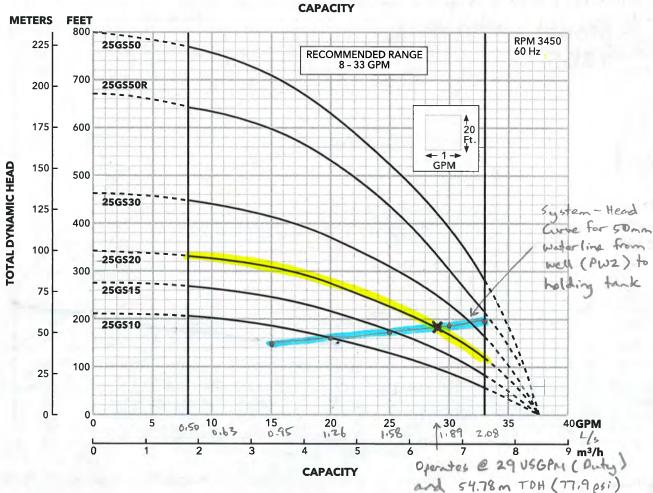
\* HH Versions



# Model 18GS



# Model 25GS



# **MODEL 5GS**

# **SELECTION CHART**

Horsepower Range ½ - 2, Recommended Range 1.2 - 7.5 GPM, 60 Hz, 3450 RPM

| Pump      | 1115  | D.C. |      |     |     |     | 0.03 | 11/24        | 112 |               |     | epti | to \ | Nate       | r in I | eet/ | Ratir | ıgs iı        | n GP | M (G | allo | ns pe | er Mi | nute          | )             |               |     |               |     |               |     |     |               |               |     |
|-----------|-------|------|------|-----|-----|-----|------|--------------|-----|---------------|-----|------|------|------------|--------|------|-------|---------------|------|------|------|-------|-------|---------------|---------------|---------------|-----|---------------|-----|---------------|-----|-----|---------------|---------------|-----|
| Model     | HP    | PSI  | 20   | 40  | 60  | 80  | 100  | 120          | 140 | 160           | 180 |      |      |            |        |      |       |               |      |      |      |       |       |               |               | 660           | 700 | 740           | 780 | 820           | 860 | 900 | 940           | 980           | 102 |
|           |       | 0    |      |     |     |     |      | 7.4          | 6.9 | 6.3           | 5.8 |      | 4.7  |            | 3.0    |      |       |               |      |      |      |       |       |               |               |               |     |               | -   |               |     |     |               |               |     |
|           |       | 20   |      |     |     | 7.3 | 6.7  | 6.2          | 5.6 | 5.1           | 4.5 | 3.8  |      |            |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | _   |
|           | ,     | 30   |      |     | 7.2 | 6.6 | 6.1  | 5.6          | 5.0 | 4.4           | 3.6 | 2.3  |      |            |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | _   |
| 5GS05R    | 1/2   | 40   |      | 7.1 | 6.6 | 6.0 | 5.5  | 4.9          | 4.3 | 3.4           | 2.1 |      |      |            |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | -   |
|           |       | 50   | 7.0  | 6.5 | 5.9 | 5.4 | 4.9  | 4.2          | 3.3 | 1.8           |     |      |      |            |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | _   |
|           |       | 60   | 6.4  | -   | 5.3 | 4.8 | 4.1  | 3.1          | 1.6 |               |     |      |      |            |        | -    |       |               |      |      | 1    |       |       |               |               |               |     |               |     |               |     |     |               | 107           | _   |
| Shut-of   | f PSI | 1    |      | 109 | _   | 92  | 83   | 75           | 66  | 57            | 49  | 40   | 31   | 23         | 14     | 5    |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | -   |
|           |       | 0    |      |     |     |     |      |              | 7.7 | 7.3           | 6.9 | 6.4  | 6.0  | 5.6        | 5.1    | 4.7  | 4.1   | 2.6           |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | -   |
|           |       | 20   |      |     |     |     | 7.5  | 7.1          | 6.7 | 6.3           | 5.9 | 5.4  | 5.0  | 4.5        |        | 3.2  | 2.3   |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | Ī   |
|           |       | 30   |      |     |     | 7.5 | 7.1  | 6.7          | 6.2 | 5.8           | 5.4 |      | 4.4  | 3.8        |        | 2.1  |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | -   |
| 5GS05     | 1/2   | 40   |      |     | 7.4 | 7.0 | 6.6  | 6.2          | 5.7 | 5.3           | 4.9 |      | 3.7  | 2.9        | 1.9    |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | -   |
|           |       | 50   | 7.7  | 7.4 | 6.9 | 6.5 | 6.1  | 5.7          | 5.2 | 4.8           | 4.2 |      | 2.8  | 1.8        |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | _   |
|           |       | 60   | 7.3  | 6.9 | 6.5 | 6.0 | 5.6  |              | 4.7 | 4.2           | 3.5 |      | 1.6  | 11.0       |        |      |       |               |      |      |      |       |       |               |               |               |     |               |     |               |     |     |               |               | T   |
| Shut-of   | f PSI | -    |      | 147 | 138 | 130 | -    | 112          | 104 | 95            | 86  | 78   | 69   | 60         | 52     | 43   | 34    | 17            |      |      |      |       |       |               |               |               |     |               |     |               |     | _   |               |               | -   |
|           |       | 0    | 1.00 |     |     |     |      | 1.72         |     | ,,,           |     |      | 7.3  | 7.0        |        | 6.3  | 5.9   |               | 44   | 3.3  | 1.6  |       |       |               |               |               |     |               |     |               |     |     | Н             |               | -   |
|           |       | 20   |      |     |     |     |      |              |     | 7.5           | 7.2 |      | 6.5  | 6.2        | 5.8    | 5.5  | 5.1   | 4.2           | 3.1  | 1.3  | 1.0  |       |       |               | <b>-</b>      | -             |     |               |     |               |     |     |               |               | -   |
|           |       | 30   |      |     |     |     |      | <del> </del> | 7.5 | 7.2           | 6.8 |      | 6.1  | 5.8        | 5.4    | 5.0  | 4.6   | 3.6           | 2.1  | 1.0  |      |       | -     |               |               |               |     |               |     |               |     |     | H             | -             | -   |
| 5GS07     | 3/4   | 40   |      |     |     |     |      | 7.4          | 7.1 | 6.8           | 6.4 |      | 5.7  | 5.4        | 5.0    | 4.6  | 4.1   | 2.8           | 2    |      |      | _     |       |               |               |               |     |               | -   |               |     |     |               |               | -   |
|           |       | 50   |      |     |     |     | 7.4  | 7.1          | 6.7 | 6.4           | 6.0 |      | 5.3  | 4.9        | 4.5    | 4.0  | 3.4   | 1.8           |      |      |      |       |       | -             | -             |               |     |               |     |               | -   |     |               | -             | _   |
|           |       | 60   |      |     | 7.6 | 7.3 | 7.0  | 6.7          | 6.3 | 6.0           | 5.6 |      | 4.9  | 4.4        | 3.9    | 3.3  | 2.6   | 1.0           |      | -    |      |       | -     |               |               |               |     |               | _   |               |     |     |               |               | -   |
| Shut-of   | f PSI | 100  |      |     | 184 | 175 |      | 158          | 149 | 141           | 132 | -    | 115  | 106        | _      | 89   | 80    | 63            | 45   | 28   | 11   |       | -     |               |               |               |     |               | _   |               |     |     |               |               | _   |
| Jiidt Oil |       | 0    |      |     | 101 | 175 | 107  | 130          | 147 | 171           | 102 | 123  | 115  | 100        | //     | 07   | 7.5   | 7.0           |      | 5.9  |      | 46    | 3.8   | 2.8           | 1.6           |               |     |               |     |               |     |     |               | -             | _   |
|           |       | 20   |      |     |     |     |      |              |     |               |     |      |      | 7.6        | 7.4    | 72   | 7.0   | 6.4           | 5.9  | 5.2  | 4.5  | 3.7   | _     | 2.0           | 1.0           | -             |     |               |     |               |     |     |               |               | -   |
|           |       | 30   |      |     |     |     |      |              |     |               |     |      | 7.6  | 7.4        |        | 6.9  | 6.7   | 6.1           |      | 4.8  | _    | 3.1   | -     |               |               |               | -   |               |     |               |     |     | -             |               | -   |
| 5GS10     | 1     | 40   |      |     |     |     |      |              |     |               |     | 7.6  | 7.4  | 7.1        |        | 6.6  | 6.3   |               | 5.1  | 4.4  | _    | _     | 1.7   |               |               |               |     |               | _   |               |     |     |               |               | -   |
|           |       | 50   |      |     |     |     |      |              |     |               | 7.5 | _    | 7.1  | 6.8        |        | 6.3  | 6.0   | 5.4           | 4.7  | 3.9  | 2.9  | 1.7   | -     |               | -             |               |     |               |     |               |     |     |               | -             | -   |
|           | -     | 60   |      |     |     |     |      |              |     | 7.5           | 7.3 |      | 6.8  | 6.5        |        | 6.0  | 5.7   | 5.0           | 4.3  | 3.4  | 2.3  | 1.7   |       |               |               |               |     |               |     |               |     |     |               | $\rightarrow$ | _   |
| Shut-off  | FPCI  | 00   |      |     |     |     |      |              |     | $\overline{}$ | -   |      |      |            |        |      | 154   |               | 119  |      | 84   | 67    | 50    | 32            | 15            |               |     |               |     |               |     | -   |               | -             | _   |
| Jiiuton   | 1131  | 0    |      |     |     |     |      |              |     | 214           | 200 | 177  | 100  | 100        | 171    | 102  | 134   | 7.5           | 7.2  | 6.8  | 6.3  | 5.9   |       |               | 4.6           | 4.1           | 3.5 | 2.8           | 1.8 |               |     |     |               |               | _   |
|           |       | 20   |      |     |     |     |      |              |     |               |     |      |      |            |        | 7.6  | 7.5   | 7.1           | 6.7  | 6.3  | 5.8  | 5.4   | -     |               | 4.0           | 3.4           | 2.6 | 1.6           | 1.0 |               |     |     |               |               | _   |
| 5GS15     | 11/2  | 30   |      |     |     |     |      |              |     |               |     |      |      |            | 7.6    | 7.5  | 7.3   | 6.9           |      | 6.0  | 5.6  | 5.2   | 4.7   | 4.2           | 3.7           |               | 2.1 | 1.0           | _   |               |     |     | -             | +             | _   |
| 30313     | 172   | 40   |      |     |     |     |      |              |     |               |     |      |      | 7.6        |        | 7.3  | 7.1   | 6.6           | _    | 5.8  | 5.3  | 4.9   | 4.7   | -             | 3.3           |               | 1.4 |               |     |               |     |     |               | -             | -   |
|           |       | 50   |      |     |     |     |      |              |     |               |     |      | 7.6  | 7.4        |        | 7.0  | 6.8   |               |      | 5.5  | 5.1  | 4.7   | 4.3   |               | 2.9           | 1.9           | 1.4 |               |     |               |     |     |               | $\dashv$      |     |
|           |       | 60   |      |     |     |     |      |              |     |               |     | 7.6  |      |            |        | 6.8  | 6.6   |               |      | 5.3  |      | _     |       | $\vdash$      |               | 1.9           |     |               |     |               |     | ,   | -             | -             | _   |
| Chart off | I DCI | 00   |      |     |     |     |      |              |     |               |     |      | 7.4  | 7.2<br>257 |        |      |       | 6.1           |      |      | 4.8  | 4.4   | 3.8   |               | 2.4           | 7.5           |     | 40            | 22  |               | _ ′ |     |               | -             | _   |
| Shut-off  | FSI   | 0    |      |     |     |     |      |              |     |               |     | 274  | 265  | 23/        | 248    | 237  | 231   | 213           | 170  | 1/9  |      | 144   | -     |               | 92            | 75            | 58  |               | 23  | 4.2           | 2.0 | 2.2 | 2.7           | -             |     |
|           |       | _    |      |     |     |     |      |              |     |               |     |      |      |            |        |      |       |               |      | 7 /  | 7.4  | 7.1   |       | _             | $\overline{}$ |               | 5.4 |               |     |               | _   | 3.3 | $\rightarrow$ | +             | _   |
|           |       | 20   |      |     |     |     |      |              | -   |               |     |      | -    |            |        |      |       |               | 7.5  | 7.4  | 7.1  | 6.7   | 6.4   |               | 5.7           | $\overline{}$ | 5.0 |               | 4.2 |               |     |     | 1.9           |               | _   |
| 5GS20     | 2     | 30   |      |     |     |     | 1    |              |     |               |     |      |      |            |        |      |       |               | 7.5  | 7.2  | 6.9  | 6.5   |       | $\overline{}$ |               | 5.1           | 4.8 | $\overline{}$ | 4.0 | $\overline{}$ |     | 2.2 | _             |               |     |
|           |       | 40   |      |     |     |     |      |              |     |               |     | _    |      | -          |        |      |       | 7.5           | 7.3  | 7.0  | 6.7  | 6.3   | 6.0   | $\overline{}$ | 5.3           | 4.9           | 4.6 |               | 3.7 | 3.2           | 2.5 | 1.7 |               |               | _   |
|           |       | 50   |      |     |     |     |      |              |     |               |     |      |      |            |        |      | 7.    | $\rightarrow$ |      |      | 6.5  |       |       |               | $\overline{}$ | 4.7           | 4.3 | 3.9           |     | 2.8           | 2.1 |     |               | -             |     |
| ** ***    |       | 60   |      |     |     |     |      |              |     |               |     |      |      |            |        |      | 7.6   |               |      |      |      | 5.9   |       |               |               | 4.5           | 4.1 | $\overline{}$ | 3.1 | 2.4           | 1.6 |     |               |               |     |
| Shut-off  | PSI   |      |      |     |     |     |      |              |     |               |     |      |      |            |        |      | 328   | 311           | 293  | 276  | 259  | 242   | 224   | 207           | 190           | 172           | 155 | 138           | 120 | 103           | 86  | 68  | 51            |               |     |

# Residential Water Systems

# **MODEL 7GS**

# **SELECTION CHART**

Horsepower Range ½ - 1, Recommended Range 1.5 - 10 GPM, 60 Hz, 3450 RPM

| Pump     | НР  | PSI  |        |      |      |      |      |      |      | De   | pth t | o Wat | er in | Feet/ | Ratin | gs in ( | GPM ( | Gallo | ns pe | r Min | ute) |     |     |     |      |       |     |       |        |     |
|----------|-----|------|--------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|---------|-------|-------|-------|-------|------|-----|-----|-----|------|-------|-----|-------|--------|-----|
| Model    | nr  | F3I  | 20     | 40   | 60   | 80   | 100  | 120  | 140  | 160  | 180   | 200   | 220   | 240   | 260   | 280     | 300   | 320   | 340   | 360   | 380  | 400 | 420 | 440 | 460  | 480   | 500 | 540   | 580    | 620 |
|          |     | 0    | 7454   |      |      |      |      | 10.2 | 8.9  | 7.5  | 5.9   | 3.6   |       |       |       |         |       |       |       |       |      | 187 | MI  | 100 |      | ( ) y |     |       |        |     |
|          |     | 20   | 17-1-1 |      |      | 9.8  | 8.5  | 7.0  | 5.3  | 2.5  |       |       |       |       |       |         |       |       |       |       |      |     |     |     |      |       |     | OF T  |        |     |
|          |     | 30   |        |      | 9.6  | 8.3  | 6.8  | 4.9  | 1.9  |      | FF    |       |       |       |       | 2       | 2     | 14.7  | 1.13  |       |      |     |     |     |      |       |     |       |        |     |
| 7GS05R   | 1/2 | 40   |        | 9.4  | 8.1  | 6.5  | 4.6  | 1.2  |      |      |       |       |       |       |       |         |       |       |       |       |      |     |     | 7.1 |      |       |     |       | 12.    |     |
|          |     | 50   | 9.2    | 7.8  | 6.3  | 4.2  | 0.5  |      |      |      |       |       |       |       |       |         |       |       |       |       | 10-1 |     |     | 131 |      |       |     |       |        |     |
|          |     | 60   | 7.6    | 6.0  | 3.8  |      | -    | -    |      |      |       |       |       |       |       | - 1     | 7     |       | -     |       |      |     |     |     |      | 77.1  |     | H.    | 11:    |     |
| Shut-off | PSI | -    | 85     | 77   | 68   | 59   | 51   | 42   | 33   | 25   | 16    | 7     |       |       |       |         |       |       |       |       |      |     |     | 277 |      | 77    |     |       |        |     |
|          |     | 0    | - 00   |      |      | 0,   |      | 12   | -    | 10.1 | 9.2   | 8.3   | 7.4   | 6.3   | 5.0   | 3.4     |       |       |       |       | 171  |     |     | 77. |      |       |     | -     |        |     |
|          |     | 20   |        |      |      |      |      | 9.8  | 9.0  | 8.1  | 7.1   | 6.0   | 4.6   | 2.7   | 0.0   | 0       |       |       |       | +     |      |     | -   | - 1 |      |       |     |       |        |     |
|          |     | 30   | -      |      |      |      | 9.7  | 8.8  | 7.9  | 6.9  | 5.8   | 4.3   | 2.4   |       |       | 29      | 6, 3  |       |       |       |      |     | -   | 7-1 |      |       |     |       |        |     |
| 7GS05    | 1/2 | 40   |        |      | 10.4 | 9.6  | 8.7  | 7.8  | 6.7  | 5.6  | 4.1   | 2.0   | 2.1   |       |       |         |       |       |       |       | _    |     |     |     | 19.6 |       |     |       |        |     |
|          |     | 50   |        | 10.3 | 9.4  | 8.5  | 7.6  | 6.6  | 5.4  | 3.8  | 1.7   | 2.0   |       |       |       |         |       |       |       |       |      |     |     |     |      |       |     |       |        | -   |
|          |     | 60   | 10.2   | 9.3  | 8.4  | 7.5  | 6.4  | 5.1  | 3.5  | 3.0  | 1.7   |       |       |       |       |         |       |       |       |       |      |     |     |     |      |       |     |       |        |     |
| Shut-off | PSI |      | 125    |      | 107  | 99   | 90   | 81   | 73   | 64   | 55    | 47    | 38    | 29    | 21    | 12      |       |       | 127   |       |      |     |     |     |      |       |     |       |        |     |
|          | T   | 0    | 120    | 110  | 107  |      | -    | -    | ,,,  |      |       | 1     | 10.0  | 9.3   | 8.6   | 7.9     | 7.1   | 6.2   | 5.2   | 4.0   | 2.4  |     |     |     |      |       |     |       | 1      |     |
|          |     | 20   |        |      | - 7  | -26  |      |      |      | 10.4 | 9.8   | 9.1   | 8.4   | 7.7   | 6.9   | 6.0     | 4.9   | 3.5   | 1.8   |       |      | -   |     |     |      |       |     |       | dy., a |     |
|          | -   | 30   |        |      |      |      |      |      | 10.3 | 9.7  | 9.0   | 8.3   | 7.5   | 6.7   | 5.8   | 4.7     | 3.3   | 1.5   |       | 1     |      |     |     |     |      | -     |     |       |        |     |
| 7GS07    | 3/4 | 40   |        |      | 17   |      |      | 10.2 | 9.5  | 8.9  | 8.2   | 7.4   | 6.6   | 5.6   | 4.5   | 3.1     | 0.0   |       |       |       |      |     |     |     |      |       |     |       |        |     |
|          |     | 50   |        |      |      | 4    | 10.1 | 9.4  | 8.8  | 8.1  | 7.3   | 6.5   | 5.5   | 4.3   | 2.8   | 0.1     |       |       |       |       |      |     |     |     |      |       | 10  |       |        |     |
|          |     | 60   | 1.1    |      | -    | 10.0 | _    | 8.7  | 7.9  | 7.2  | 6.3   | 5.3   | 4.1   | 2.5   | 2.0   |         |       |       |       |       |      |     |     |     |      |       |     |       |        |     |
| Shut-off | PSI |      |        |      | 2 3  | 140  | 131  | 122  | 114  | 105  | 96    | 88    | 79    | 70    | 62    | 53      | 44    | 36    | 27    | 18    | 10   |     |     |     |      |       |     | 11    |        |     |
|          |     | 0    | 1      |      |      | 7.0  |      | 100  | -    |      |       | -     |       | 7     |       | 10.1    | 9.6   | 9.0   | 8.5   | 7.9   | 7.3  | 6.7 | 6.0 | 5.3 | 4.4  | 3.4   | 2.1 | 100   | -31    | 150 |
|          |     | 20   |        |      | -    |      |      | 1    |      |      |       |       | 10.4  | 9.9   | 9.4   | 8.9     | 8.3   | 7.7   | 7.1   | 6.5   | 5.8  | 5.0 | 4.1 | 3.0 | 1.6  |       |     |       |        |     |
| -14      |     | 30   |        |      |      |      |      |      |      |      |       | 10.3  | 9.9   | 9.3   | 8.8   | 8.2     | 7.6   | 7.0   | 6.4   | 5.7   | 4.9  | 4.0 | 2.8 | 0.0 |      |       |     |       |        |     |
| 7GS10    | 1   | 40   |        |      |      |      |      |      |      |      | 10.3  | -     | 9.2   | 8.7   | 8.1   | 7.5     | 6.9   | 6.3   | 5.6   | 4.8   | 3.8  | 2.6 |     |     |      |       |     | NI I  | - 1-   |     |
|          |     | 50   |        | -    |      |      |      |      |      | 10.2 | 9.7   | 9.2   | 8.6   | 8.0   | 7.4   | 6.8     | 6.2   | 5.4   | 4.6   | 3.7   | 2.4  |     |     |     |      |       |     |       |        |     |
|          |     | 60   | -      |      |      | -    |      |      | 10.1 | 9.6  | 9.1   | 8.5   | 7.9   | 7.3   | 6.7   | 6.0     | 5.3   | 4.5   | 3.5   | 2.2   |      |     |     |     | -    |       | 114 | - 713 | 1-     |     |
| Shut-off | PSI | - 55 | 1      |      |      |      |      |      | 166  | 158  | 149   | 140   | 132   | 123   | 114   | 106     | 97    | 88    | 80    | 71    | 62   | 54  | 45  | 36  | 28   | 19    | 10  |       |        |     |

Horsepower Range 1½ - 3, Recommended Range 1.5 - 10 GPM, 60 Hz, 3450 RPM

| Pump     |      | D.C. |             |  | 161  | 116  |       |      |  |     |      |      |      | eet/R |     |      |     |     |     |     |     |      |     |     |      |      |      |        |
|----------|------|------|-------------|--|------|------|-------|------|--|-----|------|------|------|-------|-----|------|-----|-----|-----|-----|-----|------|-----|-----|------|------|------|--------|
| Model    | HP   | PSI  | 200 220     | 240  | 260  | 280  | 300   | 340  | 380  | 420 | 460  | 500  | 540  | 580   | 620 | 660  | 700 | 740 | 780 | 820 | 860 | 900  | 940 | 980 | 1020 | 1060 | 1100 | 1140   |
|          |      | 0    | 111         |  |      | 41.4 |       |      | 10.2   | 9.3 | 8.5  | 7.6  | 6.8  | 5.9   | 4.7 | 2.6  |     |     |     |     |     |      |     |     |      |      |      |        |
|          |      | 20   |             |  |      | Time |       | 10.1 | 9.2  | 8.3 | 7.5  | 6.7  | 5.8  | 4.5   | 2.1 | 17.5 |     |     |     |     |     |      |     |     |      |      |      |        |
| 70045    | 11/  | 30   |             |  |      |      | 10.4  | 9.6  | 8.7  | 7.8 | 7.0  | 6.2  | 5.1  | 3.3   |     |      |     |     |     |     |     |      |     |     |      | 17.3 |      |        |
| 7GS15    | 11/2 | 40   | 271         |  |      | 10.3 | 9.9   | 9.1  | 8.2  | 7.4 | 6.6  | 5.6  | 4.2  | 1.6   |     |      |     |     |     |     |     |      |     | 17  |      |      |      |        |
|          |      | 50   |             |  | 10.3 | 9.9  | 9.4   | 8.6  | 7.7  | 6.9 | 6.0  | 4.9  | 2.9  | 17.7  |     |      |     |     |     |     |     | 1114 |     |     |      | 7-1  |      |        |
|          |      | 60   | 100         | 10.2   | 9.8  | 9.4  | 8.9   | 8.1  | 7.2  | 6.4 | 5.4  | 3.9  |      | 1     | 10  |      |     |     | -3- |     |     |      |     |     |      |      |      |        |
| Shut-off | PSI  |      | 3.1 7.1     | 194  | _    |      | 168   | 151  | 134  | 116 | 99   | 82   | 64   | 47    | 30  | 12   |     |     |     |     |     |      |     |     | - 1  | 6    |      |        |
|          |      | 0    |             |  |      |      |       |      |  |     | 7    | 9.8  | 9.3  | 8.7   | 8.4 | 7.8  | 7.1 | 6.3 | 5.4 | 4.5 | 3.5 | 2.2  |     |     |      | 1-0  |      | 11,141 |
|          |      | 20   |             |  |      |      |       |      |  | 133 | 9.8  | 9.3  | 8.7  | 8.4   | 7.7 | 6.9  | 6.2 | 5.3 | 4.3 | 3.2 | 2.8 |      |     |     |      |      |      |        |
|          | 17.  | 30   |             |  |      |      | 9 2 3 | 1734 |  | 9.9 | 9.5  | 9.0  | 8.5  | 7.9   | 7.2 | 6.4  | 5.7 | 4.4 | 3.7 |     |     |      | -   |     |      |      |      |        |
| 7GS20    | 2    | 40   |             |  | 10   |      |       | _ =  | 10.0   |     | 9.2  | 8.7  | 8.3  | 7.5   | 6.7 | 6.0  | 5.2 | 4.1 | 3.0 |     |     |      |     | 71  |      |      |      |        |
|          |      | 50   |             |  |      |      |       |      | 9.9  | 9.4 | 8.9  | 8.5  | 7.8  | 7.2   | 6.3 | 5.5  | 4.7 | 3.5 | -   |     |     |      | - 1 |     |      |      |      |        |
|          |      | 60   |             |  |      |      |       | 10.0 | 9.6  | 9.1 | 8.7  | 8.2  | 7.4  | 6.6   | 5.8 | 5.0  | 4.0 | 0.0 |     |     |     |      |     |     |      |      |      |        |
| Shut-off | PSI  | -    |             | <del>                                     </del> |      |      |       | _    | -  | 234 | 216  | _    | _    |       |     | 130  | _   | 95  | 80  | 61  | 43  | 26   |     | -   |      |      |      |        |
|          |      | 0    |             | +  |      |      |       | 200  |  | 20. |      |      |      |       | 9.8 | 9.5  | _   | 8.7 | 8.3 | 7.9 | 7.4 | 6.8  | 6.2 | 5.4 | 4.7  | 3.9  | 3.0  | 2.0    |
|          |      | 20   |             |  |      |      |       |      |  |     |      |      |      | 9.8   | 9.4 | 9.2  | 8.7 | 8.3 | 7.8 | 7.2 | 6.7 | 6.2  | 5.3 | 4.5 | 3.7  | 3.3  | 1.7  |        |
|          |      | 30   |             | -  |      |      |       |      |  |     |      |      | 10.0 |       | 9.2 | 8.8  | 8.5 | 8.0 | 7.5 | 6.9 | 6.3 | 5.7  | 4.8 | 4.1 | 3.2  | 2.3  | ,,,, |        |
| 7GS30    | 3    | 40   |             | +  |      |      |       |      | <del>                                     </del> |     |      | 10.0 | 9.7  | 9.4   | 9.0 | 8.6  | 8.2 | 7.7 | 7.2 | 6.6 | 5.9 | 5.2  | 4.4 | 3.6 | 2.7  | 1.7  | -    |        |
|          |      | 50   |             | +  |      |      |       |      |  |     |      | 9.9  | 9.5  | 9.2   | 8.7 | 8.4  | 7.9 | 7.4 | 6.8 | 6.3 | 5.5 | 4.8  | 3.9 | 3.1 | 2.2  | 7.7  |      |        |
|          |      | 60   |             | +-   |      |      |       |      | -  |     | 10.0 |      | 9.3  |       | 8.6 | 8.1  | 7.6 | 7.0 | 6.5 | 5.8 | 5.1 | 4.2  | 3.4 | 2.5 | 1.5  |      |      |        |
| Shut-off | DCI  | 00   | <del></del> | +  |      |      |       |      |  |     |      |      | -    | 268   | -   |      | 216 |     | -   | 165 | 147 | 130  | 113 |     | 78   | 61   | 43   | 27     |

# Goulds Water Technology

# Residential Water Systems

# **MODEL 10GS**

SELECTION CHART Horsepower Range ½ - 3, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

| Pump        | НР   | PSI |      |      |      |      |      |      | - 111 | Dep  | th to W | ater in | Feet/Ra | tings in | GPM (  | Gallons | per Mi | nute) |      |      |     |     |      |     | 1171  |
|-------------|------|-----|------|------|------|------|------|------|-------|------|---------|---------|---------|----------|--------|---------|--------|-------|------|------|-----|-----|------|-----|-------|
| Model       | пР   | F31 | 20   | 40   | 60   | 80   | 100  | 120  | 140   | 160  | 180     | 200     | 220     | 240      | 260    | 280     | 300    | 320   | 340  | 360  | 380 | 400 | 420  | 440 | 460   |
|             |      | 0   |      |      | 15.3 | 14.2 | 13.1 | 12.0 | 10.9  | 9.8  | 8.4     | 6.1     | 2.1     |          |        |         |        |       |      |      |     |     |      |     |       |
|             | -11  | 20  | 15.0 | 13.9 | 12.8 | 11.6 | 10.6 | 9.4  | 7.8   | 5.1  | 0.3     |         |         |          |        |         |        |       |      |      |     |     |      |     | 41, 4 |
| 10GS05R*    | 1/4  | 30  | 13.7 | 12.6 | 11.5 | 10.4 | 9.2  | 7.5  | 4.6   |      |         |         |         |          |        |         |        |       |      |      |     |     | 0.1  |     |       |
| Indonsk     | 1/2  | 40  | 12.4 | 11.3 | 10.2 | 9.0  | 7.2  | 3.9  | 1/2   | 190  |         | 100     |         |          | THE RE | 10      |        |       | 0.00 |      |     | ì   |      |     |       |
|             |      | 50  | 11.1 | 10.1 | 8.8  | 6.8  | 3.2  |      |       |      |         |         |         |          |        |         |        | 7111  |      |      |     |     |      |     |       |
|             |      | 60  | 9.9  | 8.5  | 6.4  | 2.5  |      |      |       |      |         |         |         |          | 1      |         |        |       |      |      |     |     |      |     |       |
| Shut-off PS | 1    |     | 89   | 80   | 72   | 63   | 54   | 46   | 37    | 28   | 20      | 11      | 2       |          |        |         |        |       |      |      |     |     |      |     |       |
|             | 21/0 | 0   |      |      | 15.7 | 14.9 | 14.1 | 13.3 | 12.4  | 11.4 | 10.4    | 9.3     | 8.0     | 6.3      | 3.9    |         |        |       |      |      |     |     |      |     |       |
|             |      | 20  | 15.4 | 14.7 | 13.9 | 13.0 | 12.1 | 11.1 | 10.1  | 8.9  | 7.5     | 5.7     | 2.9     |          | 111    |         |        |       |      | 7.00 |     |     |      |     |       |
| 4000000     | 1,   | 30  | 14.6 | 13.8 | 12.9 | 12.0 | 11.0 | 9.9  | 8.7   | 7.3  | 5.3     | 2.3     |         |          |        |         |        |       |      |      |     |     |      |     |       |
| 10GS05*     | 1/2  | 40  | 13.6 | 12.8 | 11.8 | 10.8 | 9.7  | 8.5  | 7.0   | 4.9  | 1.7     |         |         |          |        |         |        |       |      |      |     |     |      |     |       |
|             |      | 50  | 12.6 | 11.7 | 10.6 | 9.5  | 8.3  | 6.8  | 4.5   | 1.0  |         |         |         |          |        |         |        |       | -    |      |     |     |      |     |       |
|             |      | 60  | 11.5 | 10.5 | 9.3  | 8.1  | 6.5  | 4.1  | 0.2   |      |         |         | - 4-    |          |        |         |        | Labor |      |      |     |     |      |     |       |
| Shut-off PS |      |     | 113  | 105  | 96   | 87   | 79   | 70   | 61    | 53   | 44      | 35      | 27      | 18       | 9      | 1       |        | 110   |      |      |     |     |      |     |       |
| 70.77       |      | 0   |      | 7 1  |      | 15.7 | 15.2 | 14.6 | 14.0  | 13.4 | 12.7    | 12.0    | 11.4    | 10.8     | 10.1   | 9.5     | 8.7    | 7.7   | 6.4  | 4.6  | 2.1 |     | 137  |     |       |
|             |      | 20  | 16.0 | 15.5 | 15.0 | 14.5 | 13.8 | 13.2 | 12.5  | 11.8 | 11.2    | 10.6    | 9.9     | 9.2      | 8.4    | 7.3     | 5.9    | 3.9   | 1.2  |      |     |     |      |     |       |
| 4000074     | 7/   | 30  | 15.5 | 15.0 | 14.4 | 13.7 | 13.1 | 12.4 | 11.7  | 11.1 | 10.5    | 9.8     | 9.1     | 8.3      | 7.1    | 5.6     | 3.5    | 0.7   |      |      | - 0 |     |      |     |       |
| 10GS07*     | 3/4  | 40  | 14.9 | 14.3 | 13.6 | 12.9 | 12.3 | 11.6 | 11.0  | 10.4 | 9.7     | 9.0     | 8.1     | 6.9      | 5.3    | 3.1     | 0.2    |       |      |      |     |     |      |     |       |
|             |      | 50  | 14.2 | 13.5 | 12.8 | 12.2 | 11.5 | 10.9 | 10.3  | 9.6  | 8.9     | 8.0     | 6.7     | 5.0      | 2.7    |         |        |       |      |      | 1   |     |      |     |       |
|             |      | 60  | 13.4 | 12.7 | 12.1 | 11.4 | 10.8 | 10.2 | 9.5   | 8.7  | 7.8     | 6.5     | 4.7     | 2.3      | 1      |         |        |       |      |      |     |     |      |     |       |
| Shut-off PS | i    |     | 161  | 152  | 143  | 135  | 126  | 118  | 109   | 100  | 92      | 83      | 74      | 66       | 57     | 48      | 40     | 31    | 22   | 14   | 5   |     |      |     |       |
|             |      | 0   |      |      |      |      | 15.7 | 15.2 | 14.8  | 14.4 | 14.0    | 13.6    | 13.2    | 12.7     | 12.1   | 11.4    | 10.7   | 10.0  | 9.3  | 8.6  | 7.9 | 7.0 | 5.7  | 3.8 | 0.6   |
|             |      | 20  |      | 16.0 | 15.5 | 15.0 | 14.6 | 14.3 | 13.9  | 13.5 | 13.0    | 12.5    | 11.9    | 11.2     | 10.5   | 9.8     | 9.1    | 8.4   | 7.6  | 6.7  | 5.2 | 2.9 |      |     |       |
| 4000404     | ,    | 30  | 16.0 | 15.4 | 15.0 | 14.6 | 14.2 | 13.9 | 13.4  | 13.0 | 12.4    | 11.8    | 11.1    | 10.4     | 9.7    | 9.0     | 8.3    | 7.5   | 6.5  | 4.9  | 2.5 | 111 |      |     |       |
| 10GS10*     |      | 40  | 15.3 | 14.9 | 14.5 | 14.2 | 13.8 | 13.4 | 12.9  | 12.3 | 11.6    | 11.0    | 10.3    | 9.6      | 8.9    | 8.2     | 7.4    | 6.3   | 4.6  | 2.0  |     |     | 6    |     |       |
|             |      | 50  | 14.8 | 14.5 | 14.1 | 13.7 | 13.3 | 12.8 | 12.2  | 11.5 | 10.9    | 10.1    | 9.5     | 8.8      | 8.1    | 7.2     | 6.1    | 4.3   | 1.5  |      |     |     | 21 1 |     |       |
|             |      | 60  | 14.4 | 14.1 | 13.7 | 13.2 | 12.7 | 12.1 | 11.4  | 10.7 | 10.0    | 9.4     | 8.7     | 7.9      | 7.1    | 5.8     | 3.9    | 0.9   |      | 733  |     |     |      |     |       |
| Shut-off PS |      |     | 192  | 184  | 175  | 166  | 158  | 149  | 140   | 132  | 123     | 114     | 106     | 97       | 88     | 80      | 71     | 62    | 54   | 45   | 36  | 28  | 19   | 10  | 2     |

| Pump       | HP   | DCI |    |      |    |    |      |      |      |       | Dept | h to W | ater i | n Feet/ | Rating | s in G | PM (G | allons | per M | inute) |      |      |      |      |      |      |      |      |     |     |
|------------|------|-----|----|------|----|----|------|------|------|-------|------|--------|--------|---------|--------|--------|-------|--------|-------|--------|------|------|------|------|------|------|------|------|-----|-----|
| Model      | HP   | PSI | 20 | 40   | 60 | 80 | 100  | 120  | 140  | 160   | 180  | 200    | 220    | 240     | 260    | 280    | 300   | 340    | 380   | 420    | 460  | 500  | 540  | 580  | 620  | 660  | 700  | 740  | 780 | 820 |
|            |      | 0   |    |      |    |    |      |      | -    | 144   |      | - 1    |        | 15.7    | 15.3   | 14.8   | 14.4  | 13.3   | 12.2  | 10.9   | 9.3  | 7.1  | 3.0  |      |      |      |      |      |     | ,   |
|            |      | 20  |    |      |    |    |      |      |      |       | 16.0 | 15.6   | 15.2   | 14.7    | 14.3   | 13.7   | 13.2  | 11.9   | 10.6  | 9.0    | 6.5  |      |      |      |      |      |      |      |     |     |
| 400000     | 111  | 30  |    |      |    |    |      |      |      | 15.9  | 15.5 | 15.2   | 14.6   | 14.2    | 13.5   | 13.1   | 12.6  | 11.3   | 9.7   | 7.6    | 4.0  |      |      |      |      |      |      |      |     |     |
| 10GS15     | 11/2 | 40  |    |      |    |    |      |      | 15.8 | 15.5  | 15.1 | 14.6   | 14.2   | 13.5    | 13.0   | 12.5   | 11.8  | 10.3   | 8.8   | 6.0    |      |      |      |      |      |      |      |      |     |     |
|            |      | 50  |    |      |    |    |      | 15.7 | 15.4 | 14.9  | 14.5 | 14.0   | 13.4   | 12.8    | 12.3   | 11.7   | 11.0  | 9.4    | 7.4   | 3.4    |      |      |      |      |      |      |      |      |     |     |
|            |      | 60  |    |      |    |    | 15.7 | 15.3 | 14.8 | 14.4  | 13.9 | 13.3   | 12.8   | 12.2    | 11.6   | 10.9   | 10.1  | 8.1    | 5.6   |        |      |      |      |      |      |      |      |      |     |     |
| Shut-off P | SI   |     |    |      |    |    | 197  | 188  | 180  | 171   | 162  | 154    | 144    | 136     | 128    | 119    | 110   | 93     | 76    | 58     | 41   | 24   | 6    |      |      |      |      | - 44 |     |     |
|            |      | 0   |    |      |    |    |      |      |      |       | -451 |        |        |         |        | 16.0   | 15.7  | 14.9   | 14.2  | 13.4   | 12.4 | 11.4 | 10.0 | 8.2  | 5.8  |      |      |      |     |     |
|            |      | 20  |    |      |    |    |      |      |      |       |      |        |        | 15.9    | 15.5   | 15.3   | 14.8  | 14.1   | 13.2  | 12.2   | 11.0 | 9.9  | 8.0  | 5.2  |      |      |      |      |     |     |
|            |      | 30  |    |      |    |    |      |      |      |       |      |        | 15.8   | 15.4    | 15.1   | 14.7   | 14.4  | 13.5   | 12.7  | 11.7   | 10.3 | 8.8  | 6.5  |      |      |      |      |      |     |     |
| 10GS20     | 2    | 40  |    |      |    |    |      |      |      |       |      | 15.8   | 15.4   | 15.1    | 14.7   | 14.4   | 14.0  | 12.9   | 12.2  | 10.9   | 9.5  | 7.8  | 3.9  |      |      |      |      |      |     |     |
|            |      | 50  |    |      |    |    |      |      |      | 16.1  | 15.7 | 15.3   | 15.0   | 14.6    | 14.2   | 14.0   | 13.4  | 12.5   | 11.5  | 10.1   | 8.5  | 6.0  |      |      |      |      |      |      | 9 1 |     |
|            |      | 60  |    |      |    |    |      |      | 16.0 | 15.7  | 15.3 | 14.9   | 14.5   | 14.2    | 13.8   | 13.4   | 12.8  | _      | 10.7  | 9.1    | 7.2  | 3.4  |      |      |      |      |      |      |     |     |
| Shut-off P | SI   |     |    | 1.11 |    |    |      |      | 225  | 216   | 208  | 199    | 190    | 182     | 173    | 164    | 156   | 139    | 121   | 104    | 87   | 69   | 52   | 35   | 17   |      |      |      |     |     |
|            |      | 0   |    |      |    |    |      |      |      | -     |      |        | 110    | 102     | .,,    | 101    | 700   | 107    | 15.8  | 15.2   | 14.6 | _    | 13.3 | 12.6 | 11.9 | 11.0 | 10.0 | 9.0  | 7.5 | 5.8 |
|            |      | 20  |    |      |    |    | -    |      |      |       |      |        |        |         | 7.0    |        |       | 15.7   | 15.1  | 14.5   | 13.9 | 13.2 | 12.5 | 11.8 | 10.9 | 9.9  | 8.8  | 7.2  | 5.4 | 3.0 |
|            |      | 30  |    |      |    |    |      |      |      |       |      |        |        |         |        |        | 15.9  | 15.4   | 14.8  | 14.2   | 13.4 | 12.8 | 12.0 | 11.3 | 10.3 | 9.3  | 8.1  | 6.2  | 3.8 |     |
| 10GS30     | 3    | 40  |    |      |    | -  |      |      |      | U 3 × |      |        | 700    |         |        | 15.9   | 15.6  | 15.0   | 14.4  | 13.8   | 13.1 | 12.4 | 11.5 | 10.8 | 9.7  | 8.6  | 7.1  | 4.7  | 5.0 |     |
|            |      | 50  |    |      |    |    |      |      |      |       |      |        |        | 16.0    | 15.8   | 15.6   | 15.3  | 14.7   | 14.1  | 13.3   | 12.7 | 11.9 | 11.0 | 10.0 | 9.1  | 7.8  | 6.0  | 3.0  |     |     |
|            |      | 60  |    |      |    |    |      |      |      |       |      | -      | 16.0   | 15.8    | 15.5   | 15.2   | 14.8  | 14.3   | 13.7  | 12.9   | 12.3 | 11.4 | 10.6 | 9.6  | 8.3  | 6.8  | 4.5  | 5.0  |     |     |
| Shut-off P | SI   | 7.0 |    |      |    |    |      |      |      |       |      |        | 284    | 275     | 267    | 258    | 249   | 232    | 215   | 197    | 180  | 163  | 145  | 128  | 111  | 94   | 76   | 59   | 42  | 24  |

Horsepower Range 5, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

| Pump       | НР | PSI |      |      |      |      | 2010 3 | Dept | h to Wate | er in Feet | /Ratings | in GPM ( | Gallons | er Minut | te)  |      |      |     |     | 11911 | - 41 |
|------------|----|-----|------|------|------|------|--------|------|-----------|------------|----------|----------|---------|----------|------|------|------|-----|-----|-------|------|
| Model      | nr | Lai | 340  | 380  | 420  | 460  | 500    | 540  | 580       | 620        | 660      | 700      | 740     | 780      | 820  | 860  | 900  | 940 | 980 | 1020  | 1060 |
|            |    | 0   |      |      |      |      | 15.6   | 15.1 | 14.6      | 14.2       | 13.7     | 13.3     | 12.8    | 12.3     | 11.7 | 11.0 | 10.2 | 9.2 | 7.9 | 6.3   | 4.3  |
|            |    | 20  |      |      | 16.0 | 15.5 | 15.0   | 14.6 | 14.1      | 13.6       | 13.2     | 12.7     | 12.2    | 11.6     | 10.9 | 10.1 | 9.0  | 7.6 | 6.0 | 3.9   |      |
|            | _  | 30  |      |      | 15.7 | 15.3 | 14.8   | 14.3 | 13.8      | 13.4       | 12.9     | 12.4     | 11.9    | 11.2     | 10.4 | 9.5  | 8.2  | 6.7 | 4.9 |       |      |
| lOGS50R    | 5  | 40  |      | 16.0 | 15.5 | 15.0 | 14.5   | 14.0 | 13.6      | 13.1       | 12.6     | 12.1     | 11.5    | 10.8     | 9.9  | 8.8  | 7.4  | 5.7 | 3.6 |       |      |
|            |    | 50  |      | 15.7 | 15.2 | 14.7 | 14.2   | 13.8 | 13.3      | 12.9       | 12.4     | 11.8     | 11.1    | 10.3     | 9.3  | 8.0  | 6.5  | 4.5 |     |       |      |
|            |    | 60  | 15.9 | 15.4 | 14.9 | 14.4 | 14.0   | 13.5 | 13.0      | 12.6       | 12.0     | 11.4     | 10.7    | 9.7      | 8.6  | 7.2  | 5.4  | 3.2 |     |       |      |
| Shut-off P | 51 |     | 341  | 324  | 306  | 289  | 272    | 255  | 237       | 220        | 203      | 185      | 168     | 151      | 133  | 116  | 99   | 81  | 64  | 47    | 29   |

| Pump       | HP | PSI |     |     |      |      |      |      | De   | pth to V | ater in | Feet/Ra | atings i | n GPM ( | Gallons | per Mi | nute) |      |      |      |      |      |      |      |      |
|------------|----|-----|-----|-----|------|------|------|------|------|----------|---------|---------|----------|---------|---------|--------|-------|------|------|------|------|------|------|------|------|
| Model      | nr | L3I | 440 | 480 | 520  | 560  | 600  | 640  | 680  | 720      | 760     | 800     | 840      | 880     | 920     | 960    | 1000  | 1040 | 1080 | 1120 | 1160 | 1200 | 1240 | 1280 | 1320 |
|            |    | 0   |     |     |      |      |      | 16   | 15.5 | 15.2     | 14.9    | 14.5    | 14       | 13.5    | 13      | 12.5   | 12    | 11.5 | 10.8 | 10.2 | 9.5  | 8.5  | 7    | 5.2  |      |
|            |    | 20  |     |     |      |      | 15.9 | 15.4 | 15.1 | 14.8     | 14.5    | 13.9    | 13.4     | 12.9    | 12.4    | 11.9   | 11.3  | 10.7 | 10.1 | 9.4  | 8.2  | 6.8  | 4.3  |      |      |
| 405550     | -  | 30  |     |     |      |      | 15.6 | 15.2 | 14.9 | 14.6     | 14.2    | 13.7    | 13.1     | 12.6    | 12.1    | 11.6   | 11.0  | 10.4 | 9.8  | 8.8  | 7.5  | 6.0  | 3.0  |      |      |
| 10GS50     | 5  | 40  |     |     |      | 15.8 | 15.3 | 15.1 | 14.7 | 14.4     | 13.8    | 13.3    | 12.8     | 12.3    | 11.8    | 11.2   | 10.6  | 10.0 | 9.2  | 7.9  | 6.6  | 4.1  |      |      | 1 A  |
|            |    | 50  |     |     |      | 15.5 | 15.2 | 14.9 | 14.6 | 14.1     | 13.6    | 13.0    | 12.5     | 12.1    | 11.5    | 10.9   | 10.3  | 9.7  | 8.6  | 7.3  | 5.6  |      |      |      |      |
|            |    | 60  |     |     | 15.7 | 15.3 | 15.0 | 14.7 | 14.3 | 13.7     | 13.2    | 12.7    | 12.2     | 11.7    | 11.1    | 10.5   | 9.9   | 9.0  | 7.7  | 6.5  | 3.2  |      |      |      |      |
| Shut-off P | SI |     |     |     | 346  | 329  | 312  | 294  | 277  | 260      | 242     | 225     | 208      | 191     | 173     | 156    | 139   | 121  | 104  | 87   | 69   | 52   | 35   | 17   |      |

<sup>\*</sup> HH Versions

# Goulds Water Technology

# Residential Water Systems

# **MODEL 13GS**

# **SELECTION CHART**

Horsepower Range ½ - 3, Recommended Range 4 - 20 GPM, 60 Hz, 3450 RPM

| Pump     | Lun      | DCI |      |      |          |          |      |      | *    | De   | pth t | o Wat | er in | Feet/I | Rating | as in | GPM (  | Gallo | ns pe | r Min | ute) |      |      |      |     |     |        |          |     |          |
|----------|----------|-----|------|------|----------|----------|------|------|------|------|-------|-------|-------|--------|--------|-------|--------|-------|-------|-------|------|------|------|------|-----|-----|--------|----------|-----|----------|
| Model    | HP       | PSI | 20   | 40   | 60       | 80       | 100  | 120  | 140  |      |       |       |       |        |        |       |        |       |       |       |      | 500  | 540  | 580  | 620 | 660 | 700    | 740      | 780 | 820      |
|          |          | 0   |      |      | 19.0     | 17.5     | 15.3 | 12.5 |      |      |       |       |       | Y      | -      |       | E will |       |       |       |      |      | 311  |      |     |     |        |          |     |          |
|          |          | 20  | 18.8 | 16.5 | 14.5     | 12.0     |      |      |      |      |       |       |       |        |        |       |        |       |       | - D   |      |      |      |      |     |     |        |          |     |          |
|          |          | 30  | 16.0 | 13.4 |          | 4.1      |      |      |      |      |       | 71.9  |       |        |        |       | - 11   |       |       |       |      |      |      |      |     |     |        |          |     |          |
| 13GS05   | 1/2      | 40  | 13.3 | 10.6 |          |          |      |      |      | 1.1  |       |       |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     |          |
|          |          | 50  | 9.8  |      |          |          |      |      | - 1  |      |       | 10.1  |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     |          |
|          |          | 60  | 7.0  |      |          |          |      |      |      |      |       |       |       |        |        |       |        |       |       |       |      | 100  |      |      |     |     |        |          |     |          |
| Shut-off | PSI      | 100 | 60   | 52   | 43       | 35       | 26   | 17   | 9    |      |       |       |       |        |        |       |        |       |       |       |      |      |      | -    |     |     |        |          |     |          |
| mat on   | <u> </u> | 0   | 00   | - JZ | 75       | 19.7     | 18.5 | 17.0 |      | 13.2 | 115   | 85    |       |        | - 1    |       |        |       |       |       |      | -    |      |      |     |     |        |          |     | $\vdash$ |
|          |          | 20  |      | 19.4 | 18.0     | 16.4     | 14.8 | 12.9 | 10.5 |      | 11.5  | 0.5   |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     |          |
|          |          | 30  | 18.9 | 17.5 |          | 14.6     | _    | 10.0 | 5.0  | 0.0  |       |       |       | -      |        |       |        |       |       |       |      |      |      |      |     |     |        | -        | _   |          |
| 13GS07   | 3/4      | 40  | 17.4 | 15.9 |          | 12.4     |      | 4.0  | 3.0  |      |       |       |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          | _   |          |
|          |          | 50  | 15.4 | 13.8 |          | 9.5      | 7.7  | 4.0  | -    |      |       |       |       |        |        |       |        |       | 77    |       |      |      |      |      |     |     |        |          |     | +        |
|          |          | 60  | 13.4 | 11.5 | 8.5      | 7.J      |      |      |      |      |       | -     |       |        |        | _     | _      |       |       |       |      |      | _    |      |     | _   |        |          |     | $\vdash$ |
| Thus off | DCI      | 00  | 86   |      | 69       | /1       | 52   | 43   | 35   | 26   | 17    | 8     |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     | $\vdash$ |
| Shut-off | P31      | 1 0 | 80   | 78   | 09_      | 61       | 52   |      |      |      |       |       | 141   | 12.0   | 11 4   | 0.5   | ( 0    |       |       |       |      |      |      |      |     |     |        |          |     | -        |
|          |          | 0   |      |      | 00.0     | 10.1     | 40.5 | _    |      | 17.6 |       |       | 14.1  |        |        | 9.5   | 6.0    |       |       |       |      |      |      |      |     |     |        |          |     | $\vdash$ |
|          |          | 20  |      | 00.0 | 20.0     | 19.4     |      | 17.2 |      | 15.0 |       | 12.5  |       | 8.5    | 4.0    |       | 11-    |       |       |       |      |      |      | _    |     |     |        |          |     | -        |
| 13GS10   | 1        | 30  |      | 20.0 | 19.2     | 18.2     |      | 15.8 | 14.7 | 13.6 | 12.2  | 10.5  | 7.5   |        |        |       |        | _     | -     |       |      |      |      |      |     |     |        |          |     | +-       |
|          |          | 40  | 19.9 |      | 18.0     | 17.0     |      | 14.6 | 13.5 | 12.0 | 10.1  | 7.3   |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     | ┼        |
|          |          | 50  | 18.8 |      |          | 15.5     |      |      |      | 9.9  | 7.0   |       |       |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     | -        |
|          |          | 60  | 17.6 | 16.6 | 15.4     | 14.1     |      | 11.4 | 9.5  | 6.0  | ,     |       |       |        |        |       |        | _     | _     |       |      |      |      |      |     |     |        |          |     | _        |
| Shut-off | PSI      |     | 128  | 119  | 110      | 102      | 93   | 84   | 76   | 67   | 58    | 50    | 41    | 32     | 24     | 15    | 6      |       |       |       |      |      | _    |      |     |     |        |          |     |          |
|          |          | 0   |      |      |          |          |      |      | _    | 18.9 |       |       | 16.3  |        | 14.2   | -     | 12.1   | 8.7   |       |       |      |      |      |      |     |     |        |          |     | _        |
|          |          | 20  |      |      |          |          | 19.5 | 18.4 | 17.9 | 17.0 | 16.0  | 15.1  | 14.1  | 12.9   | 11.8   | 10.2  | 8.8    |       |       |       |      |      |      |      |     |     |        |          |     | -        |
| 13GS15   | 11/2     | 30  |      |      | 20.2     |          | 18.6 |      | 16.8 | 15.8 |       | 14.0  | 12.6  | 11.5   | 9.9    | 7.9   | 4.0    |       |       |       |      |      |      |      |     |     |        |          |     |          |
| 100510   | 1 '/2    | 40  |      | 20.0 | 19.3     | _        | 17.5 |      | 15.7 |      | 13.9  |       | _     | 9.5    | 7.3    | 4.0   |        |       |       |       |      |      |      |      |     |     |        |          |     |          |
|          |          | 50  | 20.0 | 19.1 | 18.3     | 17.4     | 16.4 | 15.5 | 14.5 | 13.6 | 12.3  | 11.0  | 9.2   | 6.3    |        |       |        |       |       |       | -    |      |      |      |     |     |        |          |     |          |
|          |          | 60  | 18.9 | 18.2 | 17.3     | 16.3     | 15.2 | 14.2 | 13.3 | 12.1 | 11.0  | 8.7   | 5.6   |        |        |       |        |       |       |       |      |      |      |      |     |     |        |          |     |          |
| Shut-off | PSI      |     | 156  | 147  | 139      | 130      | 121  | 113  | 104  | 95   | 87    | 78    | 69    | 61     | 52     | 43    | 35     | 17    |       |       |      |      |      |      |     |     |        |          |     |          |
|          |          | 0   |      |      |          |          |      |      | -11  |      |       | 20.0  | 19.5  | 19.0   | 18.3   | 17.9  | 17.2   | 15.8  | 14.4  | 12.6  | 10.5 | 7.7  |      |      |     |     |        |          |     |          |
|          |          | 20  |      |      |          |          |      |      |      | 19.8 | 19.4  | 18.8  | 18.2  | 17.6   | 17.0   | 16.3  | 15.6   | 14.1  | 12.4  | 10.2  | 6.8  |      |      |      |     |     |        |          |     |          |
| 126620   | ,        | 30  |      |      |          |          |      |      | 19.7 | 19.3 | 18.7  | 18.2  | 17.4  | 16.8   | 16.2   | 15.5  | 14.8   | 13.1  | 11.1  | 8.8   |      |      |      |      |     |     | 17.74  |          |     |          |
| 13GS20   | 2        | 40  |      |      | - 1      |          |      | 19.6 | 19.2 | 18.6 | 18.1  | 17.3  | 16.7  | 16.1   | 15.4   | 14.7  | 13.8   | 12.0  | 9.8   | 6.0   |      |      |      |      |     |     | 170    |          |     | T        |
|          |          | 50  |      |      |          | 20.1     | 19.5 | 19.1 | 18.4 | 18.0 | 17.2  | 16.6  | 16.0  | 15.2   | 14.6   | 13.7  | 12.9   | 10.8  | 8.5   |       |      |      |      |      |     |     |        |          |     | T        |
|          |          | 60  |      |      | 20.0     | 19.5     | 19.0 | 18.3 | 17.9 | 17.2 | 16.5  | 15.8  | 15.1  | 14.4   | 13.6   | 12.6  | 11.5   | 9.2   | 5.0   |       |      |      |      |      |     |     |        |          |     |          |
| Shut-off | PSI      |     |      |      | 206      | 198      | 189  | 180  | 172  |      | 155   | _     |       | 129    | 120    | 111   | 103    | 85    | 68    | 51    | 33   | 16   |      |      |     |     |        |          |     |          |
|          |          | 0   |      |      |          |          |      |      |      |      |       |       |       |        | 19.8   |       | 18.9   |       |       |       | 14.6 | _    | 11.9 | 10.0 | 7.3 |     |        |          |     |          |
|          |          | 20  |      |      |          |          |      |      |      |      |       |       | 19.6  | 19.2   | 18.9   |       | 17.9   | 17.0  |       |       | 13.3 | 11.8 | 9.7  | 6.9  |     |     | 10     |          |     |          |
|          |          | 30  |      |      |          |          |      |      |      |      | 20.0  | 19.5  |       | 18.8   | 18.2   | 17.8  | _      | 16.4  |       | 13.9  |      | 10.5 | 8.3  | 4.0  |     |     | 150    |          |     | $\top$   |
| 13GS30   | 3        | 40  |      |      |          |          |      |      |      | 20.0 |       | _     |       | 18.2   |        | _     | 16.8   | 15.6  |       | 13.0  |      | 9.5  | 6.0  |      |     |     | , U.S. |          |     |          |
|          |          | 50  |      |      |          | -        | _    | 1    | 19 9 | 19.5 | 19.0  | -     |       |        |        |       | 16.1   | 14.9  |       | 12.0  |      | 7.9  | J.U  |      |     |     |        |          |     |          |
|          |          | 60  |      |      |          |          | 1    | 19.8 | -    | -    | 18.5  | 18.0  |       | 17.1   | 16.6   | 16.0  | 15.4   | 14.2  | 12.9  | 11.0  | 9.0  | 5.0  | -10  |      |     |     |        |          |     |          |
| Shut-off | DCI      | 100 |      |      | $\vdash$ | $\vdash$ | -    | 235  | 226  | _    | 209   |       | _     | 183    | 174    |       | 157    | 139   | 122   | 104   | 87   | 70   | 53   | 35   | 18  | -   | -      | $\vdash$ |     | +        |

# **MODEL 18GS**

# **SELECTION CHART**

Horsepower Range ¾ - 5, Recommended Range 6 - 28 GPM, 60 Hz, 3450 RPM

| Pump     | HP   | PSI      |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               | iallon      |      |      |      |      |              |               |     |     |      |               |      |          |
|----------|------|----------|------|------|----------|------|---------------|---------------|------|------|---------------|---------------|------|------|------|------|------|---------------|-------------|------|------|------|------|--------------|---------------|-----|-----|------|---------------|------|----------|
| Model    | пР   | 151      | 20   | 40   | 60       | 80   | 100           | 120           | 140  | 160  |               |               |      |      |      |      |      |               | 380         |      |      |      | 540  | 580          | 620           | 660 | 700 | 740  | 780           | 820  | 86       |
|          | 4    | 0        | -    |      | 28.2     | 26.5 |               |               | 17.9 |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      | 1        |
|          | 4    | 20       | 27.7 | 25.9 | 23.0     | 20.0 | 16.5          | 10.8          |      |      |               |               | -17  |      |      |      |      | 11            |             |      |      |      |      |              |               |     |     |      |               |      |          |
| 18GS07   | 3/4  | 30       |      | 22.0 |          |      | 9.5           |               |      |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     | -    | -             |      | t        |
|          |      | 40       | 22.2 | 18.9 | 15.1     |      | 11.79         |               |      |      |               |               | 8 75 |      |      |      |      |               |             |      |      |      |      |              | 1             | 4-1 |     |      |               |      | T        |
|          |      | 50       | -    | 15.0 |          |      |               |               |      |      |               |               |      |      |      |      | 1    |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
|          |      | 60       | 13.5 | 5.0  | - 13     |      |               |               |      |      |               |               |      |      |      |      |      |               | 11          |      |      |      |      |              |               |     |     |      |               |      |          |
| Shut-off | PSI  |          | 74   | 66   | 58       | 49   | 40            | 32            | 23   | 14   |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
|          |      | 0        |      |      |          |      | 27.0          |               |      | 21.2 | 18.8          | 15.9          | 12.0 |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
|          | -    | 20       |      | 28.0 | 26.6     | 25.1 | _             | _             | 17.6 |      | <del></del>   |               |      |      |      |      | 7    |               |             |      |      |      |      |              |               |     |     |      |               |      | T        |
| 8GS10    | 1    | 30       | 27.9 |      | 24.3     |      |               | _             | 13.8 |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
|          | 1    | 40       | _    |      | 22.0     | _    | 17.0          | _             | 8.0  | 0.0  |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      | t        |
|          |      | 50       |      |      | 19.1     |      | 13.0          |               | 0.0  |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      | $\vdash$ |
| -46      |      | 60       | 21.0 |      | 15.8     | 12.0 | 1010          |               |      |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      | +        |
| hut-off  | PSI  | -        | 103  | 94   | 86       | 77   | 68            | 60            | 51   | 42   | 34            | 25            | 16   |      |      |      |      |               |             |      |      |      | 1    | 1            |               |     |     | -    |               |      | $\vdash$ |
|          |      | 0        | 100  | -    | 100      |      |               |               |      |      | _             |               |      | 19.6 | 17.5 | 15.0 | 12 1 |               |             |      |      |      |      |              |               |     |     |      |               |      | H        |
| -        |      | 20       |      |      |          | 27.8 | 26.8          |               |      |      |               |               |      | 14.0 |      | _    |      |               |             |      |      |      |      |              |               |     |     | -    |               |      | t        |
|          |      | 30       |      |      | 27.7     | 26.5 |               |               |      |      | 18.5          |               |      |      | 10,0 |      | -    |               | -           |      |      |      |      |              |               |     |     |      |               | -    | t        |
| 8GS15    | 11/2 | 40       |      | 27.5 | 26.3     | 25.0 |               |               | 20.1 |      |               | _             | 9.5  | 10.0 |      | 177  |      |               |             |      |      |      |      |              |               |     |     |      |               |      | -        |
|          |      | 50       | 27.6 |      |          |      |               |               |      |      |               | 9.2           | 7.0  |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
|          |      | 60       | 26.0 |      |          |      |               |               | 15.0 |      |               | 1.2           |      |      |      |      | -    |               |             |      |      |      |      |              |               |     |     | -    |               | _    | H        |
| hut-off  | PSI  | -00      | 143  |      | 126      |      | 108           |               | 91   | 82   | 74            | 65            | 56   | 48   | 39   | 30   | 22   |               |             |      |      |      |      | -            |               |     |     |      |               |      | -        |
| mut on   | 1 91 | 0        | 143  | 134  | 120      | 117  | 100           | 100           | / 1  |      |               |               |      | 24.0 |      |      |      | 16.8          | 12 B        | -    |      |      |      |              |               |     |     |      |               | -    | $\vdash$ |
|          |      | 20       |      |      |          |      |               | 27.8          | 26.8 |      |               |               |      | 21.0 |      | 18.0 |      | 11.6          | 12.0        |      |      |      |      |              | -             |     |     |      |               |      | $\vdash$ |
|          |      | 30       | -    |      |          |      | 27.5          |               |      |      |               |               |      |      | 17.5 |      | 13.6 | 6.5           |             | -    |      |      |      | -            |               |     |     |      |               |      | H        |
| 8GS20    | 2    | 40       |      |      | 28.5     | 27.4 | 26.4          |               |      |      | 22.0          |               |      | 17.4 | 15.7 |      | 11.0 | 0.5           |             |      |      |      |      |              |               |     |     |      |               |      | $\vdash$ |
| +        |      | 50       |      | 28.0 | 27.2     |      |               |               |      |      | 20.3          |               |      | 15.3 |      | 10.5 |      |               |             |      |      |      |      |              |               | -   |     |      |               |      | $\vdash$ |
|          |      | 60       | 28.0 |      | 26.2     |      |               |               |      | -    |               | $\overline{}$ |      | 12.8 | 9.5  | 10.3 | 0.0  |               |             |      |      |      | -    |              |               | -   |     |      |               | _    | H        |
| hut-off  | DCI  | 00       | 183  | 174  |          |      | 148           | 139           | 131  |      | 113           | 10.6          | 96   | 87   | 7.3  | 70   | 61   | 44            | 27          |      |      |      |      |              |               |     |     |      |               |      | $\vdash$ |
| ilut-on  | rai  | 0        | 103  | 174  | 103      | 137  | 140           | 137           | 131  | 122  | 113           | 103           |      |      |      |      |      |               | 21.5        | 10.2 | 14.0 | 1/12 | 10.5 |              |               |     |     |      |               |      |          |
|          |      | 20       |      |      |          |      |               |               |      |      | 27.7          | 27.0          |      | 25.8 |      |      |      | 21.0          |             | 16.5 | 13.5 | _    | 10.5 |              |               |     |     | -    |               |      | H        |
|          |      | 30       |      |      |          |      |               |               |      | 27.6 |               |               |      | 24.8 |      |      |      |               | _           | -    | 11.2 | 7.0  |      | -            |               |     | _   |      |               | -    | -        |
| 8GS30    | 3    | 40       |      |      |          |      |               |               | _    | 26.9 |               | 25.4          |      | 23.8 |      |      |      | $\overline{}$ | 16.0        | _    |      |      |      |              |               |     | -   |      |               |      |          |
|          |      | 50       |      |      |          |      |               | 27.4          |      | 26.0 |               | 24.5          |      | 22.6 |      |      |      |               |             | 11.0 | 0.0  |      | _    |              |               |     |     |      |               | _    | H        |
|          | 15.7 | 60       |      |      | -        | 28.0 | $\overline{}$ | $\overline{}$ |      | 25.0 |               | 23.5          |      | 21.5 |      |      | _    |               | 12.8        | _    |      |      |      |              |               |     |     |      |               |      | -        |
| hut-off  | DCI  | 00       | -    |      |          | 225  | _             | 20.7          | 199  | 190  | $\overline{}$ | $\overline{}$ | 164  | 156  | 147  | 139  | 130  | 113           | 95          | 7.0  | 61   | 43   | 26   |              |               |     | -   |      |               |      | H        |
| ilut-oli | F 31 | 0        |      |      |          | 223  | 210           | 200           | 177  | 170  | 102           | 1/3           | 104  | 130  | 147  | _    |      |               | 25.4        |      | 22.5 |      |      | 14.0         | 14 E          | 117 | 8.1 |      |               |      | -        |
|          |      | 20       |      |      | -        |      |               |               |      |      |               |               |      |      | 27.6 |      |      |               | 23.4        |      |      |      | 16.6 |              | 11.2          | 7.4 | 0.1 |      |               |      | -        |
|          |      | 30       |      |      |          |      |               |               |      |      |               |               | 20.0 | 27.5 |      |      |      |               | 22.9        |      |      |      |      |              | $\overline{}$ | 7.4 |     |      |               |      | H        |
| 8GS5OR   | 5    | 40       |      |      |          |      | -             |               |      |      |               |               |      |      |      |      |      |               | 22.9        |      |      |      | 15.2 | 12.5<br>10.6 |               |     |     |      |               |      |          |
|          |      |          |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               | 21.0        |      |      |      |      |              | 6.7           |     |     |      |               |      | _        |
|          |      | 50<br>60 |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               |             |      |      |      |      |              |               |     |     |      |               |      |          |
| hou off  | DCI  | 00       |      |      | $\vdash$ |      |               |               |      | 27.0 | 27.2          | 20./          | 20.1 | 23.4 | 24./ | 200  | 200  | 102           | 20.0<br>166 | 140  | 13.9 | 13.3 | 10.1 | 0.0          | /2            | 44  | 27  |      |               |      |          |
| hut-off  | L21  | •        |      |      |          |      | -             |               |      | 201  | 252           | 244           | 235  | 226  | 2181 | 209  | 200  |               |             |      |      |      |      |              | 62            |     | 27  | 14.0 | 14.0          | 40.4 | _        |
|          |      | 0        |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               | 27.9        |      |      |      |      |              |               |     |     |      |               |      | 9.       |
|          |      | 20       |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               | 26.6        |      |      |      |      |              |               |     |     |      |               |      |          |
| BGS50    | 5    | 30       |      |      |          |      |               |               | -    |      |               |               |      |      |      |      |      |               | 26.0        |      |      |      |      |              |               |     |     |      |               | 6.2  | _        |
|          |      | 40       | -    |      |          |      | _             |               |      |      |               |               |      |      |      |      |      |               | 25.3        |      |      |      |      |              |               |     |     |      | $\overline{}$ |      | _        |
|          |      | 50       |      |      |          |      |               |               |      |      |               |               |      |      |      |      |      |               | 24.9        |      |      |      |      |              |               |     |     |      | 6.0           |      |          |
|          |      | 60       |      |      |          |      | _             |               |      | -    |               |               |      |      |      |      |      |               | 24.1        |      |      |      |      |              | 15.8          |     |     |      |               |      |          |
| hut-off  | PSI  |          |      |      |          |      |               |               |      |      |               |               |      | 307  | 298  | 290  | 281  | 264           | 246         | 229  | 212  | 195  | 177  | 160          | 143           | 125 | 108 | 91   | 73            | 56   | 3        |

# **MODEL 25GS**

# **SELECTION CHART**

Horsepower Range 1 - 5, Recommended Range 8 - 33 GPM, 60 Hz, 3450 RPM

| Pump        | HP   | PSI  |         |       |      |      |      |      | D             | epth 1      |             |             | Feet/F      |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
|-------------|------|------|---------|-------|------|------|------|------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|------|-------------|-------|------|--------|--------------|-------------|------------|------|-------|------|------|
| Model       | ***  | 1 31 | 20      | 40    | 60   | 80   |      | 120  |               | 160         |             | 200         | 220         | 240           | 260         | 280         | 300  | 340         | 380   | 420  | 460    | 500          | 540         | 580        | 620  | 660   | 700  | 74   |
|             |      | 0    |         |       | 32.8 | 30.8 | 28.6 | 26.2 | $\overline{}$ | 20.0        | 16.2        | 11.0        |             |               |             |             |      |             | 4.7   |      |        |              |             |            |      |       |      |      |
|             | 1.59 | 20   | 31.8    |       | 27.5 | 25.2 | 22.0 | 19.0 | 15.0          | 8.0         |             |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
| 25GS10      | 1    | 30   | 29.6    |       | 25.0 | 21.6 | 18.0 | 14.0 |               |             |             |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       | 1    |      |
| 230310      | 17.0 | 40   | 27.1    |       | 21.5 | 17.9 | 13.9 |      |               |             |             |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
|             |      | 50   | 24.3    | 21.0  | 17.5 | 13.0 |      |      |               |             |             |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
|             |      | 60   | 20.0    | 16.2  | 11.0 |      |      |      |               | _111        |             |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
| Shut-off PS | i _  |      | 82      | 74    | 65   | 56   | 48   | 39   | 30            | 22          | 13          | 4           |             |               |             |             |      |             |       |      |        | -119         |             |            |      |       |      |      |
|             |      | 0    |         |       |      | 33.0 | 31.8 | 30.3 | 28.8          | 26.9        | 24.8        | 22.0        | 19.8        | 16.5          | 11.0        |             |      |             |       |      |        |              |             |            |      |       |      |      |
|             |      | 20   |         | 32.6  | 31.2 | 29.6 | 28.0 | 26.0 | 23.8          | 21.0        | 18.1        | 14.8        | 8.0         |               |             |             |      |             |       |      |        | 6            |             |            | -1-7 |       |      |      |
| 256645      | 41/  | 30   | 32.5    | 31.0  | 29.5 | 27.6 | 25.6 | 23.2 | 20.9          | 17.9        | 14.0        |             |             |               |             |             |      |             |       |      |        |              |             |            |      |       |      |      |
| 25GS15      | 11/2 | 40   | 30.9    | 29.4  | 27.5 | 25.5 | 23.1 | 20.8 | 17.7          | 13.6        | 4           |             | -           | -             |             |             |      |             |       |      |        | _ 14         |             | -          |      | Ш     |      |      |
|             |      | 50   | 29.0    | 27.2  | 25.1 | 22.9 | 20.4 | 17.2 | 13.0          |             |             |             |             | 174           | 7.00        |             |      |             |       |      |        |              |             |            |      |       |      |      |
|             | -4.1 | 60   | 26.9    | 24.8  | 22.0 | 19.8 | 16.5 | 11.0 |               |             |             |             |             |               |             |             |      |             | -     |      |        |              |             |            |      |       |      |      |
| Shut-off PS | i i  |      | 111     | 103   | 94   | 85   | 77   | 68   | 59            | 51          | 42          | 33          | 25          | 16            | 7           |             |      |             |       |      |        |              |             |            | 111  |       | 1    |      |
|             |      | 0    |         |       |      |      |      | 33.0 | 31.8          | 30.4        | 29.0        | 27.4        | 25.7        | 22.6          | 21.5        | 19.3        | 15.4 |             | -     |      |        |              |             |            |      |       | 1    |      |
|             |      | 20   | 4       | 172-1 |      | 32.7 | 31.3 | 30.0 | 28.6          | 26.8        | 25.0        | 22.9        | 20.9        | 18.3          | 14.3        | 9.0         | 1    |             |       | 5    |        |              |             |            | al t | 11.00 |      |      |
|             | _    | 30   |         |       | 32.3 | 31.0 | 29.6 | 28.5 | 26.4          | 24.5        | 22.6        | 20.5        | 18.0        | 14.0          | 8.0         |             |      |             |       |      | - = 3  |              |             |            |      |       |      |      |
| 25GS20      | 2    | 40   |         | 1     | 30.9 | 29.5 | 28.2 | 26.3 | 24.3          | 22.4        | 20.4        | 17.8        | 13.6        | 8.0           |             | 1. 3        | 1    |             |       |      |        | - 40         |             | 13         |      |       |      |      |
|             |      | 50   |         | 30.5  | 29.4 | 28.0 | 26.0 | 24.1 | 22.1          | 20.0        | 17.2        | 13.2        |             |               |             | 7.33        |      |             | 14.3  | TI.  |        |              |             |            |      |       |      | 14.5 |
|             |      | 60   | 30.4    | 29.0  | 27.4 | 25.7 | 22.6 |      | 19.3          | 15.4        | 12.2        | 10          | 130         | 111           |             | 114         |      |             |       |      |        |              |             |            |      |       | -    |      |
| Shut-off P  | SI   |      | 139     | 130   | 121  | 113  | 104  | 95   | 87            | 78          | 69          | 61          | 52          | 43            | 35          | 26          | 17   |             | 1 71  | - 11 | 91.0   | T. I         |             |            |      |       |      |      |
|             |      | 0    |         |       |      |      |      |      |               | 33.0        | 32.2        | 31.5        | 30.5        | 29.6          | 28.3        | 27.1        | 25.8 | 22.6        | 19.0  | 14.0 |        |              |             |            | 7.0  |       |      |      |
|             |      | 20   | - 1     |       |      |      |      | 32.8 | 32.0          | 31.0        | 30.0        | 29.0        | 27.9        | 26.6          | 25.0        | 23.8        | 21.9 | 20.0        | 12.6  |      |        |              |             |            | 110  |       | 1    |      |
|             |      | 30   | 77.9    | ,     |      | U.S. | 32.6 | 31.8 | 30.9          | 30.0        | 28.8        | 27.6        |             | 24.9          |             | 21.6        | 19.9 | 15.2        | 8.0   |      |        | 81           |             |            |      |       |      |      |
| 25GS30      | 3    | 40   |         |       |      | 32.5 | 31.7 | 30.9 | 29.9          | 28.8        | 27.5        | 26.2        | 24.7        | 23.3          | 21.5        | 19.9        | 17.8 | 11.9        | F = 1 |      | 1/1/11 | 7.17         |             |            | 710  |       |      |      |
|             | т.   | 50   |         |       | 32.3 | 31.6 | 30.8 | 29.8 | 28.5          | 27.3        | 26.0        | 24.5        |             | 21.2          | 19.5        | 17.4        | 11.5 |             |       | 100  | 10     | The state of | 1           |            | 12   |       |      |      |
|             |      | 60   | 33.0    | 32.2  | 31.5 | 30.5 | 29.6 |      | 27.1          | 25.8        | 24.1        | 22.6        | 20.9        | 19.0          | 16.9        | 14.0        | 10.0 |             |       | 111  | 1.7    |              |             |            |      |       |      |      |
| Shut-off P  | si i |      | 191     | 183   | 174  | 165  | 157  | 148  | 139           | 131         | 122         | 113         | 105         | 96            | 87          | 79          | 70   | 53          | 35    | 18   |        |              |             |            |      |       |      |      |
|             | i i  | 0    | .,,     | 100   |      |      |      |      |               |             |             |             | 32.7        | 32.2          | 31.7        | 31.2        | 30.5 | 29.1        | 27.3  | 25.3 | 23.3   | 21.4         | 19.3        | 16.5       | 11.7 |       |      |      |
|             |      | 20   |         |       |      |      |      |      |               | 33.0        | 32.5        | 32.1        | 31.5        | 31.0          | 30.3        | 29.6        | 28.8 | 27.0        | 25.0  | 23.0 | 21.1   | 18.9         | 15.9        | 10.6       |      |       |      |      |
|             |      | 30   |         |       | -    |      |      |      | 32.9          | 32.5        | 32.0        | 31.5        |             | 30.2          | 29.5        | 28.7        | 27.8 | 25.9        | 23.9  | 21.9 | 19.9   | 17.4         | 13.3        |            |      |       | 1    |      |
| 25G\$50R    | 5    | 40   |         |       |      |      |      | 32.9 | 32.4          | 31.9        | 31.4        | 30.8        | 30.1        | 29.4          | 28.5        | 27.6        | 26.7 | 24.7        | 22.7  | 20.8 | 18.6   |              | 10.0        |            |      |       |      | 1    |
|             |      | 50   |         |       |      |      | 32.8 | -    | 31.8          | 31.3        | 30.7        | 30.0        | 29.2        | 28.4          | 27.5        | 26.5        | 25.6 | 23.6        | 21.6  | 19.6 | 16.9   | 10.5         |             |            |      |       |      |      |
|             |      | 60   |         |       |      | 32.7 | 32.2 | 31.7 | 31.2          | 30.6        | 29.9        | 29.1        | 28.3        | 27.4          | 26.4        | 25.4        | 24.4 | 22.4        | 20.4  | 18.2 | 14.6   |              |             |            | 7.1  |       |      |      |
| Shut-off P  | SI I | 00   |         |       |      | 252  | 243  | 234  | 226           | 217         | 208         | 200         | 191         | 182           | 174         | 165         | 156  | 139         | 122   | 10.2 | 87     | 70           | 52          | 35         | 18   |       | - 10 |      |
| Jiiut VII P | 71   | 0    |         |       |      | 232  | 243  | 234  | 220           | 21/         | 200         | 200         | 171         | 102           | 1/4         | 33.0        | 32.5 | 31.5        | 30.2  | 29.0 | 27.6   |              | 24.2        | 22.4       | 20.5 | 18.3  | 15.8 | 12.  |
|             |      | 20   |         |       |      |      |      |      |               |             |             |             |             | 32.9          | 32.3        | 31.8        | 31.3 | 30.0        | 28.8  | 27.2 | 25.8   |              | 22.0        | 20.0       | 17.8 | 15.0  | 11.0 | 12.  |
|             |      | 30   | <b></b> |       |      |      |      |      |               |             |             | -           | 32.8        | 32.7          | 31.8        | 31.2        | 30.5 | 29.3        | 27.9  | 26.4 | 24.8   |              | 21.0        | 18.9       | 16.2 | 13.0  | 8.0  | -    |
| 25GS50      | 5    | 40   | -       |       |      |      |      |      |               |             |             | 32.7        | 32.1        | 31.7          | 31.0        | 30.4        | 29.9 | 28.5        | 27.1  | 25.4 | 23.7   | 21.9         | 19.9        | 17.5       | 14.5 | 10.5  | 0.0  | 1    |
|             |      |      |         |       | -    | -    |      | -    | -             |             | 22 /        | 32.1        | _           | 31.7          | 30.3        | 29.9        | 29.9 | 27.8        | 26.3  | 24.5 | 22.6   |              | 18.7        | 16.0       | 14.5 | 10.5  |      | -    |
|             |      | 50   | -       |       |      |      |      |      | 22.0          | 22.5        | 32.6        |             | 31.6        | $\overline{}$ |             |             | -    | _           | 25.1  | 23.3 | 21.5   |              |             | _          | 9.5  |       |      | -    |
|             |      | 60   |         |       |      |      |      |      | 33.0<br>286   | 32.5<br>277 | 32.0<br>268 | 31.5<br>260 | 30.8<br>251 | 30.2<br>242   | 29.8<br>234 | 29.0<br>225 | 28.3 | 26.9<br>199 | 182   | 165  | 147    | 19.5<br>130  | 17.0<br>113 | 14.0<br>95 | 78   | 61    | 43   | 26   |



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# Existing 38mm Waterline from Well PW1 (13GS10 pump) - System Head Curve Mansfield Ski Club

<<< Elements Requiring Input Information</p>

Static Head,  $h_{S, MAX} = h_{F} - h_{LWL}$  (m)

Date: 11-Aug-20 Project No: 15-319

Prepared by: JWL

Total Dynamic Head,  $h_{D, MAX} = h_{S, MAX} + h_{T.H.L.}$  (m)

Velocity, V = Qp (m/s, MOE Requirements: 0.8m/s - 2.5m/s) <u>Hazen - Williams Equation (re-arranged for Friction Slope)</u>

(Forcemain Head Loss Calculation)

there,  $Q_p$  = Peak Sewage Flow (m³/s) Friction Slope, S =  $(V)^{1/0.54}$  x 100 (m/100m) Static Head,  $h_{S, MEDIAN} = h_F - h_{MWL}$  (m) Total Dynamic Head,  $h_{D, MEDIAN} = h_{S, MEDIAN} + h_{T.H.L.}$  (m)

Minor Head Loss,  $H_L = (K_1 + K_2 + K_3...) \times V^2/2g$  where, V = mean velocity (m/s) where, V = mean velocity (m/s) where, V = mean velocity (m/s)

where,  $\sum K = (K_1 + K_2 + K_3...)$  k = 0.85 for SI units  $h_{LWL} = Wet Well Low Water Level (m)$   $h_{S, MEDIAN} = Median Static Head (m)$   $h_{S, MEDIAN} = Median Static Head (m)$   $h_{S, MIN} = Minimum Static Head (m)$ 

= 9.81 (acceleration due to gravity,  $m/s^2$ ) R = hydraulic radius (m)  $h_{HWL}$  = Wet Well High Water Level (m)  $h_{T.H.L.}$  = Total Head Loss (m)

| Pipe Design        |       |          | Forcei   | main      |          |           | Fittings          | Pump Station       | Total     | Wet Well        | Wet Well           | Wet Well         | Forcemain Max.     |       | Static Head |       |       | Total Dynamic He | ead   |
|--------------------|-------|----------|----------|-----------|----------|-----------|-------------------|--------------------|-----------|-----------------|--------------------|------------------|--------------------|-------|-------------|-------|-------|------------------|-------|
| Coefficient        | Flow  | Diameter | Velocity | Head Loss | Distance | Head Loss | Head Loss         | Head Loss          | Head Loss | Low Water Level | Median Water Level | High Water Level | Elev. Along Length | MAX.  | Median      | MIN.  | MAX.  | Median           | MIN.  |
| С                  | (L/s) | (mm)     | (m/s)    | (m/100m)  | (m)      | (m)       | (m)               | (m)                | (m)       | (m)             | (m)                | (m)              | (m)                | (m)   | (m)         | (m)   | (m)   | (m)              | (m)   |
| Wet Well           |       |          |          |           |          |           | ∑K <sub>F</sub> = | ∑K <sub>PS</sub> = |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| Low Water Level    |       |          |          |           |          |           | 8.36              |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 120                | 0.25  | 38       | 0.22     | 0.27      | 593.90   | 1.57      | 0.02              | 0.00               | 1.60      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 46.69 | 44.69            | 42.69 |
| 120                | 0.5   | 38       | 0.44     | 0.96      | 593.90   | 5.68      | 0.08              | 0.00               | 5.77      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 50.86 | 48.86            | 46.86 |
| 120                | 0.76  | 38       | 0.67     | 2.08      | 593.90   | 12.34     | 0.19              | 0.00               | 12.54     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 57.63 | 55.63            | 53.63 |
| 120                | 1.01  | 38       | 0.89     | 3.52      | 593.90   | 20.90     | 0.34              | 0.00               | 21.24     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 66.33 | 64.33            | 62.33 |
| 120                | 1.26  | 38       | 1.11     | 5.30      | 593.90   | 31.48     | 0.53              | 0.00               | 32.01     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 77.10 | 75.10            | 73.10 |
| Wet Well           |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| Median Water Level |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 130                | 0.25  | 38       | 0.22     | 0.23      | 593.90   | 1.36      | 0.02              | 0.00               | 1.38      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 46.47 | 44.47            | 42.47 |
| 130                | 0.5   | 38       | 0.44     | 0.83      | 593.90   | 4.90      | 0.08              | 0.00               | 4.98      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 50.07 | 48.07            | 46.07 |
| 130                | 0.76  | 38       | 0.67     | 1.79      | 593.90   | 10.64     | 0.19              | 0.00               | 10.84     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 55.93 | 53.93            | 51.93 |
| 130                | 1.01  | 38       | 0.89     | 3.03      | 593.90   | 18.02     | 0.34              | 0.00               | 18.36     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 63.45 | 61.45            | 59.45 |
| 130                | 1.26  | 38       | 1.11     | 4.57      | 593.90   | 27.14     | 0.53              | 0.00               | 27.67     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 72.76 | 70.76            | 68.76 |
| Wet Well           |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| High Water Level   |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 140                | 0.25  | 38       | 0.22     | 0.20      | 593.90   | 1.18      | 0.02              | 0.00               | 1.20      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 46.29 | 44.29            | 42.29 |
| 140                | 0.5   | 38       | 0.44     | 0.72      | 593.90   | 4.27      | 0.08              | 0.00               | 4.36      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 49.45 | 47.45            | 45.45 |
| 140                | 0.76  | 38       | 0.67     | 1.56      | 593.90   | 9.28      | 0.19              | 0.00               | 9.47      | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 54.56 | 52.56            | 50.56 |
| 140                | 1.01  | 38       | 0.89     | 2.65      | 593.90   | 15.71     | 0.34              | 0.00               | 16.05     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 61.14 | 59.14            | 57.14 |
| 140                | 1.26  | 38       | 1.11     | 3.98      | 593.90   | 23.66     | 0.53              | 0.00               | 24.19     | 256.66          | 258.66             | 260.66           | 301.75             | 45.09 | 43.09       | 41.09 | 69.28 | 67.28            | 65.28 |

NOTES:

- Loss Coefficients: Wells - Holding Tank

7 - 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop

3 - Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank

1- Exit loss into holding tank @ K=1.0

- Maximum Pressure Ratings for various watermain pipe diameters: 50mm 200psi SDR 21 75mm 200psi SDR 21 100mm 235psi DR18 305psi DR14

<sup>-</sup> The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW1 is considered to have a yield of 17 IPGM (20.4 USGPM OR 1.29 L/s) at a depth of 4.2m below ground grade (262.86m-4.2m=258.66m) based on its pump test.

<sup>-</sup> The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be conservative

<sup>-</sup> This system-head curve when plotted against the pump-head curve for the existing well pump (Goulds 13GS1010412C), the operating flow capacity of the existing 38mm waterline is 13.3 IPGM (16 USGPM OR 1.01 L/s) @ TDH of 201.6 ft (61.45 m OR 87.4 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).



# Proposed 50mm Waterline from Well PW2 (25GS20 pump) - System Head Curve Mansfield Ski Club

**Elements Requiring Input Information** 

Static Head,  $h_{S, MAX} = h_{F} - h_{LWL}$  (m)

Date: 11-Aug-20 Project No: 15-319 Prepared by: JWL

Total Dynamic Head,  $h_{D, MAX} = h_{S, MAX} + h_{T.H.L.}$  (m)

(m/s, MOE Requirements: 0.8m/s - 2.5m/s) Hazen -Williams Equation (re-arranged for Friction Slope) Velocity, V =

(Forcemain Head Loss Calculation)

 $(V)^{1/0.54}$ Q<sub>P</sub> = Peak Sewage Flow (m<sup>3</sup>/s) Friction Slope, S = x 100 (m/100m) Static Head,  $h_{S, MEDIAN} = h_{F} - h_{MWL}$  (m) Total Dynamic Head,  $h_{D, MEDIAN} = h_{S, MEDIAN} + h_{T.H.L.} (m)$ 

(0.85CR<sup>0.63</sup>)<sup>1/0.54</sup> A = Cross-Sectional Area (m<sup>2</sup>) Total Dynamic Head,  $h_{D, MIN} = h_{S, MIN} + h_{T.H.L.}$  (m) Static Head,  $h_{S. MIN} = h_{F} - h_{HWL}$  (m)

Minor Head Loss,  $H_1 = (K_1 + K_2 + K_3...) \times V^2/2g$ h<sub>F</sub> = Forcemain Max. Elev. Along Length (m  $h_{S, MAX}$  = Maximum Static Head (m) where. V = mean velocity (m/s)

where,  $\sum K = (K_1 + K_2 + K_3...)$ k = 0.85 for SI units h<sub>LWL</sub> = Wet Well Low Water Level (m) h<sub>S, MEDIAN</sub> = Median Static Head (m) mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s) C = Roughness Coefficient h<sub>MWL</sub> = Wet Well Median Water Level (m) h<sub>S. MIN</sub> = Minimum Static Head (m)

9.81 (acceleration due to gravity, m/s²) R = hydraulic radius (m) h<sub>HWL</sub> = Wet Well High Water Level (m) h<sub>T.H.L.</sub> = Total Head Loss (m)

| Pipe Design        |       |          | Forcer   | main      |          |           | Fittings          | Pump Station       | Total     | Wet Well        | Wet Well           | Wet Well         | Forcemain Max.     |       | Static Head |       |       | Total Dynamic He | ead   |
|--------------------|-------|----------|----------|-----------|----------|-----------|-------------------|--------------------|-----------|-----------------|--------------------|------------------|--------------------|-------|-------------|-------|-------|------------------|-------|
| Coefficient        | Flow  | Diameter | Velocity | Head Loss | Distance | Head Loss | Head Loss         | Head Loss          | Head Loss | Low Water Level | Median Water Level | High Water Level | Elev. Along Length | MAX.  | Median      | MIN.  | MAX.  | Median           | MIN.  |
| С                  | (L/s) | (mm)     | (m/s)    | (m/100m)  | (m)      | (m)       | (m)               | (m)                | (m)       | (m)             | (m)                | (m)              | (m)                | (m)   | (m)         | (m)   | (m)   | (m)              | (m)   |
| Wet Well           |       |          |          |           |          |           | ∑K <sub>F</sub> = | ∑K <sub>PS</sub> = |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| Low Water Level    |       |          |          |           |          |           | 8.36              |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 120                | 0.95  | 50       | 0.48     | 0.83      | 540.50   | 4.46      | 0.10              | 0.00               | 4.56      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 47.97 | 45.97            | 43.97 |
| 120                | 1.26  | 50       | 0.64     | 1.39      | 540.50   | 7.53      | 0.18              | 0.00               | 7.70      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 51.11 | 49.11            | 47.11 |
| 120                | 1.58  | 50       | 0.80     | 2.12      | 540.50   | 11.45     | 0.28              | 0.00               | 11.72     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 55.13 | 53.13            | 51.13 |
| 120                | 1.89  | 50       | 0.96     | 2.95      | 540.50   | 15.95     | 0.39              | 0.00               | 16.34     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 59.75 | 57.75            | 55.75 |
| 120                | 2.08  | 50       | 1.06     | 3.52      | 540.50   | 19.05     | 0.48              | 0.00               | 19.52     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 62.93 | 60.93            | 58.93 |
| Wet Well           |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  | ļ     |
| Median Water Level |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 130                | 0.95  | 50       | 0.48     | 0.71      | 540.50   | 3.85      | 0.10              | 0.00               | 3.95      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 47.36 | 45.36            | 43.36 |
| 130                | 1.26  | 50       | 0.64     | 1.20      | 540.50   | 6.49      | 0.18              | 0.00               | 6.67      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 50.08 | 48.08            | 46.08 |
| 130                | 1.58  | 50       | 0.80     | 1.83      | 540.50   | 9.87      | 0.28              | 0.00               | 10.15     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 53.56 | 51.56            | 49.56 |
| 130                | 1.89  | 50       | 0.96     | 2.54      | 540.50   | 13.75     | 0.39              | 0.00               | 14.15     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 57.56 | 55.56            | 53.56 |
| 130                | 2.08  | 50       | 1.06     | 3.04      | 540.50   | 16.42     | 0.48              | 0.00               | 16.90     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 60.31 | 58.31            | 56.31 |
| Wet Well           |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| High Water Level   |       |          |          |           |          |           |                   |                    |           |                 |                    |                  |                    |       |             |       |       |                  |       |
| 140                | 0.95  | 50       | 0.48     | 0.62      | 540.50   | 3.35      | 0.10              | 0.00               | 3.45      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 46.86 | 44.86            | 42.86 |
| 140                | 1.26  | 50       | 0.64     | 1.05      | 540.50   | 5.66      | 0.18              | 0.00               | 5.83      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 49.24 | 47.24            | 45.24 |
| 140                | 1.58  | 50       | 0.80     | 1.59      | 540.50   | 8.60      | 0.28              | 0.00               | 8.88      | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 52.29 | 50.29            | 48.29 |
| 140                | 1.89  | 50       | 0.96     | 2.22      | 540.50   | 11.99     | 0.39              | 0.00               | 12.38     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 55.79 | 53.79            | 51.79 |
| 140                | 2.08  | 50       | 1.06     | 2.65      | 540.50   | 14.32     | 0.48              | 0.00               | 14.79     | 258.34          | 260.34             | 262.34           | 301.75             | 43.41 | 41.41       | 39.41 | 58.20 | 56.20            | 54.20 |

NOTES:

- Loss Coefficients:

Wells - Holding Tank

- 7 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop
- 3 Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank
- 1- Exit loss into holding tank @ K=1.0
- 200psi SDR 21 235psi DR18 305psi DR14 - Maximum Pressure Ratings for various watermain pipe diameters: **50mm** 200psi SDR 21 75mm 100mm

<sup>-</sup> The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW2 is considered to have a yield of 25 IPGM (30.0 USGPM OR 1.89 L/s) at a depth of 2.8m below ground grade (263.14m-2.8m=260.34m) based on its pump test.

<sup>-</sup> The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be

<sup>-</sup> This system-head curve when plotted against the pump-head curve for the proposed well pump (Goulds 25GS20412C), the operating flow capacity of the proposed 50mm waterline is 24.1 IPGM (29 USGPM OR 1.83 L/s) @ 179.7 ft (54.78 m OR 77.9 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).

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Project No: 14-Aug-20 Prepared by: AW

#### Sanitary Sewer Design Sheet Mansfield Ski Club

Elements Requiring Input Information Peak Flow Formulas: where, P = population in 1000's Q<sub>pop</sub> = (P\*q\*M)/86.4 (L/s) Q<sub>Comm/inst</sub> = Design Flow x Peaking Factor (L/s) q = residential sewage unit flow rate Ex Main Chalet Peaking Factor: 4 M = Ultimate Flow Factor (residential peaking factor) Res - SFD Single Family Dwellings: ppd = Q<sub>Ind</sub> = Design Flow x Peaking Factor (L/s) (Harmon) M=1+(14/(4+P<sup>0.5</sup>)) Res - MFD Multi-Family Dwellings: q: 275 L/cap./day ppu = 4 (rainfor)

Q<sub>pop</sub> = peak population flow (L/s)

Q<sub>comm/inst</sub> = peak commercial/institutional flow (L/s)

Q<sub>ind</sub> = peak industrial flow (L/s) Q<sub>Infilt</sub> = i\*A (L/s), where A = Area (ha) i: 1.38 L/mm Ø/100m/hr (as per MOE Guidelines use 1.38 for sewer design & 0.31 (avg) - 0.78 (peak) for PS/STS)

Mannings Coefficient  $Q_d = Q_{pop} + Q_{Comm/lnst} + Q_{Ind} + Q_{Infilt} (L/s)$ Q<sub>Infilt</sub> = peak extraneous (i.e. infiltration) flow (L/s) i = **peak** extraneous (i.e. infiltration) unit flow rate

n: **0.013** 

|                        |                          |                              |                            |                             |                            |                             | MOE Velocity Re            | quirements: 0.6m/s               | s - 3.0m/s       |                                  |   | Q <sub>d</sub> = total peak de   | sign flow (L/s)                  |                              |                                  |                                  |                        |                          |                          |                             |                                  |                              |                              |                              |                                      |                                      |                                      |                                      |
|------------------------|--------------------------|------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------------|------------------|----------------------------------|---|----------------------------------|----------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------|--------------------------|--------------------------|-----------------------------|----------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
|                        | Location                 |                              |                            |                             |                            |                             |                            |                                  | Sewage           | Flow Calculation [               | Data  |                                  |                                  |                              |                                  |                                  |                        |                          | Se                       | wer Calcula                 | ation Data                       |                              |                              |                              | Sewer                                | Profile Data                         |                                      |                                      |
| Block/<br>Building     | Upstream<br>MH           | Downstream<br>MH             | Res - SFD<br># of<br>Units | Res - SFD<br># of<br>People | Res - MFD<br># of<br>Units | Res - MFD<br># of<br>People | Comm/Inst Total Daily Flow | Ex Uses Total Daily Flow (L/day) | -                | Cum. Res - MFD<br># of<br>People | Cum. Comm/Inst<br>Total Daily Flow<br>(L/day) | -                                | Residential<br>Peaking<br>Factor | Sewage<br>Flow               | Infii<br>Individual              | Cumulative                       | Total<br>Flow<br>(L/s) | Dia.                     | Slope                    | Length<br>(m)               | Capacity<br>(L/s)                | Velocity<br>(m/s)            | Fall in<br>Sewer<br>(m)      | Drop in MH (m)               | Top of Grate                         | Elevation (m)                        | Invert Ele                           | evation (m)                          |
| BLOCK 6<br>BLOCK 5     | MH K<br>MH J             | MH J<br>MH H                 | Utilis                     | 0<br>0                      | 12<br>12                   | 48<br>48                    | (L/day)                    | (L'uay)                          | 0<br>0           | 48<br>96                         | 0<br>0  | 0<br>0                           | 4.32<br>4.25                     | 0.66<br>1.30                 | 0.031<br>0.021                   | 0.031<br>0.052                   | 0.69<br>1.35           | 200 200                  | 3.8<br>6.0               | 41.0<br>27.2                | 66.35<br>83.81                   | 2.05                         | 1.54                         | 0.90<br>0.90                 | 305.81<br>305.10                     | 305.10<br>302.71                     | 303.46<br>301.02                     | 301.92<br>299.39                     |
| Ex Uses<br>B           | MH L<br>MH I             | MH I<br>MH H                 |                            | 0<br>0                      | 15                         | 0<br>60                     | 10101                      | 13800                            | 0<br>0           | 0<br>60                          | 0<br>10101                                    | 13800<br>13800                   | 4.30                             | 0.64<br>1.81                 | 0.036<br>0.030                   | 0.036<br>0.066                   | 0.67<br>1.88           | 200<br>200               | 1.0<br>1.0               | 47.0<br>38.6                | 34.22<br>34.22                   | 1.06<br>1.06                 | 0.47<br>0.39                 | 0.05<br>0.05                 | 301.60<br>302.72                     | 302.72<br>302.71                     | 299.45<br>298.93                     | 298.98<br>298.54                     |
| A<br>Block 4           | MH H<br>MH G<br>MH F     | MH G<br>MH F<br>MH E         |                            | 0<br>0<br>0                 | 10<br>8                    | 40<br>32<br>0               | 8132                       |                                  | 0<br>0<br>0      | 196<br>228<br>228                | 18233<br>18233<br>18233                       | 13800<br>13800<br>13800          | 4.15<br>4.13<br>4.13             | 3.86<br>4.27<br>4.27         | 0.021<br>0.016<br>0.013          | 0.139<br>0.155<br>0.168          | 4.00<br>4.42<br>4.44   | 200<br>200<br>200        | 1.0<br>1.3<br>2.8        | 27.7<br>20.3<br>17.4        | 34.22<br>39.46<br>57.26          | 1.06<br>1.22<br>1.77         | 0.28<br>0.27<br>0.49         | 0.10<br>0.10<br>0.08         | 302.71<br>302.25<br>301.23           | 302.25<br>301.23<br>300.15           | 298.49<br>298.11<br>297.74           | 298.21<br>297.84<br>297.25           |
| Block 3 & 2<br>Block 1 | MHE<br>MHD<br>MHC<br>MHB | MH D<br>MH C<br>MH B<br>MH A |                            | 0<br>0<br>0<br>0            | 22<br>12                   | 0<br>88<br>48<br>0          |                            |                                  | 0<br>0<br>0<br>0 | 228<br>316<br>364<br>364         | 18233<br>18233<br>18233<br>18233              | 13800<br>13800<br>13800<br>13800 | 4.13<br>4.07<br>4.04<br>4.04     | 4.27<br>5.37<br>5.95<br>5.95 | 0.019<br>0.055<br>0.018<br>0.007 | 0.187<br>0.242<br>0.260<br>0.267 | 6.21<br>6.22           | 200<br>200<br>200<br>200 | 5.5<br>3.8<br>2.1<br>0.6 | 24.6<br>71.5<br>23.9<br>9.7 | 80.24<br>66.70<br>49.23<br>26.50 | 2.47<br>2.06<br>1.52<br>0.82 | 1.35<br>2.72<br>0.49<br>0.06 | 0.10<br>0.05<br>0.05<br>0.05 | 300.15<br>298.02<br>296.06<br>294.63 | 298.02<br>296.06<br>294.63<br>294.35 | 297.17<br>295.72<br>292.95<br>292.41 | 295.82<br>293.00<br>292.46<br>292.35 |
|                        | MH A                     | BIO                          |                            | 0                           |                            | 0                           |                            |                                  | 0                | 364                              | 18233   | 13800                            | 4.04                             | 5.95                         | 0.004                            | 0.271                            | 6.22                   | 200                      | 4.9                      | 4.7                         | 75.74                            | 2.34                         | 0.23                         | 0.05                         | 294.35                               | 294.48                               | 292.30                               | 292.07                               |

Individual Totals: Cumulative # of People (SFD + MFD):

NOTES: - # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x population density (people per unit = # of bedrooms x 2 people per bedroom).

- The flows from the existing buildings (Main Chalet, Admin Building, GM office & Ski house) have all be conservatively assumed to enter the sewage system from the existing Main Chalet Building.

- The commercial flow have been determined by distributing the commercial/industrial flow over the building area of building 'A' & 'B'.

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where

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# **Sewage Pump Station Design - System Head Curve** Mansfield Ski Club - Sewage Treatment System Discharge Pump Station

**Elements Requiring Input Information** 

Date: 14-Aug-20 Project No: 15-319 Prepared by: JWL

Velocity, V =  $Q_P$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s) <u>Hazen -Williams Equation (re-arranged for Friction Slope)</u>

Q<sub>P</sub> = Peak Sewage Flow (m<sup>3</sup>/s)

9.81 (acceleration due to gravity, m/s²)

(Forcemain Head Loss Calculation)  $(V)^{1/0.54}$ Friction Slope, S = x 100 (m/100m)

Static Head,  $h_{S.MAX} = h_F - h_{LWL}$  (m) Static Head,  $h_{S.MEDIAN} = h_{F} - h_{MWL}$  (m)

Static Head,  $h_{S. MIN} = h_{F} - h_{HWL}$  (m)

Total Dynamic Head,  $h_{D, MAX} = h_{S, MAX} + h_{T.H.L.}$  (m)

Total Dynamic Head,  $h_{D, MEDIAN} = h_{S, MEDIAN} + h_{T.H.L.}(m)$ Total Dynamic Head,  $h_{D, MIN} = h_{S, MIN} + h_{T,H,L}$  (m)

A = Cross-Sectional Area (m²) (0.85CR<sup>0.63</sup>)<sup>1/0.54</sup> Minor Head Loss,  $H_L = (K_1 + K_2 + K_3...) \times V^2/2g$ where,

V = mean velocity (m/s) k = 0.85 for SI units

h<sub>F</sub> = Forcemain Max. Elev. Along Length (m

h<sub>S. MAX</sub> = Maximum Static Head (m) h<sub>S, MEDIAN</sub> = Median Static Head (m)

 $\Sigma K = (K_1 + K_2 + K_3...)$ mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)

C = Roughness Coefficient

R = hydraulic radius (m)

h<sub>LWL</sub> = Wet Well Low Water Level (m) h<sub>MWL</sub> = Wet Well Median Water Level (m) h<sub>HWL</sub> = Wet Well High Water Level (m)

h<sub>S, MIN</sub> = Minimum Static Head (m)  $h_{T.H.L.}$  = Total Head Loss (m)

Wet Well Wet Well Fittings oump Station Wet Well Forcemain Max. Static Head Total Dynamic Head Pipe Design Forcemain Total Coefficient Velocity Distance Head Loss Head Loss Low Water Level Median Water Level High Water Level Elev. Along Length MAX. MIN. Head Loss Head Loss Head Loss Median MAX. Diameter Median (m/100m) (L/s) (mm) (m/s) (m) (m) (m) ΣK<sub>F</sub>= Wet Well ∑K<sub>PS</sub>= Low Water Level 50 133.60 290.80 292.00 299.93 8.53 10.37 9.17 120 0.51 0.91 1.21 0.03 0.00 1.24 291.40 9.13 7.93 9 77 120 2 1.02 3.28 133.60 4.38 0.11 0.00 4.48 290.80 291.40 292.00 299.93 9.13 8.53 7.93 13.61 13.01 12.41 50 120 2.5 50 1.27 4.95 133.60 6.62 0.17 0.00 6.78 290.80 291.40 292.00 299.93 9.13 8.53 7.93 15.91 15.31 14.71 120 3 50 1.53 6.94 133.60 9.28 0.24 0.00 9.51 290.80 291.40 292.00 299.93 9.13 8.53 7.93 18.64 18.04 17.44 120 50 2.04 11.83 133.60 15.80 0.42 0.00 16.23 290.80 291.40 292.00 299.93 9.13 8.53 7.93 25.36 24.76 24.16 Wet Well Median Water Level 0.78 133.60 1.05 1.07 290.80 291.40 292.00 299.93 9.13 8.53 7.93 10.20 9.00 130 50 0.51 0.03 0.00 2 1.02 2.83 133.60 3.77 0.11 0.00 3.88 290.80 291.40 292.00 299.93 9.13 8.53 7.93 13.01 12.41 11.81 130 50 130 2.5 50 1.27 4.27 133.60 5.71 0.17 0.00 5.87 290.80 291.40 292.00 299.93 9.13 8.53 7.93 15.00 14.40 13.80 130 3 50 1.53 5.99 133.60 8.00 0.24 0.00 8.24 290.80 291.40 292.00 299.93 9.13 8.53 7.93 17.37 16.77 16.17 130 50 2.04 10.20 133.60 13.63 0.42 0.00 14.05 290.80 291.40 292.00 299.93 9.13 8.53 7.93 23.18 22.58 21.98 Wet Well High Water Level 290.80 292.00 299.93 8.53 7.93 8.87 50 0.51 0.68 133.60 0.91 0.03 0.00 0.94 291 40 9 13 10.07 9 47 140 292.00 299.93 8.53 7.93 2 50 1.02 2.46 133.60 3.29 0.11 0.00 3.40 290.80 291.40 12.53 11.93 11.33 140 9.13 2.5 50 291.40 299.93 8.53 7.93 13.67 140 1.27 3.72 133.60 4.97 0.17 0.00 5.14 290.80 292.00 9.13 14.27 13.07 140 3 50 1.53 5.22 133.60 6.97 0.24 0.00 7.21 290.80 291.40 292.00 299.93 9 13 8.53 7.93 16.34 15.74 15.14 140 50 2.04 8.89 133.60 11.88 0.42 0.00 12.30 290.80 291.40 292.00 299.93 9.13 8.53 7.93 21.43 20.83 20.23

NOTES:

<sup>-</sup> The Forcemain Flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) used to design the Pump Station should be bound above and below with a range of values to provide a sufficient assessment of the System Head Curve for the particular pump station under all three (3) Pipe Design Conditions/Coefficients.

<sup>-</sup> Pump station head loss is assumed to be negligible based on discussions with John Brooks Company Ltd.

<sup>-</sup> Inlet pipe invert is 292.30m. Temporary inlet is slightly less for Phase 1A.

<sup>-</sup> Fitting headloss consists of a 90 elbow at the discharge point (K=1) and exit loss (K=1).

**APPENDIX C** 

STORMWATER MANAGEMENT CALCULATIONS

# Ontario IDF CURVE LOOKUP

# **Active coordinate**

44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT



# **Location summary**

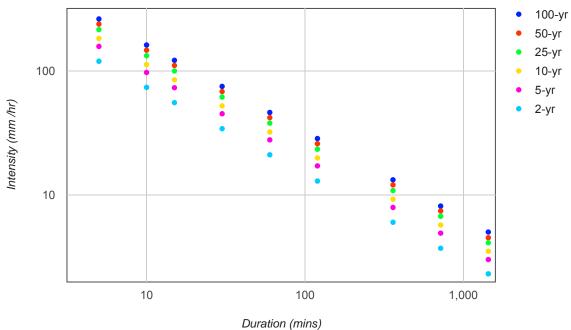
These are the locations in the selection.

**IDF Curve:** 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

### **Results**

An IDF curve was found.





1 of 2

# **Coefficient summary**

IDF Curve: 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT

Data year: 2010 IDF curve year: 2010

| Return period | 2-yr   | 5-yr   | 10-yr  | 25-yr  | 50-yr  | 100-yr |
|---------------|--------|--------|--------|--------|--------|--------|
| Α             | 21.0   | 27.7   | 32.1   | 37.8   | 41.9   | 46.1   |
| В             | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 |

# **Statistics**

# Rainfall intensity (mm hr<sup>-1</sup>)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|----------|-------|--------|--------|--------|------|------|------|-------|-------|
| 2-yr     | 119.3 | 73.5   | 55.3   | 34.1   | 21.0 | 12.9 | 6.0  | 3.7   | 2.3   |
| 5-yr     | 157.3 | 96.9   | 73.0   | 45.0   | 27.7 | 17.1 | 7.9  | 4.9   | 3.0   |
| 10-yr    | 182.3 | 112.3  | 84.6   | 52.1   | 32.1 | 19.8 | 9.2  | 5.7   | 3.5   |
| 25-yr    | 214.7 | 132.3  | 99.6   | 61.4   | 37.8 | 23.3 | 10.8 | 6.7   | 4.1   |
| 50-yr    | 238.0 | 146.6  | 110.4  | 68.0   | 41.9 | 25.8 | 12.0 | 7.4   | 4.5   |
| 100-yr   | 261.8 | 161.3  | 121.5  | 74.8   | 46.1 | 28.4 | 13.2 | 8.1   | 5.0   |

# Rainfall depth (mm)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|----------|-------|--------|--------|--------|------|------|------|-------|-------|
| 2-yr     | 9.9   | 12.2   | 13.8   | 17.0   | 21.0 | 25.9 | 36.0 | 44.4  | 54.7  |
| 5-yr     | 13.1  | 16.2   | 18.2   | 22.5   | 27.7 | 34.1 | 47.5 | 58.5  | 72.1  |
| 10-yr    | 15.2  | 18.7   | 21.1   | 26.1   | 32.1 | 39.5 | 55.0 | 67.8  | 83.6  |
| 25-yr    | 17.9  | 22.0   | 24.9   | 30.7   | 37.8 | 46.6 | 64.8 | 79.9  | 98.4  |
| 50-yr    | 19.8  | 24.4   | 27.6   | 34.0   | 41.9 | 51.6 | 71.9 | 88.5  | 109.1 |
| 100-yr   | 21.8  | 26.9   | 30.4   | 37.4   | 46.1 | 56.8 | 79.1 | 97.4  | 120.0 |

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Last Modified: September 2016

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# STORMWATER MANAGEMENT CALCULATIONS PRE-DEVELOPMENT CONDITION PARAMETERS

**Date**: 17-Aug-20 **Project No**.: 15-319

Project: Mansfield Ski Club Prepared By: JWL

# Pre-Development Condition

| Intern              | al Drainage Are | eas     | Externa             | al Drainage | Areas    |
|---------------------|-----------------|---------|---------------------|-------------|----------|
| PRE1                | = -             | 2.66 ha | EXT                 | =           | 11.71 ha |
| PRE2                | =               | 1.36 ha |                     |             |          |
| Total Internal Area | =               | 4.02 ha | Total External Area | =           | 11.71 ha |

#### Soil Characteristics

(Soil Map of Simcoe County, Ontario, North Sheet, Soil Survey Report No. 29)

#### PRE & EXT

- -> Duc
- -> Dunedin
- -> clay
- -> Good Drainage
- -> Hydrologic Soil Group (D)

To provide an accurate comparison between the pre- and post-development condition considering that both will consist of large gravel parking areas, the STANDHYD command was used for both conditions. To account for the large gravel area present within the pre-development condition, a composite "C" value was determined for the Buildings and parking area. Using the calculated composite "C" value, a "CA" ratio for the Building and Parking areas was determined and then working backwards, an equivalent "CA" ratio assuming all impervious surfaces was used to calculate an equivalent TIMP value for the pre-development conditions STANDHYD command to accurately account for the large packed gravel parking area.

#### SAMPLE CALCULATION:

|                    | SAMPLE | PRE1                    | =      | 2.66 ha   |   |   |  |
|--------------------|--------|-------------------------|--------|---|---|---|--|
|                    |        | С                       | =      | (0.6)(0.90ha) x (0.95)(0  | <u>Gravel Area) + (Buildin</u><br>(Gravel Area + Buildin<br>1.07ha) | _ | Building Area)                           |
|                    |        | С                       | =      | 0.97ha<br>0.63  |   |   |  |
| ACTUAL<br>(gravel) | >>>    | CA <sub>RATIO</sub>     | =<br>= | (0.63)(0.97ha)<br>0.61  | TIMP  | = | 0.07ha<br>2.66ha<br>2.63%                |
|                    |        | A <sub>EQUIVALENT</sub> | = =    | CA <sub>RATIO</sub> C <sub>IMPERVIOUS</sub> 0.61  0.95  0.64 ha |   |   |  |
| EQUIV.<br>(Imp.)   | >>>    | CA <sub>RATIO</sub>     | =<br>= | (0.95)(0.64ha)<br>0.61  | TIMP  | = | <u>0.64ha</u><br>2.66ha<br><b>24.10%</b> |

(Calib Nashyd Command)

# PRE1

| Total Area =  | 2.66         | ha             |           |                            |            |                        |
|---|--------------|----------------|-----------|----------------------------|------------|------------------------|
| Impervious Areas:   |              |                |           | Pervious Areas:            |            |                        |
| Buildings   | =            | 0.07           | ha        | Unimproved                 | =          | 1.59 ha                |
| Grave   | =            | 0.90           | ha        | Treed                      | =          | 0.10 ha                |
| See above notes and sa<br>Buildings and Gravel are            | •            | ations for the | e determi | nation of the Equivalent T | IMP value  | which accounts for the |
| Total Impervious Area   | =            | 0.64           | ha        | Total Pervious Area        | =          | 2.02 ha                |
| XIMP  | =            | 1              | %*        | CN                         | =          | 81 *                   |
| TIMP  | =            | 24             | %         | $I_{A}$                    | =          | 8.1 mm                 |
| LGI   | =            | 100.0          | m         | LGP                        | =          | 80.0 m                 |
| SLPI  | =            | 2.0            | %         | SLPP                       | =          | 10.0 %                 |
| * XIMP was based on the connected areas are the - None of the | e following: | n that the di  | rectly    | * Refer to the             | ne CN & IA | spreadsheet            |

# <u>EXT</u>

| Total Area =      | 11.71 | ha      | CN                       | =                        | 83 *       |
|-------------------|-------|---------|--------------------------|--------------------------|------------|
|                   |       |         | $I_{A}$                  | =                        | 6.8 mm*    |
| Buildings & Roads | =     | 0.80 ha | * Refer to th            | ne CN & I <sub>A</sub> s | preadsheet |
| Pasture           | =     | 2.60 ha |                          |                          |            |
| Lawn              | =     | 2.75 ha | С                        | =                        | 0.41       |
| Treed             | =     | 3.38 ha | * Refer to th            | ne C spread              | sheet      |
| Unimproved        | =     | 2.18 ha |                          | _                        |            |
|                   |       |         | $T_P$                    | =                        | 0.24 hr*   |
|                   |       |         | *Refer to T <sub>0</sub> | & T <sub>P</sub> Sprea   | adsheet    |

# PRE2 (Calib Standhyd Command)

| Total Area =               | 1.36 ha      | a                    |                              |          |                        |
|----------------------------|--------------|----------------------|------------------------------|----------|------------------------|
| Impervious Areas:          |              |                      | Pervious Areas:              |          |                        |
| Buildings                  | =            | 0.06 ha              | Unimproved                   | =        | 0.88 ha                |
| Gravel                     | =            | 0.42 ha              |                              |          |                        |
|                            | •            | ons for the determin | nation of the Equivalent TIM | 1P value | which accounts for the |
| Buildings and Gravel area  | S.           |                      |                              |          |                        |
| Total Impervious Area      | =            | 0.33 ha              | Total Pervious Area          | =        | 1.03 ha                |
| XIMP                       | =            | 1 %*                 | CN                           | =        | 81 *                   |
| TIMP                       | =            | 24 %                 | $I_{A}$                      | =        | 8.0 mm                 |
| LGI                        | =            | 45.0 m               | LGP                          | =        | 70.0 m                 |
| SLPI                       | =            | 3.5 %                | SLPP                         | =        | 13.0 %                 |
| * XIMP was based on the    | assumption t | that the directly    | * Refer to the               | CN & IA  | spreadsheet            |
| connected areas are the fo | ollowing:    |                      |                              |          |                        |
| - None of the              | Areas        |                      |                              |          |                        |

#### **SWMHYMO Results**

#### Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

### 24-hour SCS Type II Storm Distribution

#### PRE1

|                  | Peak Flo |       |                   |
|------------------|----------|-------|-------------------|
| $Q_2$            | =        | 0.166 | m <sup>3</sup> /s |
| $Q_5$            | =        | 0.282 |                   |
| $Q_{25}$         | =        | 0.482 | m <sup>3</sup> /s |
| Q <sub>100</sub> | =        | 0.647 | m <sup>3</sup> /s |

#### PRE2

| Peak Flow Rates  |   |       | Runoff Volumes    |           |   |      |                |
|------------------|---|-------|-------------------|-----------|---|------|----------------|
| $Q_2$            | = | 0.097 | m <sup>3</sup> /s | $V_2$     | = | 344  | m <sup>3</sup> |
| $Q_5$            | = | 0.160 | m <sup>3</sup> /s | $V_5$     | = | 534  | m³             |
| $Q_{25}$         | = | 0.272 | m³/s              | $V_{25}$  | = | 844  |                |
| Q <sub>100</sub> | = | 0.362 | m <sup>3</sup> /s | $V_{100}$ | = | 1110 | $m^3$          |

### Site + External Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed by-pass swale, by-pass storm sewer section and dry detention basin design based on the greater peak flows generated in comparison to the other storm distributions.

|            |                  |   | 24-hour SCS             | Type II Storm Distribution |          |                         |
|------------|------------------|---|-------------------------|----------------------------|----------|-------------------------|
| <u>EXT</u> |                  |   |                         | TOTAL (PRE                 | 1 + EXT) | 1                       |
|            | $Q_2$            | = | 0.592 m <sup>3</sup> /s | $Q_2$                      | =        | 0.756 m <sup>3</sup> /s |
|            | $Q_5$            | = | 0.948 m <sup>3</sup> /s | $Q_{5}$                    | =        | 1.213 m <sup>3</sup> /s |
|            | $Q_{25}$         | = | 1.529 m <sup>3</sup> /s | $Q_{25}$                   | =        | 1.947 m <sup>3</sup> /s |
|            | Q <sub>100</sub> | = | 2.025 m <sup>3</sup> /s | Q <sub>100</sub>           | =        | 2.580 m <sup>3</sup> /s |



# STORMWATER MANAGEMENT CALCULATIONS POST-DEVELOPMENT CONDITION PARAMETERS

**Date:** 17-Aug-20 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: JWL

# Post-Development Condition

| Interna<br>POST1  | al Drainage Areas<br>= | 2.94 ha | External<br>EXT     | Drainage Ar | eas<br>11.94 ha  |  |  |
|---|------------------------|---------|---------------------|-------------|------------------|--|--|
| POST2   | =                      | 0.85 ha |                     |             |                  |  |  |
| Total Internal Area   | =                      | 3.79 ha | Total External Area | =           | 11.94 ha         |  |  |
| POST1   |                        |         |                     | (Calib S    | tandhyd Command) |  |  |
| Total Area =  | 2.94 ha                |         |                     |             |                  |  |  |
| Impervious Areas:   |                        |         | Pervious Areas:     |             |                  |  |  |
| Buildings/Parking   | =                      | 2.03 ha | Lawn                | =           | 0.91 ha          |  |  |
| All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt. |                        |         |                     |             |                  |  |  |
| Total Impervious Area   | =                      | 2.03 ha | Total Pervious Area | =           | 0.91 ha          |  |  |

|   | Total Impervious Area    | =        | 2.03          | ha    | Total Pervious Area | =       | 0.91 ha     |
|---|--------------------------|----------|---------------|-------|---------------------|---------|-------------|
|   | XIMP                     | =        | 59            | %*    | CN                  | =       | 84 *        |
|   | TIMP                     | =        | 69            | %     | $I_{A}$             | =       | 5.0 mm      |
|   | LGI                      | =        | 300.0         | m     | LGP                 | =       | 6.0 m       |
|   | SLPI                     | =        | 3.5           | %     | SLPP                | =       | 33.3 %      |
| * | XIMP was based on the as | ssumptio | n that the di | ectly | * Refer to the      | CN & IA | spreadsheet |

connected areas are the following:
- All areas not directed towards the landscaped parking islands (grass filter strips).

POST2 (Calib Standhyd Command)

| Total Area =  | 0.85        | ha                  |                     |         |             |  |  |  |
|---|-------------|---------------------|---------------------|---------|-------------|--|--|--|
| Impervious Areas: Pervious Areas: Buildings/Parking = 0.18 ha Lawn = 0.67 ha  |             |                     |                     |         |             |  |  |  |
| All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt. |             |                     |                     |         |             |  |  |  |
| Total Impervious Area   | =           | 0.18 ha             | Total Pervious Area | =       | 0.67 ha     |  |  |  |
| XIMP  | =           | 10.5 %*             | CN                  | =       | 84 *        |  |  |  |
| TIMP  | =           | 21 %                | $I_{A}$             | =       | 5.0 mm      |  |  |  |
| LGI   | =           | 120.0 m             | LGP                 | =       | 50.0 m      |  |  |  |
| SLPI  | =           | 6.0 %               | SLPP                | =       | 11.1 %      |  |  |  |
| * XIMP was based on the a   | ssumption   | n that the directly | * Refer to the      | CN & IA | spreadsheet |  |  |  |
| connected areas are the following:  |             |                     |                     |         |             |  |  |  |
| - The east half   | of the buil | dings and the drive | eway/access road.   |         |             |  |  |  |

| Total Area =      | 11.94 | ha      | CN                       | =                        | 83 *       |
|-------------------|-------|---------|--------------------------|--------------------------|------------|
|                   |       |         | $I_{A}$                  | =                        | 6.8 mm*    |
| Buildings & Roads | =     | 0.80 ha | * Refer to th            | ne CN & I <sub>A</sub> s | preadsheet |
| Pasture           | =     | 2.60 ha |                          |                          |            |
| Lawn              | =     | 2.75 ha | С                        | =                        | 0.41       |
| Treed             | =     | 3.38 ha | * Refer to th            | ne C spread              | sheet      |
| Unimproved        | =     | 2.41 ha |                          |                          |            |
|                   |       |         | $T_P$                    | =                        | 0.24 hr*   |
|                   |       |         | *Refer to T <sub>c</sub> | & T <sub>P</sub> Sprea   | adsheet    |

### **SWMHYMO Results**

# Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

# 24-hour SCS Type II Storm Distribution

# SWM Facility

| Uncontrolled Feak Flow Rates |   |       |      |  |  |
|------------------------------|---|-------|------|--|--|
| $Q_2$                        | = | 0.887 |      |  |  |
| $Q_5$                        | = | 1.350 |      |  |  |
| $Q_{25}$                     | = | 2.068 |      |  |  |
| Q <sub>100</sub>             | = | 2.695 | m³/s |  |  |

# Controlled Peak Flow Rates

| $Q_2$            | = | 0.722 |                   |
|------------------|---|-------|-------------------|
| $Q_5$            | = | 1.158 |                   |
| $Q_{25}$         | = | 1.807 |                   |
| Q <sub>100</sub> | = | 2.389 | m <sup>3</sup> /s |

#### Storage Volumes

| $V_2$            | = | 863  |                |
|------------------|---|------|----------------|
| $V_5$            | = | 1037 |                |
| $V_{25}$         | = | 1279 |                |
| V <sub>100</sub> | = | 1463 | m <sup>3</sup> |

# POST2

# Uncontrolled Peak Flow Rates

| $Q_2$            | = | 0.070 | m³/s |
|------------------|---|-------|------|
| $Q_5$            | = | 0.111 | m³/s |
| $Q_{25}$         | = | 0.183 |      |
| Q <sub>100</sub> | = | 0.240 | m³/s |

#### Runoff Volumes

| $V_2$     | = | 254 |   |
|-----------|---|-----|---|
| $V_5$     | = | 378 | m |
| $V_{25}$  | = | 578 |   |
| $V_{100}$ | = | 747 | m |



# RUNOFF COEFFICIENT CALCULATIONS "C" SPREADSHEET

**Date:** 31-Jul-17 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: TG

### **RUNOFF COEFFICIENT NUMBERS**

| Land Cover         |  | Hydro | Hydrologic Soil Groups   |      |  |  |
|--------------------|--|-------|--|------|--|--|
|                    |  | A-AB  | B-BC   | C-D  |  |  |
|                    | 0 - 5% grade                                     | 0.22  | 0.35   | 0.55 |  |  |
| Cultivated Land    | 5 - 10% grade                                    | 0.3   | 0.45   | 0.6  |  |  |
|                    | 10 - 30% grade                                   | 0.4   | 0.65   | 0.7  |  |  |
|                    | 0 - 5% grade                                     | 0.1   | 0.28   | 0.4  |  |  |
| Pasture Land       | 5 - 10% grade                                    | 0.15  | 0.35   | 0.45 |  |  |
|                    | 10 - 30% grade                                   | 0.22  | 0.4  | 0.55 |  |  |
|                    | 0 - 5% grade                                     | 0.08  | 0.25   | 0.35 |  |  |
| Woodlot or Cutover | 5 - 10% grade                                    | 0.12  | 0.3  | 0.42 |  |  |
|                    | 10 - 30% grade                                   | 0.18  | 0.35   | 0.52 |  |  |
| Lakes and Wetlands |  | 0.05  | 0.05   | 0.05 |  |  |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       | 0.95  | 0.95   | 0.95 |  |  |
| Gravel             | (not used for proposed parking or storage areas) | 0.4   | 0.5  | 0.6  |  |  |
| Residential        | Single Family                                    | 0.3   | 0.4  | 0.5  |  |  |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) | 0.5   | A-AB         B-BC           0.22         0.35           0.3         0.45           0.4         0.65           0.1         0.28           0.15         0.35           0.22         0.4           0.08         0.25           0.12         0.3           0.18         0.35           0.05         0.05           0.95         0.95           0.4         0.5           0.3         0.4 | 0.7  |  |  |
| Industrial         | Light  | 0.55  | 0.65   | 0.75 |  |  |
| iridustriai        | Heavy  | 0.65  | A-AB B-BC 0.22 0.35 0.3 0.45 0.4 0.65 0.1 0.28 0.15 0.35 0.22 0.4 0.08 0.25 0.12 0.3 0.18 0.35 0.05 0.05 0.95 0.95 0.4 0.5 0.3 0.4 0.5 0.6 0.55 0.65 0.65 0.75 0.6 0.75 0.6 0.75 0.1 0.2 0.05 0.11 0.1 0.16  | 0.85 |  |  |
| Commercial         |  | 0.6   | 0.7  | 8.0  |  |  |
| Unimproved Areas   |  | 0.1   | 0.2  | 0.3  |  |  |
|                    | < 2% grade                                       | 0.05  | 0.11   | 0.17 |  |  |
| Lawn               | 2 - 7% grade                                     | 0.1   | 0.16   | 0.22 |  |  |
|                    | > 7% grade                                       | 0.15  | 0.25   | 0.35 |  |  |

Ref: Runoff Coefficient Numbers - Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO. (1997)

Elements Requiring Input Information

# PRE-DEVELOPMENT CONDITION - SITE (PRE1)

| Land Cover         |  | Hydrologic Soil Groups |      |      |
|--------------------|--|------------------------|------|------|
|                    |  | A-AB                   | B-BC | C-D  |
| Cultivated Land    | 0 - 5% grade                                     |                        |      |      |
|                    | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Pasture Land       | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      | 0.1  |
| Woodlot or Cutover | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
| Lakes and Wetlands |  |                        |      |      |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       |                        |      | 0.07 |
| Gravel             | (not used for proposed parking or storage areas) |                        |      | 0.9  |
| Residential        | Single Family                                    |                        |      |      |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) |                        |      |      |
| Industrial         | Light  |                        |      |      |
| muusmai            | Heavy  |                        |      |      |
| Commercial         |  |                        |      |      |
| Unimproved Areas   |  |                        |      | 1.59 |
| Lawn               | < 2% grade                                       |                        |      |      |
|                    | 2 - 7% grade                                     |                        |      |      |
|                    | > 7% grade                                       |                        |      |      |

# PRE-DEVELOPMENT CONDITION - SITE (PRE2)

| Land Cover         |  | Hydrologic Soil Groups |      |      |
|--------------------|--|------------------------|------|------|
|                    |  | A-AB                   | B-BC | C-D  |
| Cultivated Land    | 0 - 5% grade                                     |                        |      |      |
|                    | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Pasture Land       | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Woodlot or Cutover | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
| Lakes and Wetlands |  |                        |      |      |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       |                        |      | 0.06 |
| Gravel             | (not used for proposed parking or storage areas) |                        |      | 0.42 |
| Residential        | Single Family                                    |                        |      |      |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) |                        |      |      |
| Industrial         | Light  |                        |      |      |
|                    | Heavy  |                        |      |      |
| Commercial         |  |                        |      |      |
| Unimproved Areas   |  |                        |      | 0.88 |
| Lawn               | < 2% grade                                       |                        |      |      |
|                    | 2 - 7% grade                                     |                        |      |      |
|                    | > 7% grade                                       |                        |      |      |

Total Area (ha) = 1.36

Runoff Coefficient, C = 0.42

# POST-DEVELOPMENT CONDITION - SITE (POST1)

|                    | Land Cover                                       | Hydrologic Soil Groups |      |      |
|--------------------|--|------------------------|------|------|
|                    |  | A-AB                   | B-BC | C-D  |
|                    | 0 - 5% grade                                     |                        |      |      |
| Cultivated Land    | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Pasture Land       | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Woodlot or Cutover | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
| Lakes and Wetlands |  |                        |      |      |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       |                        |      | 2.03 |
| Gravel             | (not used for proposed parking or storage areas) |                        |      |      |
| Residential        | Single Family                                    |                        |      |      |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) |                        |      |      |
| Industrial         | Light  |                        |      |      |
| industriai         | Heavy  |                        |      |      |
| Commercial         |  |                        |      |      |
| Unimproved Areas   |  |                        |      |      |
| Lawn               | < 2% grade                                       |                        |      |      |
|                    | 2 - 7% grade                                     |                        |      |      |
|                    | > 7% grade                                       |                        |      | 0.91 |

Total Area (ha) = 2.94

Runoff Coefficient, C = 0.76

# POST-DEVELOPMENT CONDITION - SITE (POST2)

| Land Cover         |  | Hydrologic Soil Groups |      |      |
|--------------------|--|------------------------|------|------|
|                    |  | A-AB                   | B-BC | C-D  |
| Cultivated Land    | 0 - 5% grade                                     |                        |      |      |
|                    | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Pasture Land       | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
|                    | 0 - 5% grade                                     |                        |      |      |
| Woodlot or Cutover | 5 - 10% grade                                    |                        |      |      |
|                    | 10 - 30% grade                                   |                        |      |      |
| Lakes and Wetlands |  |                        |      |      |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       |                        |      | 0.18 |
| Gravel             | (not used for proposed parking or storage areas) |                        |      |      |
| Residential        | Single Family                                    |                        |      |      |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) |                        |      |      |
| Industrial         | Light  |                        |      |      |
| muusman            | Heavy  |                        |      |      |
| Commercial         |  |                        |      |      |
| Unimproved Areas   |  |                        |      |      |
| Lawn               | < 2% grade                                       | _                      |      |      |
|                    | 2 - 7% grade                                     |                        |      |      |
|                    | > 7% grade                                       | _                      |      | 0.67 |

Total Area (ha) = 0.85

Runoff Coefficient, C = 0.48

# EXTERNAL DRAINAGE AREA (EXT)

| Land Cover         |  | Hydro | Hydrologic Soil Groups |      |  |
|--------------------|--|-------|------------------------|------|--|
|                    |  | A-AB  | B-BC                   | C-D  |  |
| Cultivated Land    | 0 - 5% grade                                     |       |                        |      |  |
|                    | 5 - 10% grade                                    |       |                        |      |  |
|                    | 10 - 30% grade                                   |       |                        |      |  |
|                    | 0 - 5% grade                                     |       |                        | 2.6  |  |
| Pasture Land       | 5 - 10% grade                                    |       |                        |      |  |
|                    | 10 - 30% grade                                   |       |                        |      |  |
|                    | 0 - 5% grade                                     |       |                        |      |  |
| Woodlot or Cutover | 5 - 10% grade                                    |       |                        |      |  |
|                    | 10 - 30% grade                                   |       |                        | 3.38 |  |
| Lakes and Wetlands |  |       |                        |      |  |
| Impervious Area    | (i.e. buildings, roads, parking lot, etc.)       |       |                        | 0.8  |  |
| Gravel             | (not used for proposed parking or storage areas) |       |                        |      |  |
| Desidential        | Single Family                                    |       |                        |      |  |
| Residential        | Multiple (i.e. semi, townhouse, apartment, etc.) |       |                        |      |  |
| Industrial         | Light  |       |                        |      |  |
| industriai         | Heavy  |       |                        |      |  |
| Commercial         |  |       |                        |      |  |
| Unimproved Areas   |  |       |                        | 2.41 |  |
| Lawn               | < 2% grade                                       |       |                        |      |  |
|                    | 2 - 7% grade                                     |       |                        | 2.75 |  |
|                    | > 7% grade                                       |       |                        |      |  |

**Total Area (ha) =** 11.94

Runoff Coefficient, C = 0.41



# CURVE NUMBER & INITIAL ABSTRACTION CALCULATIONS CN & IA SPREADSHEET

**Date:** 31-Jul-17 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: TG

### SCS CURVE NUMBERS (AMC II (NORMAL) CONDITION)

INITIAL RAINFALL ABSTRACTION

|                       |     |     | IA  |     |     |     |     |      |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|------|
| Land Cover            | Α   | AB  | В   | BC  | С   | CD  | D   | (mm) |
| Wetlands/Lakes/SWMF's | 50  | 50  | 50  | 50  | 50  | 50  | 50  |      |
| Woods                 | 32  | 46  | 60  | 67  | 73  | 76  | 79  | 10   |
| Meadows               | 38  | 51  | 65  | 71  | 76  | 79  | 81  | 8    |
| Pasture/Lawn          | 49  | 59  | 69  | 74  | 79  | 82  | 84  | 5    |
| Cultivated            | 62  | 68  | 74  | 78  | 82  | 84  | 86  | 7    |
| Impervious Areas      | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 2    |

Ref: SCS Curve Numbers - Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO.(1997)

Ref: Initial Rainfall Abstraction Values - UNESCO, Manual on Drainage in Urbanized Areas, (1987)

Ref: AMC I & III Condition SCS Curve Number Values - Modern Sewer Design, Third Edition (Canadian), pg. 69, Table 3.6, (1996)

**NOTES:** - **AMC II Condition** SCS Curve Number values are not applicable to frozen soils or to the period where snowmelt contributes to stormwater runoff.

- STANDHYD COMMANDS (Swmhymo) CN values are based solely on the pervious surfaces within the catchment.
- NASHYD COMMANDS (Swmhymo) CN values are based on both the pervious and impervious surfaces within the catchment (composite CN value).

|  | <<< | Elements Requiring | Input Information |
|--|-----|--------------------|-------------------|
|--|-----|--------------------|-------------------|

#### PRE-DEVELOPMENT CONDITION - SITE (PRE1)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

|                       |   |    | (for Standhyd Command) |    |   |    |      |                      |      |
|-----------------------|---|----|------------------------|----|---|----|------|----------------------|------|
| Land Cover            | Α | AB | В                      | BC | С | CD | D    | Pervious Area (ha) = | 1.69 |
| Wetlands/Lakes/SWMF's |   |    |                        |    |   |    |      |                      |      |
| Woods                 |   |    |                        |    |   |    | 0.1  | CN(I) =              | 64   |
| Meadows               |   |    |                        |    |   |    | 1.59 | CN(II) =             | 81   |
| Pasture/Lawn          |   |    |                        |    |   |    |      | CN(III) =            | 92   |
| Cultivated            |   |    |                        |    |   |    |      |                      |      |
| Impervious Areas      |   |    |                        |    |   |    |      | IA (mm) =            | 8.1  |

#### PRE-DEVELOPMENT CONDITION - SITE (PRE2)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

|                       |   |    | Hydro | (for Standhyd Command) |   |    |      |                      |      |
|-----------------------|---|----|-------|------------------------|---|----|------|----------------------|------|
| Land Cover            | Α | AB | В     | BC                     | С | CD | D    | Pervious Area (ha) = | 0.88 |
| Wetlands/Lakes/SWMF's |   |    |       |                        |   |    |      |                      |      |
| Woods                 |   |    |       |                        |   |    |      | CN(I) =              | 64   |
| Meadows               |   |    |       |                        |   |    | 0.88 | CN(II) =             | 81   |
| Pasture/Lawn          |   |    |       |                        |   |    |      | CN(III) =            | 92   |
| Cultivated            |   |    |       |                        |   |    |      |                      |      |
| Impervious Areas      |   |    |       |                        |   |    |      | IA (mm) =            | 8.0  |

### POST-DEVELOPMENT CONDITION - SITE (POST1)

### Area per Land Cover Type and Hydrologic Soil Group

| _                     | Hydrologic Soil Groups |    |   |    |   |    |      | (for Standhyd C      | command) |
|-----------------------|------------------------|----|---|----|---|----|------|----------------------|----------|
| Land Cover            | Α                      | AB | В | BC | С | CD | D    | Pervious Area (ha) = | 0.91     |
| Wetlands/Lakes/SWMF's |                        |    |   |    |   |    |      |                      |          |
| Woods                 |                        |    |   |    |   |    |      | CN(I) =              | 68       |
| Meadows               |                        |    |   |    |   |    |      | CN(II) =             | 84       |
| Pasture/Lawn          |                        |    |   |    |   |    | 0.91 | CN(III) =            | 93       |
| Cultivated            |                        |    |   |    |   |    |      |                      |          |
| Impervious Areas      |                        |    |   |    |   |    |      | IA (mm) =            | 5.0      |

### POST-DEVELOPMENT CONDITION - SITE (POST2)

#### Area per Land Cover Type and Hydrologic Soil Group

|                       |   |    | Hydro | (for Standhyd Command) |   |    |      |                      |      |
|-----------------------|---|----|-------|------------------------|---|----|------|----------------------|------|
| Land Cover            | Α | AB | В     | BC                     | С | CD | D    | Pervious Area (ha) = | 0.67 |
| Wetlands/Lakes/SWMF's |   |    |       |                        |   |    |      |                      |      |
| Woods                 |   |    |       |                        |   |    |      | CN(I) =              | 68   |
| Meadows               |   |    |       |                        |   |    |      | CN(II) =             | 84   |
| Pasture/Lawn          |   |    |       |                        |   |    | 0.67 | CN(III) =            | 93   |
| Cultivated            |   |    |       |                        |   |    |      |                      |      |
| Impervious Areas      |   |    |       |                        |   |    |      | IA (mm) =            | 5.0  |

### External Drainage Area (EXT)

#### Area per Land Cover Type and Hydrologic Soil Group

|                       |   |    | Hydro | (for Nashyd C | Command) |    |      |                   |       |
|-----------------------|---|----|-------|---------------|----------|----|------|-------------------|-------|
| Land Cover            | Α | AB | В     | BC            | С        | CD | D    | Total Area (ha) = | 11.94 |
| Wetlands/Lakes/SWMF's |   |    |       |               |          |    |      |                   |       |
| Woods                 |   |    |       |               |          |    | 3.38 | CN(I) =           | 67    |
| Meadows               |   |    |       |               |          |    | 2.41 | CN(II) =          | 83    |
| Pasture/Lawn          |   |    |       |               |          |    | 5.35 | CN(III) =         | 93    |
| Cultivated            |   |    |       |               |          |    |      |                   |       |
| Impervious Areas      |   |    |       |               |          |    | 8.0  | IA (mm) =         | 6.8   |

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\lssue\_No2\[170731-CN\_&\_IA\_CALCS.xlsx]CN & IA CALCS



# TIME OF CONCENTRATION & TIME TO PEAK CALCULATIONS $T_{\text{C}} \& T_{\text{P}} \mbox{ SPREADSHEET} \label{eq:total_constraint}$

**Date:** 31-Jul-17 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: TG

OVERLAND SHEET FLOW TIME OF CONCENTRATION ( $T_{\text{C}}$ ) CALCULATION,  $T_{\text{C, OVER}}$ 

The Runoff Coefficient 'C' governs which Time of Concentration Formula is used: C > 0.40 Bransby Williams Formula

C <= 0.40 Airport Formula (FAA Equation)

Ref: MTO, Drainage Management Manual, pg 28, Ch. 8, 1997

<<< Elements Requiring Input Information</p>

| Catchment | Area | h₁  | h <sub>2</sub> | Length | Runoff      | h <sub>DELTA</sub> | Slope |
|-----------|------|-----|----------------|--------|-------------|--------------------|-------|
| I.D.      | (ha) | (m) | (m)            | (m)    | Coefficient | (m)                | (%)   |
|           |      |     |                |        |             |                    |       |

| T <sub>C, OVER</sub> (min.) |         |  |  |  |  |
|-----------------------------|---------|--|--|--|--|
| Airport Bransby Williams    |         |  |  |  |  |
| Formula                     | Formula |  |  |  |  |
|                             | 21.0    |  |  |  |  |

Airport Formula (FAA Equation)

 $T_{C, OVER}$  =  $3.26 (1.1-C) (L)^{0.5} (min.)$ 

 $T_{C, OVER} = 0.057 (L)$   $(S)^{0.2} (A)^{0.1}$ 

Bransby Williams Formula

\_\_\_ (min.)

where, C = Runoff Coefficient

L = Length of Overland Flow Path, (m)
S = Avg. Slope of Overland Flow Path, (%)

where, L = Length of Overland Flow Path, (m)

S = Avg. Slope of Overland Flow Path, (%) A = Catchment Area, (ha)

CHANNELIZED FLOW TIME OF CONCENTRATION ( $T_{C}$ ) CALCULATION,  $T_{C,\;CHAN}$ 

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Flow Master Output, Manning's Channel Spreadsheet, etc.).

| Catchment I.D. | Length<br>(m) | Velocity<br>(m/s) |
|----------------|---------------|-------------------|
|                |               |                   |
|                |               |                   |
|                |               |                   |

$$T_{C, CHAN} = L$$

where, L = Length of Channel, (m)

V = Flow Velocity in Channel, (m/s)

PIPED FLOW TIME OF CONCENTRATION ( $T_{\text{C}}$ ) CALCULATION,  $T_{\text{C, PIPE}}$ 

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Culvert Master Output, Manning's Pipe Spreadsheet, etc.).

(min.)

| Catchment I.D. | Length<br>(m) | Velocity<br>(m/s) |
|----------------|---------------|-------------------|
|                |               |                   |
|                |               |                   |
|                |               |                   |

(min.) v

L = Length of Pipe, (m)

V = Flow Velocity in Pipe, (m/s)

TOTAL TIME OF CONCENTRATION ( $T_{C}$ ) AND TIME TO PEAK ( $T_{P}$ ) CALCULATION,  $T_{C,\,TOTAL}$ ,  $T_{P,\,TOTAL}$ 

The Total Time of Concentration and Time to Peak values consist of a combination of the Overland, Channel and/or Pipe travel times.

| Catchment I.D. | T <sub>C, OVER</sub> (min.) | T <sub>C, CHAN</sub><br>(min.) | T <sub>C, PIPE</sub><br>(min.) |
|----------------|-----------------------------|--------------------------------|--------------------------------|
| EXT            | 21.0                        |                                |                                |

$$\begin{array}{lll} T_{C,\; TOTAL} & = & T_{C,\; OVER} + T_{C,\; CHAN} + T_{C,\; PIPE} & (min.) \\ T_{P,\; TOTAL} & = & 0.67\; x\; T_{C,\; TOTAL} & (min.) \\ \end{array}$$



# STAGE-STORAGE CALCULATIONS SWM FACILITY DESIGN SPREADSHEET

**Date**: 17-Aug-20 **Project No.**: 15-319

Project: Mansfield Ski Club Prepared By: BD

<>< Elements Requiring Input Information

Required Permanent Pool Volume = m<sup>3</sup>
Provided Permanent Pool Volume = m<sup>3</sup>

Bottom Elevation, Base = 294.35 m

Normal Water Level Elevation, NWL = 294.35 m (for dry facilities, NWL is assumed at Base)

Top Elevation, Top = 296.90 m

Stage-Storage Information:

| Description | Elevation<br>(m) | Stage<br>(m) | Area<br>1<br>(m²) | Area<br>2<br>(m²) | Total<br>Area<br>(m²) | Avg.<br>Area<br>(m²) | Incremental<br>Storage<br>Volume<br>(m³) | Total<br>Storage<br>Volume<br>(m³) | Total Storage<br>Volume Above<br>NWL<br>(m³) |
|-------------|------------------|--------------|-------------------|-------------------|-----------------------|----------------------|--|------------------------------------|--|
| Base        | 294.35<br>295.55 | 0.00<br>1.20 | 182.3<br>645.0    |                   | 182.3<br>645.0        | -<br>413.7           | -<br>496.4                               | 0.0<br>496.4                       | 0.0<br>0.0                                   |
|             | 296.60           | 2.25         | 1269.4            |                   | 1269.4                | 957.2                | 1005.1                                   | 1501.4                             | 0.0  |
| Тор         | 296.90           | 2.55         | 1420.4            |                   | 1420.4                | 1344.9               | 403.5                                    | 1904.9                             | 0.0  |

Only increments of 0.01m are valid

Determining the Water Surface Elevation of a known Storage Volume:

Determining the Storage Volume at a known Water Surface Elevation:

Total Storage Incl. P.P. Only

W.S. Elevation = Storage Volume =

|           |                  | Total Storage<br>Incl. P.P. | Active Storage<br>Only |
|-----------|------------------|-----------------------------|------------------------|
| Extended  | Storage Volume = | 493                         |                        |
| Detention | W.S. Elevation = | 295.55                      |                        |
| 2 voor    | Storage Volume = | 863                         |                        |
| 2-year    | W.S. Elevation = | 296.02                      |                        |
| Even      | Storage Volume = | 1037                        |                        |
| 5-year    | W.S. Elevation = | 296.20                      |                        |
| 25 year   | Storage Volume = | 1279                        |                        |
| 25-year   | W.S. Elevation = | 296.42                      |                        |
| 100-year  | Storage Volume = | 1463                        |                        |
| 100-year  | W.S. Elevation = | 296.57                      |                        |
| Regional  | Storage Volume = | 1192                        |                        |
| Regional  | W.S. Elevation = | 296.35                      |                        |



# EXTENDED DETENTION VOLUME DRAWDOWN TIME & PEAK FLOW CALCULATIONS SWM FACILITY DESIGN SPREADSHEET

**Date:** 17-Aug-20 **Project No.:** 15-319

Project: Mansfield Ski Club Prepared By: BD

Elements Requiring Input Information

Active Storage Stage-Area Relationship (from Table above):

|     | Elevation<br>(m) | Stage<br>(m) | Total<br>Area<br>(m²) |
|-----|------------------|--------------|-----------------------|
| NWL | 294.35           | 0.00         | 182.3                 |
|     | 295.55           | 1.20         | 645.0                 |
|     | 296.60           | 2.25         | 1269.4                |
| Top | 296.90           | 2.55         | 1420.4                |
|     |                  |              |                       |
|     |                  |              |                       |
|     |                  |              |                       |
|     |                  |              |                       |
|     |                  |              |                       |

#### Extended Detention Drawdown Time:

|                     | t                    | = | 0.66C <sub>2</sub> h <sup>1.5</sup> +2C | C <sub>3</sub> h <sup>0.5</sup> /2.75Ao | (MOE Equation 4.11)   |
|---------------------|----------------------|---|---|---|---|
| where,              | t                    | = | drawdown tim                            | e (sec)                                 |   |
|                     | $C_2$                | = | slope coeff. fro                        | om area-depth l                         | inear regression  |
|                     | $C_3$                | = | intercept from                          | area-depth line                         | ar regression   |
|                     | $h_{CL}$             | = | maximum hea                             | ad (extended de                         | tention volume) acting on centroid of orifice (m)   |
| Extended Detenti    | on Elev              | = | extended dete                           | ention water sur                        | face elevation (m)  |
| Orifice Inve        | ert Flev             | = |   | invert elevation                        | ` '   |
| 000                 | A <sub>O</sub>       |   |   | ectional area (r                        | *_ *  |
|                     | 70                   | = | Office Cross-s                          | ectional area (i                        | II <i>)</i>   |
| 0                   | .:                   |   | 0.00                                    | (t i lb                                 | 00 (  |
| Orifice Coeffi      | , -                  | = | 0.63                                    |   | .63 for orifice plate design)   |
| Orifice Plate Diame | eter, D <sub>O</sub> | = | 75                                      | •                                       | n recommended orifice size is a <b>75mm</b> diameter)   |
|                     | $A_{O}$              | = | 0.00442                                 | m <sup>2</sup>                          |   |
| Extended Detenti    | on Elev              | = | 295.55                                  | m                                       |   |
| Orifice Inve        | ert Elev             | = | 294.35                                  | m                                       |   |
|                     | $h_{CL}$             | = | 1.162                                   | m                                       |   |
|                     | $C_2$                | = | 493.51                                  | <<<                                     | within each of these two (2) formulas the arrays must be changed to match the range of values listed in the table above |
|                     | $C_3$                | = | 139.01                                  | <<<                                     | (i.e. Stage & Total Area columns)   |
|                     |                      |   |   |   |   |
|                     | t                    | = | 58276                                   | sec                                     |   |
|                     | t                    | = | 16.2                                    | hr                                      |   |

**NOTE:** The recommended drawdown time is 24hr but if an orifice size smaller than the required minimum (75mm dia.) is necessary to achieve the 24hr drawdown time than a minimum 12hr drawdown time is considered to be acceptable).

Quality Storm Peak Release Rate from Facility:

Submerged Weir (Orifice Flow)

 $(m^3/s)$ 

Submerged Sharp-Crested Weirs  $Q = C_0 A_0 (2gH)^{1/2}$ 

where, Q = Flow through submerged weir

opening (m<sup>3</sup>/s)

opening (m)

C<sub>O</sub> = Orifice Discharge Coefficient

A<sub>O</sub> = Cross-sectional area of opening (m<sup>2</sup>)

g = Gravitational acceleration (9.81m²/s)

H = Head/Depth of water acting on orifice

measured from centroid of the



#### STAGE-STORAGE-DISCHARGE (S-S-D) CALCULATIONS **SWM FACILITY**

Date: 17-Aug-20 Project No.: 15-319 Project: Mansfield Ski Club Prepared By: BD

<<<

 $Q = C_0 A_0 (2gH)^{1/2} (m^3/s)$ 

For circular vertical orifice,

For circular horizontal orifice.

where, Q = Flow through submerged orifice (m<sup>3</sup>/s)

C<sub>O</sub> = Orifice Discharge Coefficient

A<sub>O</sub> = Cross-sectional area of orifice (m<sup>2</sup>)

g = Gravitational acceleration (9.81m<sup>2</sup>/s)

H = Head/Depth of water acting on orifice

H = Head/Depth of water acting on orifice

measured from above the invert (m)

measured from centroid of the opening (m)

Submerged Orifice (Orifice Flow)

Unsubmerged Weir (Weir Flow)

Rectangular Broad- & Sharp-Crested Weirs  $Q = C_W L H^{3/2} \qquad (m^3/s)$ Triangular Broad-Crested Weirs

 $Q = 1.225H^{5/2}tan(Theta/2) (m^3/s)$ 

**Elements Requiring Input Information** 

Triangular Sharp-Crested Weirs

 $Q = 0.581(8/15)(2g)^{1/2}tan(Theta/2)H^{5/2}$  (m<sup>3</sup>/s) Trapezoidal Broad- & Sharp-Crested Weirs

Q<sub>TRAPEZOIDAL</sub> = Q<sub>RECTANGULAR</sub> + Q<sub>TRIANGULAR</sub> (m<sup>3</sup>/s)

where, Q = Flow through unsubmerged weir (m<sup>3</sup>/s)

C<sub>W</sub> = Weir Coefficient

(1.65 for Broad-Crested)

(1.80 for Sharp-Crested) H = Head/Depth of water acting on weir

measured from above the crest (m) L = Length of weir measured perpendicular

to flow direction (m)
Theta/2 = Angle of side slope measured from vertical

axis (degrees)

g = Gravitational acceleration (9.81m<sup>2</sup>/s)

#### NOTES: Orifice Flow Notes

Unsubmerged Orifice (Weir Flow)

 $Q = C_W LH^{3/2} (m^3/s)$ 

where, Q = Flow through unsubmerged

orifice (m³/s)

L = Length of weir (m)

L = Wetted Perimeter

L = Circumference

L = 3.14 x D

For circular vertical weir,

For circular horizontal weir.

H = Head/Depth of water acting on

crest/invert of orifice (m)

D = Diameter of Pipe/Orifice (m)

 $L = D \times \cos^{-1}((D/2 - H)/(D/2))$ 

weir measured from above the

C<sub>w</sub> = Weir Coefficient

- Vertical Orifice Flow calculations assume weir flow up to the centroid/center of orifice and then orifice flow above the crown/top of the orifice. Between the centroid and crown of the orifice is a flow transition stage from weir to orifice flow and is calculated based on a linear interpolation between the known weir flow at the centroid of the orifice and the known orifice flow at the crown.

- Horizontal Orifice Flow calculations assume weir flow up to one-quarter of the orifices diameter (0.25xD) and then orifice flow above three-quarters of the orifices diameter (0.75xD). Between (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and the known orifice flow at (0.75xD). Weir Flow Notes

- Orifice control is only applicable if the weir opening is submerged and not exposed to atmospheric pressure for all ranges of water elevations.

- For all Weir Types, orifice control occurs when the water surface elevation is equal to or greater than the crown/top of the opening.

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\lssue\_No1\[200817\_Detailed\_S-S-D\_Table.xlsx]S-S-D Table

Starting Water Elevation, m = Incremental Depth, m =

NOTES:

|                                | Orifice 1 | Orifice 2 | Orifice 3 | Weir 1        | Weir 2               | Weir 3               |
|--------------------------------|-----------|-----------|-----------|---------------|----------------------|----------------------|
|                                |           |           |           | Rectangular   | Triangular           | Trapezoidal          |
| Orifice Type =                 | Vertical  |           |           | Sharp-Crested | <b>Broad-Crested</b> | <b>Broad-Crested</b> |
| Orifice Invert Elev., m =      | 294.35    |           |           | 295.55        | 296.25               | 296.55               |
| Incremental Depth, m =         | 0.05      | 0.05      | 0.05      | 0.05          | 0.05                 | 0.05                 |
| Water Elev. @ Inflow, m =      | 294.35    |           |           |               |                      |                      |
| Orifice Diameter, m =          | 0.075     |           |           | 1.20          |                      | 4.00                 |
| Centroid of Orifice, m =       | 294.388   |           |           | 1.80          | 1.65                 | 1.65                 |
| Orifice Area, m <sup>2</sup> = | 0.0044    |           |           |               | 2                    | 10                   |
| Orifice Coefficient =          | 0.63      |           |           |               | 63                   | 84                   |
| Weir Coefficient =             | 1.80      |           |           |               |                      |                      |
| _                              |           |           |           |               |                      |                      |

= Weir Type

= Weir Crest Elev.. m

= Incremental Depth, m = Weir Openings Crown Elev., m (if appl.)

= Weir Length, m

= Weir Coefficient = Side Slope (H:1)

= Theta/2, Degrees

= Centroid of Orifice, m (if appl.)

= Orifice Area, m<sup>2</sup> (if appl.) Orifice Coefficient (if appl.)

| Elevation | Area   | Area | Total  | Storage |
|-----------|--------|------|--------|---------|
|           | 1      | 2    | Area   | Volume  |
| (m)       | (m²)   | (m²) | (m²)   | (m³)    |
| 294.35    | 182.3  |      | 182.3  | 0.0     |
| 295.55    | 645.0  |      | 645.0  | 496.4   |
| 296.60    | 1269.4 |      | 1269.4 | 1501.4  |
| 296.90    | 1420.4 |      | 1420.4 | 1904.9  |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |
|           |        |      |        |         |

Only increments of 0.01m are valid

|             |           |           |           |           |                     |                     |                     |                     |                   | Only increments of 0.01m are valid                       |
|-------------|-----------|-----------|-----------|-----------|---------------------|---------------------|---------------------|---------------------|-------------------|--|
| Description | Elevation | Orifice 1 | Orifice 2 | Orifice 3 | Weir 1              | Weir 2              | Weir 3              | Total               | Total             | Notes  |
|             |           | Flow      | Flow      | Flow      | Flow                | Flow                | Flow                | Flow                | Storage Volume    |  |
|             | (m)       | (m³/s)    | (m³/s)    | (m³/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> ) |  |
| Base        | 294.35    | 0.0000    |           |           |                     |                     |                     | 0.0000              | 0.0               |  |
|             | 294.40    | 0.0015    |           |           |                     |                     |                     | 0.0015              | 9.5               |  |
|             | 294.45    | 0.0031    |           |           |                     |                     |                     | 0.0031              | 19.6              |  |
|             | 294.50    | 0.0041    |           |           |                     |                     |                     | 0.0041              | 30.5              |  |
|             | 294.55    | 0.0050    |           |           |                     |                     |                     | 0.0050              | 42.2              |  |
|             | 294.60    | 0.0057    |           |           |                     |                     |                     | 0.0057              | 54.7              |  |
|             | 294.65    | 0.0063    |           |           |                     |                     |                     | 0.0063              | 68.1              |  |
|             | 294.70    | 0.0069    |           |           |                     |                     |                     | 0.0069              | 82.3              |  |
|             | 294.75    | 0.0074    |           |           |                     |                     |                     | 0.0074              | 97.5              |  |
|             | 294.80    | 0.0079    |           |           |                     |                     |                     | 0.0079              | 113.6             |  |
|             | 294.85    | 0.0084    |           |           |                     |                     |                     | 0.0084              | 130.8             |  |
|             | 294.90    | 0.0088    |           |           |                     |                     |                     | 0.0088              | 148.9             |  |
|             | 294.95    | 0.0092    |           |           |                     |                     |                     | 0.0092              | 168.2             |  |
|             | 295.00    | 0.0096    |           |           |                     |                     |                     | 0.0096              | 188.5             |  |
|             | 295.05    | 0.0100    |           |           |                     |                     |                     | 0.0100              | 210.0             |  |
|             | 295.00    | 0.0104    |           |           |                     |                     |                     | 0.0104              | 232.7             |  |
|             | 295.15    | 0.0104    |           |           |                     |                     |                     | 0.0104              | 256.6             |  |
|             | 295.20    | 0.0100    |           |           |                     |                     |                     | 0.0100              | 281.8             |  |
|             | 295.25    | 0.0111    |           |           |                     |                     |                     | 0.0111              | 308.3             |  |
|             | 295.30    | 0.0114    |           |           |                     |                     |                     | 0.0114              | 336.1             |  |
|             | 295.35    | 0.0116    |           |           |                     |                     |                     | 0.0116              | 365.3             |  |
|             | 295.40    | 0.0121    |           |           |                     |                     |                     | 0.0121              | 395.8             |  |
|             |           |           |           |           |                     |                     |                     |                     |                   |  |
|             | 295.45    | 0.0127    |           |           |                     |                     |                     | 0.0127              | 427.9             |  |
|             | 295.50    | 0.0130    |           |           | 0.000               |                     |                     | 0.0130              | 461.4             | -  |
|             | 295.55    | 0.0133    |           |           | 0.000               |                     |                     | 0.0133              | 496.4             | Extended Detention (Q=0.0133m3/s, V=493.00m3 at 295.54m) |
|             | 295.60    | 0.0136    |           |           | 0.024               |                     |                     | 0.0377              | 529.3             |  |
|             | 295.65    | 0.0139    |           |           | 0.068               |                     |                     | 0.0822              | 563.4             |  |
|             | 295.70    | 0.0141    |           |           | 0.125               |                     |                     | 0.1396              | 598.9             |  |
|             | 295.75    | 0.0144    |           |           | 0.193               |                     |                     | 0.2076              | 635.7             |  |
|             | 295.80    | 0.0147    |           |           | 0.270               |                     |                     | 0.2847              | 673.8             |  |
|             | 295.85    | 0.0149    |           |           | 0.355               |                     |                     | 0.3698              | 713.4             |  |
|             | 295.90    | 0.0152    |           |           | 0.447               |                     |                     | 0.4624              | 754.5             |  |
|             | 295.95    | 0.0154    |           |           | 0.546               |                     |                     | 0.5619              | 797.0             |  |
|             | 296.00    | 0.0157    |           |           | 0.652               |                     |                     | 0.6677              | 841.1             | 2-year storm (Q=0.722m3/s, V=863m3 at 296.02m)           |
|             | 296.05    | 0.0159    |           |           | 0.764               |                     |                     | 0.7796              | 886.7             |  |
|             | 296.10    | 0.0161    |           |           | 0.881               |                     |                     | 0.8972              | 933.9             |  |
|             | 296.15    | 0.0164    |           |           | 1.004               |                     |                     | 1.0202              | 982.7             |  |
|             | 296.20    | 0.0166    |           |           | 1.132               |                     |                     | 1.1485              | 1033.2            | 5-year storm (Q=1.158m3/s, V=1037m3 at 296.20m)          |
|             | 296.25    | 0.0168    |           |           | 1.265               | 0.000               |                     | 1.2819              | 1085.4            |  |
|             | 296.30    | 0.0170    |           |           | 1.403               | 0.001               |                     | 1.4214              | 1139.4            |  |
|             | 296.35    | 0.0173    |           |           | 1.546               | 0.008               |                     | 1.5706              | 1195.1            | Regional storm (Q=1.576m3/s, V=1192.0m3 at 296.35m)      |
|             | 296.40    | 0.0175    |           |           | 1.693               | 0.021               |                     | 1.7315              | 1252.6            | 25-year storm (Q=1.807m3/s, V=1279.0m3 at 296.43m)       |
|             | 296.45    | 0.0177    | ĺ         |           | 1.844               | 0.044               | ĺ                   | 1.9058              | 1312.0            |  |
|             | 296.50    | 0.0179    | ĺ         |           | 2.000               | 0.077               | ĺ                   | 2.0945              | 1373.2            |  |
| Freeboard   | 296.55    | 0.0181    | 1         |           | 2.160               | 0.121               | 0.000               | 2.2989              | 1436.3            | 100-year storm (Q=2.389m3/s, V=1463.0m3 at 296.58m)      |
|             | 296.60    | 0.0183    | 1         |           | 2.324               | 0.178               | 0.081               | 2.6005              | 1501.4            |  |
|             | 296.65    | 0.0185    |           |           | 2.492               | 0.248               | 0.247               | 3.0059              | 1565.5            |  |
|             | 296.70    | 0.0187    | ĺ         |           | 2.664               | 0.333               | 0.490               | 3.5055              | 1630.8            |  |
|             | 296.75    | 0.0189    | ĺ         |           | 2.839               | 0.433               | 0.809               | 4.1009              | 1697.4            |  |
|             | 296.80    | 0.0191    |           |           | 3.019               | 0.550               | 1.208               | 4.7953              | 1765.3            |  |
|             | 296.85    | 0.0193    | ĺ         |           | 3.202               | 0.683               | 1.688               | 5.5925              | 1834.4            |  |
| Тор         | 296.90    | 0.0195    | İ         |           | 3.388               | 0.835               | 2.254               | 6.4966              | 1904.9            |  |

### **Culvert Calculator Report** 15-319 SWM Facility Outlet Pipe

Comments: Outlet Pipe sized to convey the attenuated 100-year peak flow (2.389cu.m/s) released from the SWM Facility.

Solve For: Headwater Elevation

| Culvert Summary           |                    |     |                        |               |      |
|---------------------------|--------------------|-----|------------------------|---------------|------|
| Allowable HW Elevation    | 296.57             | m   | Headwater Depth/Height | 2.55          |      |
| Computed Headwater Eleva  | 296.54             | m   | Discharge              | 2.3890        | m³/s |
| Inlet Control HW Elev.    | 296.54             | m   | Tailwater Elevation    | 294.05        | m    |
| Outlet Control HW Elev.   | 296.17             | m   | Control Type           | Inlet Control |      |
| Grades                    |                    |     |                        |               |      |
| Upstream Invert           | 294.20             | m   | Downstream Invert      | 294.07        | m    |
| Length                    | 12.50              |     | Constructed Slope      | 0.010400      |      |
| Hydraulic Profile         |                    |     |                        |               |      |
| Profile CompositeM2Pres   | sureProfile        |     | Depth, Downstream      | 0.86          | m    |
| Slope Type                | Mild               |     | Normal Depth           | N/A           | m    |
| Flow Regime               | Subcritical        |     | Critical Depth         | 0.86          | m    |
| Velocity Downstream       | 3.74               | m/s | Critical Slope         | 0.013830      | m/m  |
| Section                   |                    |     |                        |               |      |
| Section Shape             | Circular           |     | Mannings Coefficient   | 0.013         |      |
| Section Material          | Concrete           |     | Span                   | 0.91          | m    |
| Section Size              | 900 mm             |     | Rise                   | 0.91          | m    |
| Number Sections           | 1                  |     |                        |               |      |
| Outlet Control Properties |                    |     |                        |               |      |
| Outlet Control HW Elev.   | 296.17             | m   | Upstream Velocity Head | 0.67          | m    |
| Ke                        | 0.50               |     | Entrance Loss          | 0.34          | m    |
| Inlet Control Properties  |                    |     |                        |               |      |
| Inlet Control HW Elev.    | 296.54             | m   | Flow Control           | Submerged     |      |
| Inlet Type Square edge v  |                    |     | Area Full              | 0.7           | m²   |
| K                         | 0.00980            |     | HDS 5 Chart            | 1             |      |
|                           |                    |     |                        | -             |      |
| M                         | 2.00000            |     | HDS 5 Scale            | 1             |      |
| M<br>C                    | 2.00000<br>0.03980 |     | Equation Form          | 1             |      |

## Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

|                       | <u> </u>        | <u>'</u> |
|-----------------------|-----------------|----------|
| Project Description   |                 |          |
| Friction Method       | Manning Formula |          |
| Solve For             | Discharge       |          |
| Input Data            |                 |          |
| Roughness Coefficient | 0.069           |          |
| Channel Slope         | 33.30           | %        |
| Normal Depth          | 0.30            | m        |
| Left Side Slope       | 4.0             | H:V      |
| Right Side Slope      | 4.0             | H:V      |
| Bottom Width          | 2.00            | m        |
| Results               |                 |          |
| Discharge             | 2.878           | m³/s     |
| Flow Area             | 0.96            | m²       |
| Wetted Perimeter      | 4.47            | m        |
| Hydraulic Radius      | 0.21            | m        |
| Top Width             | 4.40            | m        |
| Critical Depth        | 0.44            | m        |
| Critical Slope        | 7.15            | %        |
| Velocity              | 3.00            | m/s      |
| Velocity Head         | 0.46            | m        |
| Specific Energy       | 0.76            | m        |
| Froude Number         | 2.05            |          |
| Flow Type             | Supercritical   |          |
| GVF Input Data        |                 |          |
| Downstream Depth      | 0.00            | m        |
| Length                | 0.00            | m        |
| Number Of Steps       | 0               |          |
| GVF Output Data       |                 |          |
| Upstream Depth        | 0.00            | m        |
| Profile Description   |                 |          |
| Profile Headloss      | 0.00            | m        |
| Downstream Velocity   | Infinity        | m/s      |
| Upstream Velocity     | Infinity        | m/s      |
| Normal Depth          | 0.30            | m        |
| Critical Depth        | 0.44            | m        |
| Channel Slope         | 33.30           | %        |
|                       |                 |          |

### Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

### **GVF Output Data**

Critical Slope 7.15 %

### Messages

Notes

The governing release rate from the basin is the 100-year design storm controlled peak flow (24 hour SCS Type-II Distribution)

The Basin Overflow Spillway Capacity is 2.878cms.

## Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

|           |      | _     |     |     |        |   |
|-----------|------|-------|-----|-----|--------|---|
| $Dr \cap$ | IDOT | 1 100 | ori | nti | $^{r}$ | ٦ |
| Pro       | ICUL | DC3   | o i | บแ  | UΙ     | ı |
|           |      |       |     |     |        |   |

Friction Method Manning Formula
Solve For Discharge

### Input Data

 Roughness Coefficient
 0.069

 Channel Slope
 33.30 %

 Normal Depth
 0.30 m

 Left Side Slope
 4.0 H:V

 Right Side Slope
 4.0 H:V

 Bottom Width
 2.00 m

|                  |                  |                |                | Wetted Perimeter |               |
|------------------|------------------|----------------|----------------|------------------|---------------|
| Normal Depth (m) | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | (m)              | Top Width (m) |
| 0.00             |                  | 0.00           | 0.00           | 0.00             | 0.00          |
| 0.00             | 0.000            | 0.00           | 0.00           | 2.00             | 2.00          |
| 0.01             | 0.008            | 0.38           | 0.02           | 2.08             | 2.08          |
| 0.02             | 0.025            | 0.60           | 0.04           | 2.16             | 2.16          |
| 0.03             | 0.049            | 0.78           | 0.06           | 2.25             | 2.24          |
| 0.04             | 0.080            | 0.93           | 0.09           | 2.33             | 2.32          |
| 0.05             | 0.117            | 1.07           | 0.11           | 2.41             | 2.40          |
| 0.06             | 0.160            | 1.19           | 0.13           | 2.49             | 2.48          |
| 0.07             | 0.209            | 1.31           | 0.16           | 2.58             | 2.56          |
| 0.08             | 0.263            | 1.42           | 0.19           | 2.66             | 2.64          |
| 0.09             | 0.323            | 1.52           | 0.21           | 2.74             | 2.72          |
| 0.10             | 0.388            | 1.62           | 0.24           | 2.82             | 2.80          |
| 0.11             | 0.459            | 1.71           | 0.27           | 2.91             | 2.88          |
| 0.12             | 0.535            | 1.80           | 0.30           | 2.99             | 2.96          |
| 0.13             | 0.616            | 1.88           | 0.33           | 3.07             | 3.04          |
| 0.14             | 0.703            | 1.96           | 0.36           | 3.15             | 3.12          |
| 0.15             | 0.796            | 2.04           | 0.39           | 3.24             | 3.20          |
| 0.16             | 0.894            | 2.12           | 0.42           | 3.32             | 3.28          |
| 0.17             | 0.997            | 2.19           | 0.46           | 3.40             | 3.36          |
| 0.18             | 1.107            | 2.26           | 0.49           | 3.48             | 3.44          |
| 0.19             | 1.222            | 2.33           | 0.52           | 3.57             | 3.52          |
| 0.20             | 1.342            | 2.40           | 0.56           | 3.65             | 3.60          |
| 0.21             | 1.469            | 2.46           | 0.60           | 3.73             | 3.68          |
| 0.22             | 1.601            | 2.53           | 0.63           | 3.81             | 3.76          |

## Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

### Input Data

| Normal Depth ( | (m)  | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|----------------|------|------------------|----------------|----------------|----------------------|---------------|
|                | 0.23 | 1.740            | 2.59           | 0.67           | 3.90                 | 3.84          |
|                | 0.24 | 1.884            | 2.65           | 0.71           | 3.98                 | 3.92          |
|                | 0.25 | 2.034            | 2.71           | 0.75           | 4.06                 | 4.00          |
|                | 0.26 | 2.190            | 2.77           | 0.79           | 4.14                 | 4.08          |
|                | 0.27 | 2.353            | 2.83           | 0.83           | 4.23                 | 4.16          |
| 1              | 0.28 | 2.521            | 2.89           | 0.87           | 4.31                 | 4.24          |
| /'             | 0.29 | 2.696            | 2.94           | 0.92           | 4.39                 | 4.32          |
|                | 0.30 | 2.878            | 3.00           | 0.96           | 4.47                 | 4.40          |

100-yr controlled release rate from the basin is 2.389cms

# Cross Section for Trapezoidal Channel - Basin Overflow Spillway E-E

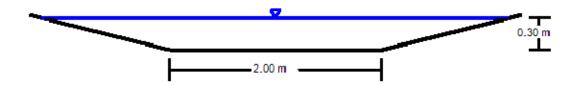
### **Project Description**

Friction Method Manning Formula
Solve For Discharge

### Input Data

| Roughness Coefficient | 0.069 |      |
|-----------------------|-------|------|
| Channel Slope         | 33.30 | %    |
| Normal Depth          | 0.30  | m    |
| Left Side Slope       | 4.0   | H:V  |
| Right Side Slope      | 4.0   | H:V  |
| Bottom Width          | 2.00  | m    |
| Discharge             | 2.878 | m³/s |

### **Cross Section Image**



V: 1 📐 H: 1



### Storm Sewer Design Sheet Mansfield Ski Club

<<< Elements Requiring Input Information</p>

Manning's Formula Calculation: Rainfall Intensity Calculation: **Rational Method Calculation:**  $Q = 2.78*(C_F*C*I*A)$  $V = (k*R^{2/3}*S^{1/2}) / n$ I = A\*T<sup>B</sup> Rainfall IDF Data: http://www.mto.gov.on.ca/IDF Curves/terms.shtml MOE Velocity Requirements: 0.8m/s - 6.0m/s 25-year 5-year A = 27.7 37.8 where, Q = peak flow rate (L/s) V = mean velocity (m/s) I = Rainfall Intensity (mm/hr) B = -0.699 -0.699 C<sub>F</sub> = runoff coefficient factor for storms > 10-yr  $(C_F = 1.0 \text{ for the } 2, 5 \& 10\text{-yr storm events and})$ T = Time of Concentration (hr) k = 1.0 for SI units C<sub>F</sub> = 1.1, 1.2 & 1.25 for the 25, 50 & 100-yr Runoff Coeff. Factors, C<sub>F</sub> = C = runoff coefficient R = hydraulic radius (m) A = Rainfall IDF Coefficient 1.00 1.10 storm events respectively) = rainfall intensity (mm/hr) S = friction slope (m/m) B = Rainfall IDF Coefficient n = Mannings Coefficient 0.013 A = area (ha)

Date: 17-Aug-20 Project No: 15-319

Prepared by: AW

|                 | Location       |            |      |          |           |      | Rı         | unoff Calculation | Data          |         |           |              |          |       |        | Sewer Calcula | ation Data |           |                   |         |                | Sewe         | r Profile Data          |                  |                         |
|-----------------|----------------|------------|------|----------|-----------|------|------------|-------------------|---------------|---------|-----------|--------------|----------|-------|--------|---------------|------------|-----------|-------------------|---------|----------------|--------------|-------------------------|------------------|-------------------------|
| Street          | Upstream       | Downstream |      | Drainage | Areas (ha | )    | Individual | Accumulated       | Time of       | Storm   | Rainfall  | Peak Runoff  | Diameter | Slope | Length | Capacity      | Velocity   | Pipe Flow | Pipe Storage      | Fall in | Drop in MH (m) | Top of Grate | Elevation (m)           | Invert Ele       | vation (m)              |
|                 | MH             | MH         | C =  | C =      | C =       | C =  | 2.78CA     | 2.78CA            | Concentration | Event   | Intensity | Flow         |          |       |        |               |            | Time      | Volume            | Sewer   |                |              |                         |                  |                         |
|                 |                |            | 0.20 | 0.40     | 0.65      | 0.75 |            |                   | (mins)        |         | (mm/hr)   | (L/s)        | (mm)     | (%)   | (m)    | (L/s)         | (m/s)      | (mins)    | (m <sup>3</sup> ) | (m)     | DS             | US           | DS                      | US               | DS                      |
|                 |                |            |      |          |           |      |            |                   |               |         |           |              |          |       |        |               |            |           |                   |         |                |              |                         |                  |                         |
| Site Drainage   | CB 10          | CBMH 11    |      |          |           | 0.02 | 0.04       | 0.04              | 10.00         | 5-year  | 96.92     | 4.04         | 300      | 1.2   | 27.60  | 110.51        | 1.51       | 0.30      | 2.0               | 0.33    | 0.05           | 301.93       | 301.60                  | 300.33           | 300.00                  |
| to SWM basin    | CBMH 11        | CBMH 12    |      |          |           | 0.14 | 0.29       | 0.33              | 10.30         | 5-year  | 94.91     | 31.66        | 300      | 0.5   | 20.50  | 71.33         | 0.98       | 0.35      | 1.5               | 0.10    | 0.05           | 301.60       | 301.70                  | 299.95           | 299.85                  |
|                 | CBMH 12        | CBMH 14    |      |          |           | 0.05 | 0.10       | 0.44              | 10.65         | 5-year  | 92.73     | 40.60        | 300      | 0.5   | 26.60  | 71.33         | 0.98       | 0.45      | 1.9               | 0.13    | 0.05           | 301.70       | 301.53                  | 299.80           | 299.67                  |
|                 | CBMH 14        | MH 18      |      |          |           | 0.06 | 0.13       | 0.56              | 11.11         | 5-year  | 90.06     | 50.70        | 300      | 3.4   | 51.60  | 185.47        | 2.54       | 0.34      | 3.8               | 1.74    | 0.05           | 301.53       | 299.75                  | 299.62           | 297.88                  |
|                 | CBMH 21        | CBMH 15    |      |          |           | 0.07 | 0.15       | 0.15              | 10.00         | 5-year  | 96.92     | 14.15        | 300      | 1.4   | 29.50  | 118.08        | 1.62       | 0.30      | 2.2               | 0.40    | 0.05           | 302.71       | 302.35                  | 301.10           | 300.70                  |
|                 | CBMH 15        | CBMH 16    |      |          |           | 0.25 | 0.52       | 0.67              | 10.30         | 5-year  | 94.91     | 63.33        | 300      | 4.6   | 17.30  | 216.13        | 2.96       | 0.10      | 1.3               | 0.79    | 0.05           | 302.35       | 301.36                  | 300.65           | 299.86                  |
|                 | <b>CBMH 16</b> | MH 18      |      |          |           | 0.10 | 0.21       | 0.88              | 10.40         | 5-year  | 94.29     | 82.57        | 300      | 5.0   | 38.20  | 226.48        | 3.10       | 0.21      | 2.8               | 1.93    | 0.05           | 301.36       | 299.75                  | 299.81           | 297.88                  |
|                 |                |            |      |          |           |      |            |                   |               | 5-year  |           |              |          |       |        |               |            |           |                   |         |                |              |                         |                  |                         |
|                 | MH 18          | MH 20      |      |          |           | 0.14 | 0.29       | 1.73              | 11.45         | 5-year  | 88.19     | 152.62       | 450      | 0.5   | 50.70  | 210.32        | 1.28       | 0.66      | 8.3               | 0.25    | 0.05           | 299.75       | 300.18                  | 297.83           | 297.58                  |
|                 | CB 20A         | MH 20      |      |          |           | 0.17 | 0.35       | 0.35              | 10.00         | F       | 96.92     | 34.35        | 200      | 4.0   | 9.00   | 201.76        | 2.77       | 0.05      | 0.7               | 0.36    | 0.40           | 300.19       | 300.18                  | 298.29           | 297.93                  |
|                 | CB 20A         | IVITI 20   |      |          |           | 0.17 | 0.35       | 0.35              | 10.00         | 5-year  | 90.92     | 34.33        | 300      | 4.0   | 9.00   | 201.76        | 2.11       | 0.05      | 0.7               | 0.36    | 0.40           | 300.19       | 300.16                  | 290.29           | 297.93                  |
|                 | DICB 23        | MH 20      |      |          |           |      |            |                   |               | 25-year |           | 1560.00      | 675      | 5.0   | 46.00  | 1960.88       | 5.31       | 0.14      | 17.0              | 2.30    | 0.05           | 302.07       | 300.18                  | 299.88           | 297.58                  |
|                 |                |            |      |          |           |      |            |                   |               |         |           |              |          |       |        |               |            |           |                   |         |                |              |                         |                  |                         |
|                 | MH 20          | MH 21      |      |          |           | 0.00 | 0.00       | 2.09              | 12.10         | 25-year | 115.73    | 1825.42      | 675      | 4.5   | 34.50  | 1860.26       | 5.04       | 0.11      | 12.7              | 1.55    | 0.03           | 300.18       | 297.85                  | 297.53           | 295.98                  |
|                 |                |            |      |          |           |      |            |                   |               |         |           |              |          |       |        |               |            |           |                   |         |                |              |                         |                  |                         |
|                 | MH 21          | HEADWALL   |      |          |           | 0.00 | 0.00       | 2.09              | 12.22         | 25-year | 114.97    | 1823.69      | 675      | 4.6   | 15.30  | 1880.81       | 5.09       | 0.05      | 5.7               | 0.70    | 0.00           | 297.85       | 296.15                  | 295.95           | 295.25                  |
| Septic Effluent | MH 1           | MH 2       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 13.9  | 76.1   | 127.57        | 3.93       | 0.32      | 2.5               | 10.58   | 0.90           | 301.43       | 290.80                  | 299.88           | 289.30                  |
| Discharge to    | MH 2           | MH 3       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 16.3  | 50.1   | 138.02        | 4.26       | 0.32      | 1.6               | 8.15    | 0.90           | 290.80       | 281.75                  | 288.40           | 280.25                  |
| Pine River      | MH 3           | MH 4       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 13.2  | 100.5  | 124.46        | 3.84       | 0.44      | 3.3               | 13.30   | 0.90           | 281.75       | 267.55                  | 279.35           | 266.05                  |
|                 | MH 4           | MH 5       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 2.4   | 84.0   | 53.45         | 1.65       | 0.85      | 2.7               | 2.05    | 0.05           | 267.55       | 264.55                  | 265.15           | 263.10                  |
|                 | MH 5           | MH 6       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 3.8   | 49.5   | 66.96         | 2.06       | 0.40      | 1.6               | 1.90    | 0.05           | 264.55       | 262.65                  | 263.05           | 261.15                  |
|                 | MH 6           | MH 7       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 0.9   | 55.9   | 31.73         | 0.98       | 0.95      | 1.8               | 0.48    | 0.04           | 262.65       | 261.30                  | 261.10           | 260.62                  |
|                 | MH 7           | MH 8       |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 0.5   | 50.1   | 24.19         | 0.75       | 1.12      | 1.6               | 0.25    | 0.03           | 261.30       | 260.86                  | 260.58           | 260.33                  |
|                 | MH 8<br>MH 9   | MH 9       |      |          |           |      |            |                   |               |         |           | 2.50<br>2.50 | 200      | 0.5   | 37.8   | 24.19         | 0.75       | 0.84      | 1.2               | 0.19    | 0.03           | 260.86       | 261.05<br><b>260.04</b> | 260.30<br>260.08 | 260.11<br><b>260.04</b> |
|                 | IVIT 9         | OUTLET     |      |          |           |      |            |                   |               |         |           | 2.50         | 200      | 0.8   | 5.1    | 30.60         | 0.94       | 0.09      | 0.2               | 0.04    | 0.00           | 261.05       | 260.04                  | ∠00.08           | 260.04                  |
|                 |                |            |      |          |           |      |            | l                 |               |         |           |              |          |       |        |               |            |           |                   | 1       |                |              |                         |                  |                         |

Sum of Drainage Areas (ha): 0.00 0.00 0.00 1.00 Total Drainage Area (ha): 1.00

NOTES: - The septic effluent forcemain flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) and was used to design the Pump Station, forcemain and downstream storm sewer.

- The peak flow into DICB 23 (by-pass swale flow) is 1560L/s and is based on the SWMHYMO hydrologic model (25-yr design storm peak flow based on the 24-hr SCS Type-II storm distribution from the external drainage area (EXT)).

## Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

| Project Description   |                 |          |      |
|-----------------------|-----------------|----------|------|
| Friction Method       | Manning Formula |          |      |
| Solve For             | Discharge       |          |      |
| Input Data            |                 |          |      |
| Roughness Coefficient |                 | 0.040    |      |
| Channel Slope         |                 | 1.00     | %    |
| Normal Depth          |                 | 0.50     | m    |
| Left Side Slope       |                 | 3.0      | H:V  |
| Right Side Slope      |                 | 3.0      | H:V  |
| Bottom Width          |                 | 1.00     | m    |
| Results               |                 |          |      |
| Discharge             |                 | 1.401    | m³/s |
| Flow Area             |                 | 1.25     | m²   |
| Wetted Perimeter      |                 | 4.16     | m    |
| Hydraulic Radius      |                 | 0.30     | m    |
| Top Width             |                 | 4.00     | m    |
| Critical Depth        |                 | 0.40     | m    |
| Critical Slope        |                 | 2.59     | %    |
| Velocity              |                 | 1.12     | m/s  |
| Velocity Head         |                 | 0.06     | m    |
| Specific Energy       |                 | 0.56     | m    |
| Froude Number         |                 | 0.64     |      |
| Flow Type             | Subcritical     |          |      |
| GVF Input Data        |                 |          |      |
| Downstream Depth      |                 | 0.00     | m    |
| Length                |                 | 0.00     | m    |
| Number Of Steps       |                 | 0        |      |
| GVF Output Data       |                 |          |      |
| Upstream Depth        |                 | 0.00     | m    |
| Profile Description   |                 |          |      |
| Profile Headloss      |                 | 0.00     | m    |
| Downstream Velocity   |                 | Infinity | m/s  |
| Upstream Velocity     |                 | Infinity | m/s  |
| Normal Depth          |                 | 0.50     | m    |
| Critical Depth        |                 | 0.40     | m    |
| Channel Slope         |                 | 1.00     | %    |
|                       |                 |          |      |

## Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

#### **GVF Output Data**

Critical Slope 2.59 %

#### Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms

Only the downstream section of the External By-pass swale (section graded at 2.4% longitudinal slope) will experience the total 100-year flow noted above. The rest of the External By-pass swale (section graded at 1.0% longitudinal slope) will only receive drainage from the backslope of the existing dry ponds east bank and some local drainage at the upstream end of the swale off of the base of the ski hill which is considerably less runoff.

## Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

| Pro | iect | Descri | ption |
|-----|------|--------|-------|
|     |      |        |       |

Friction Method Manning Formula
Solve For Discharge

### Input Data

 Roughness Coefficient
 0.040

 Channel Slope
 1.00 %

 Normal Depth
 0.50 m

 Left Side Slope
 3.0 H:V

 Right Side Slope
 3.0 H:V

 Bottom Width
 1.00 m

| Normal Depth (m) Dis |                |                |                |                      |               |
|----------------------|----------------|----------------|----------------|----------------------|---------------|
|                      | scharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|                      |                |                |                |                      |               |
| 0.00                 |                | 0.00           | 0.00           | 1.00                 | 1.00          |
| 0.01                 | 0.001          | 0.11           | 0.01           | 1.06                 | 1.06          |
| 0.02                 | 0.004          | 0.18           | 0.02           | 1.13                 | 1.12          |
| 0.03                 | 0.007          | 0.23           | 0.03           | 1.19                 | 1.18          |
| 0.04                 | 0.012          | 0.27           | 0.04           | 1.25                 | 1.24          |
| 0.05                 | 0.018          | 0.31           | 0.06           | 1.32                 | 1.30          |
| 0.06                 | 0.024          | 0.35           | 0.07           | 1.38                 | 1.36          |
| 0.07                 | 0.032          | 0.38           | 0.08           | 1.44                 | 1.42          |
| 0.08                 | 0.040          | 0.41           | 0.10           | 1.51                 | 1.48          |
| 0.09                 | 0.050          | 0.44           | 0.11           | 1.57                 | 1.54          |
| 0.10                 | 0.060          | 0.46           | 0.13           | 1.63                 | 1.60          |
| 0.11                 | 0.071          | 0.49           | 0.15           | 1.70                 | 1.66          |
| 0.12                 | 0.084          | 0.51           | 0.16           | 1.76                 | 1.72          |
| 0.13                 | 0.097          | 0.54           | 0.18           | 1.82                 | 1.78          |
| 0.14                 | 0.111          | 0.56           | 0.20           | 1.89                 | 1.84          |
| 0.15                 | 0.126          | 0.58           | 0.22           | 1.95                 | 1.90          |
| 0.16                 | 0.142          | 0.60           | 0.24           | 2.01                 | 1.96          |
| 0.17                 | 0.159          | 0.62           | 0.26           | 2.08                 | 2.02          |
| 0.18                 | 0.178          | 0.64           | 0.28           | 2.14                 | 2.08          |
| 0.19                 | 0.197          | 0.66           | 0.30           | 2.20                 | 2.14          |
| 0.20                 | 0.217          | 0.68           | 0.32           | 2.26                 | 2.20          |
| 0.21                 | 0.238          | 0.70           | 0.34           | 2.33                 | 2.26          |
| 0.22                 | 0.261          | 0.71           | 0.37           | 2.39                 | 2.32          |

## Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

### Input Data

| Normal Depth (m) | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|------------------|------------------|----------------|----------------|----------------------|---------------|
| 0.23             | 0.284            | 0.73           | 0.39           | 2.45                 | 2.3           |
| 0.24             | 0.309            | 0.75           | 0.41           | 2.52                 | 2.4           |
| 0.25             | 0.335            | 0.77           | 0.44           | 2.58                 | 2.5           |
| 0.26             | 0.362            | 0.78           | 0.46           | 2.64                 | 2.5           |
| 0.27             | 0.390            | 0.80           | 0.49           | 2.71                 | 2.0           |
| 0.28             | 0.420            | 0.81           | 0.52           | 2.77                 | 2.            |
| 0.29             | 0.450            | 0.83           | 0.54           | 2.83                 | 2.            |
| 0.30             | 0.482            | 0.85           | 0.57           | 2.90                 | 2.            |
| 0.31             | 0.515            | 0.86           | 0.60           | 2.96                 | 2.            |
| 0.32             | 0.549            | 0.88           | 0.63           | 3.02                 | 2.            |
| 0.33             | 0.585            | 0.89           | 0.66           | 3.09                 | 2.            |
| 0.34             | 0.622            | 0.91           | 0.69           | 3.15                 | 3.            |
| 0.35             | 0.660            | 0.92           | 0.72           | 3.21                 | 3.            |
| 0.36             | 0.700            | 0.93           | 0.75           | 3.28                 | 3.            |
| 0.37             | 0.741            | 0.95           | 0.78           | 3.34                 | 3.            |
| 0.38             | 0.783            | 0.96           | 0.81           | 3.40                 | 3.            |
| 0.39             | 0.826            | 0.98           | 0.85           | 3.47                 | 3.            |
| 0.40             | 0.871            | 0.99           | 0.88           | 3.53                 | 3.            |
| 0.41             | 0.918            | 1.00           | 0.91           | 3.59                 | 3.            |
| 0.42             | 0.966            | 1.02           | 0.95           | 3.66                 | 3.            |
| 0.43             | 1.015            | 1.03           | 0.98           | 3.72                 | 3             |
| 0.44             | 1.066            | 1.04           | 1.02           | 3.78                 | 3.            |
| 0.45             | 1.118            | 1.06           | 1.06           | 3.85                 | 3.            |
| 0.46             | 1.172            | 1.07           | 1.09           | 3.91                 | 3.            |
| 0.47             | 1.227            | 1.08           | 1.13           | 3.97                 | 3.            |
| 0.48             | 1.283            | 1.10           | 1.17           | 4.04                 | 3.            |
| 0.49             | 1.342            | 1.11           | 1.21           | 4.10                 | 3.            |
| 0.50             | 1.401            | 1.12           | 1.25           | 4.16                 | 4.            |

68% of total EXT 100-yr flow of 2.065cms which is more than will be directed to this section of the swale

## Cross Section for Trapezoidal Channel - External By-Pass Swale A-A

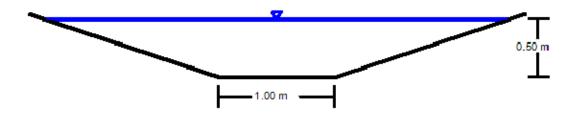
### **Project Description**

Friction Method Manning Formula Solve For Discharge

### Input Data

| 0.040 |                            |
|-------|----------------------------|
| 1.00  | %                          |
| 0.50  | m                          |
| 3.0   | H:V                        |
| 3.0   | H:V                        |
| 1.00  | m                          |
| 1.401 | m³/s                       |
|       | 1.00<br>0.50<br>3.0<br>3.0 |

### **Cross Section Image**



## Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

| Project Description   |                 |      |
|-----------------------|-----------------|------|
| Friction Method       | Manning Formula |      |
| Solve For             | Discharge       |      |
| Input Data            |                 |      |
| Roughness Coefficient | 0.040           |      |
| Channel Slope         | 2.40            | %    |
| Normal Depth          | 0.50            | m    |
| Left Side Slope       | 3.0             | H:V  |
| Right Side Slope      | 3.0             | H:V  |
| Bottom Width          | 1.00            | m    |
| Results               |                 |      |
| Discharge             | 2.171           | m³/s |
| Flow Area             | 1.25            | m²   |
| Wetted Perimeter      | 4.16            | m    |
| Hydraulic Radius      | 0.30            | m    |
| Top Width             | 4.00            | m    |
| Critical Depth        | 0.50            | m    |
| Critical Slope        | 2.44            | %    |
| Velocity              | 1.74            | m/s  |
| Velocity Head         | 0.15            | m    |
| Specific Energy       | 0.65            | m    |
| Froude Number         | 0.99            |      |
| Flow Type             | Subcritical     |      |
| GVF Input Data        |                 |      |
| Downstream Depth      | 0.00            | m    |
| Length                | 0.00            | m    |
| Number Of Steps       | 0               |      |
| GVF Output Data       |                 |      |
| Upstream Depth        | 0.00            | m    |
| Profile Description   |                 |      |
| Profile Headloss      | 0.00            | m    |
| Downstream Velocity   | Infinity        | m/s  |
| Upstream Velocity     | Infinity        | m/s  |
| Normal Depth          | 0.50            | m    |
| Critical Depth        | 0.50            | m    |
| Channel Slope         | 2.40            | %    |
|                       |                 |      |

### Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

### **GVF Output Data**

Critical Slope 2.44 %

### Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms.

Section B-B is located at DICBMH 23 which is where the total flow from the upstream external lands (EXT) will be collected.

## Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

Friction Method Manning Formula
Solve For Discharge

### Input Data

 Roughness Coefficient
 0.040

 Channel Slope
 2.40 %

 Normal Depth
 0.50 m

 Left Side Slope
 3.0 H:V

 Right Side Slope
 3.0 H:V

 Bottom Width
 1.00 m

| Normal Depth (m) | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|------------------|------------------|----------------|----------------|----------------------|---------------|
|                  |                  |                |                |                      |               |
| 0.00             |                  | 0.00           | 0.00           | 1.00                 | 1.00          |
| 0.01             | 0.002            | 0.18           | 0.01           | 1.06                 | 1.06          |
| 0.02             | 0.006            | 0.27           | 0.02           | 1.13                 | 1.12          |
| 0.03             | 0.012            | 0.35           | 0.03           | 1.19                 | 1.18          |
| 0.04             | 0.019            | 0.42           | 0.04           | 1.25                 | 1.24          |
| 0.05             | 0.028            | 0.48           | 0.06           | 1.32                 | 1.30          |
| 0.06             | 0.038            | 0.53           | 0.07           | 1.38                 | 1.36          |
| 0.07             | 0.050            | 0.59           | 0.08           | 1.44                 | 1.42          |
| 0.08             | 0.063            | 0.63           | 0.10           | 1.51                 | 1.48          |
| 0.09             | 0.077            | 0.68           | 0.11           | 1.57                 | 1.54          |
| 0.10             | 0.093            | 0.72           | 0.13           | 1.63                 | 1.60          |
| 0.11             | 0.111            | 0.76           | 0.15           | 1.70                 | 1.66          |
| 0.12             | 0.130            | 0.79           | 0.16           | 1.76                 | 1.72          |
| 0.13             | 0.150            | 0.83           | 0.18           | 1.82                 | 1.78          |
| 0.14             | 0.172            | 0.86           | 0.20           | 1.89                 | 1.84          |
| 0.15             | 0.195            | 0.90           | 0.22           | 1.95                 | 1.90          |
| 0.16             | 0.220            | 0.93           | 0.24           | 2.01                 | 1.96          |
| 0.17             | 0.247            | 0.96           | 0.26           | 2.08                 | 2.02          |
| 0.18             | 0.275            | 0.99           | 0.28           | 2.14                 | 2.08          |
| 0.19             | 0.305            | 1.02           | 0.30           | 2.20                 | 2.14          |
| 0.20             | 0.336            | 1.05           | 0.32           | 2.26                 | 2.20          |
| 0.21             | 0.369            | 1.08           | 0.34           | 2.33                 | 2.26          |
| 0.22             | 0.404            | 1.11           | 0.37           | 2.39                 | 2.32          |
|                  |                  |                |                |                      |               |

## Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

### Input Data

| voimai Deoin (m)      | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|-----------------------|------------------|----------------|----------------|----------------------|---------------|
| Normal Depth (m) 0.23 | 0.441            | 1.13           | 0.39           | 2.45                 | 2.            |
| 0.24                  | 0.479            | 1.16           | 0.41           | 2.52                 | 2.            |
| 0.25                  | 0.519            | 1.19           | 0.44           | 2.58                 | 2.            |
| 0.26                  | 0.561            | 1.21           | 0.46           | 2.64                 | 2.            |
| 0.27                  | 0.604            | 1.24           | 0.49           | 2.71                 | 2.            |
| 0.28                  | 0.650            | 1.26           | 0.52           | 2.77                 | 2.            |
| 0.29                  | 0.697            | 1.29           | 0.54           | 2.83                 | 2.            |
| 0.30                  | 0.747            | 1.31           | 0.57           | 2.90                 | 2.            |
| 0.31                  | 0.798            | 1.33           | 0.60           | 2.96                 | 2.            |
| 0.32                  | 0.851            | 1.36           | 0.63           | 3.02                 | 2             |
| 0.33                  | 0.906            | 1.38           | 0.66           | 3.09                 | 2             |
| 0.34                  | 0.964            | 1.40           | 0.69           | 3.15                 | 3             |
| 0.35                  | 1.023            | 1.43           | 0.72           | 3.21                 | 3             |
| 0.36                  | 1.084            | 1.45           | 0.75           | 3.28                 | 3             |
| 0.37                  | 1.147            | 1.47           | 0.78           | 3.34                 | 3             |
| 0.38                  | 1.213            | 1.49           | 0.81           | 3.40                 | 3             |
| 0.39                  | 1.280            | 1.51           | 0.85           | 3.47                 | 3             |
| 0.40                  | 1.350            | 1.53           | 0.88           | 3.53                 | 3             |
| 0.41                  | 1.422            | 1.56           | 0.91           | 3.59                 | 3             |
| 0.42                  | 1.496            | 1.58           | 0.95           | 3.66                 | 3             |
| 0.43                  | 1.572            | 1.60           | 0.98           | 3.72                 | 3             |
| 0.44                  | 1.651            | 1.62           | 1.02           | 3.78                 | 3             |
| 0.45                  | 1.732            | 1.64           | 1.06           | 3.85                 | 3             |
| 0.46                  | 1.815            | 1.66           | 1.09           | 3.91                 | 3             |
| 0.47                  | 1.900            | 1.68           | 1.13           | 3.97                 | 3             |
| 0.48                  | 1.988            | 1.70           | 1.17           | 4.04                 | 3             |
| 0.49                  | 2.078            | 1.72           | 1.21           | 4.10                 | 3             |
|                       | 2.171            | 1.74           | 1.25           | 4.16                 | 4             |

2.065cms

## Cross Section for Trapezoidal Channel - External By-Pass Swale B-B

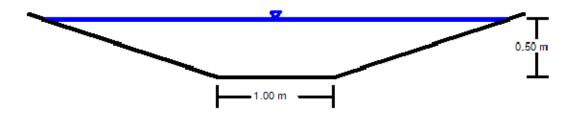
### **Project Description**

Friction Method Manning Formula Solve For Discharge

### Input Data

| Roughness Coefficient | 0.040 |      |
|-----------------------|-------|------|
| Channel Slope         | 2.40  | %    |
| Normal Depth          | 0.50  | m    |
| Left Side Slope       | 3.0   | H:V  |
| Right Side Slope      | 3.0   | H:V  |
| Bottom Width          | 1.00  | m    |
| Discharge             | 2.171 | m³/s |

### Cross Section Image



## Worksheet for External By-Pass Spill Overland Flow

| TTOTACTION            | Ter External By Face |      |
|-----------------------|----------------------|------|
| Project Description   |                      |      |
| Friction Method       | Manning Formula      |      |
| Solve For             | Discharge            |      |
| Innut Data            | •                    |      |
| Input Data            |                      |      |
| Roughness Coefficient | 0.030                |      |
| Channel Slope         | 6.00                 | %    |
| Normal Depth          | 0.10                 | m    |
| Left Side Slope       | 50.0                 | H:V  |
| Right Side Slope      | 50.0                 | H:V  |
| Results               |                      |      |
| Discharge             | 0.506                | m³/s |
| Flow Area             | 0.47                 | m²   |
| Wetted Perimeter      | 9.67                 | m    |
| Hydraulic Radius      | 0.05                 | m    |
| Top Width             | 9.67                 | m    |
| Critical Depth        | 0.12                 | m    |
| Critical Slope        | 2.28                 | %    |
| Velocity              | 1.08                 | m/s  |
| Velocity Head         | 0.06                 | m    |
| Specific Energy       | 0.16                 | m    |
| Froude Number         | 1.57                 |      |
| Flow Type             | Supercritical        |      |
| GVF Input Data        |                      |      |
| Downstream Depth      | 0.00                 | m    |
| Length                | 0.00                 | m    |
| Number Of Steps       | 0                    |      |
| GVF Output Data       |                      |      |
| Upstream Depth        | 0.00                 | m    |
| Profile Description   |                      |      |
| Profile Headloss      | 0.00                 | m    |
| Downstream Velocity   | Infinity             | m/s  |
| Upstream Velocity     | Infinity             | m/s  |
| Normal Depth          | 0.10                 | m    |
| Critical Depth        | 0.12                 | m    |
| Channel Slope         | 6.00                 |      |
| Critical Slope        | 2.28                 | %    |

### Worksheet for External By-Pass Spill Overland Flow

| M  | lessag | es |
|----|--------|----|
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Notes

The 100-year peak flow from the upstream external drainage area (EXT) is 2.065cms. The External by-pass section storm sewer has been sized to convey the 25-year peak flow from the external drainage area (EXT). Therefore, a peak flow of 0.506cms has been used to calculate the External By-pass spill (overland flow to the basin).

## Rating Table for External By-Pass Spill Overland Flow

### **Project Description**

Friction Method Manning Formula Solve For Discharge

### Input Data

0.030 Roughness Coefficient Channel Slope 6.00 Normal Depth 0.10 m Left Side Slope 50.0 H:V Right Side Slope 50.0 H:V

|              |       |                  |                |                | Wetted Perimeter |               |
|--------------|-------|------------------|----------------|----------------|------------------|---------------|
| Normal Depth | n (m) | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | (m)              | Top Width (m) |
|              |       |                  |                |                |                  |               |
|              | 0.00  |                  |                | 0.00           | 0.00             | 0.00          |
|              | 0.01  | 0.001            | 0.24           | 0.01           | 1.00             | 1.00          |
|              | 0.02  | 0.008            | 0.38           | 0.02           | 2.00             | 2.00          |
|              | 0.03  | 0.022            | 0.50           | 0.05           | 3.00             | 3.00          |
|              | 0.04  | 0.048            | 0.60           | 0.08           | 4.00             | 4.00          |
|              | 0.05  | 0.087            | 0.70           | 0.13           | 5.00             | 5.00          |
|              | 0.06  | 0.142            | 0.79           | 0.18           | 6.00             | 6.00          |
|              | 0.07  | 0.214            | 0.87           | 0.25           | 7.00             | 7.00          |
|              | 0.08  | 0.306            | 0.95           | 0.32           | 8.00             | 8.00          |
|              | 0.09  | 0.418            | 1.03           | 0.41           | 9.00             | 9.00          |
| Γ            | 0.10  | 0.554            | 1.11           | 0.50           | 10.00            | 10.00         |



## Cross Section for External By-Pass Spill Overland Flow

Friction Method Manning Formula
Solve For Discharge

### Input Data

| Roughness Coefficient | 0.030 |      |
|-----------------------|-------|------|
| Channel Slope         | 6.00  | %    |
| Normal Depth          | 0.10  | m    |
| Left Side Slope       | 50.0  | H:V  |
| Right Side Slope      | 50.0  | H:V  |
| Discharge             | 0.506 | m³/s |

### Cross Section Image



/: 1 📐 H: 1

## Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

|                       | Tapozordar oriarinor |          | THE EINIGHTOOD OF GOOD OWNER |
|-----------------------|----------------------|----------|------------------------------|
| Project Description   |                      |          |                              |
| Friction Method       | Manning Formula      |          |                              |
| Solve For             | Discharge            |          |                              |
| Innut Data            |                      |          |                              |
| Input Data            |                      |          |                              |
| Roughness Coefficient |                      | 0.040    |                              |
| Channel Slope         |                      | 1.00     | %                            |
| Normal Depth          |                      | 0.50     | m                            |
| Left Side Slope       |                      | 3.0      | H:V                          |
| Right Side Slope      |                      | 3.0      | H:V                          |
| Bottom Width          |                      | 1.00     | m                            |
| Results               |                      |          |                              |
| Discharge             |                      | 1.401    | m³/s                         |
| Flow Area             |                      | 1.401    | m²                           |
| Wetted Perimeter      |                      | 4.16     | m                            |
| Hydraulic Radius      |                      | 0.30     | m                            |
| Top Width             |                      | 4.00     | m                            |
| Critical Depth        |                      | 0.40     | m                            |
| Critical Slope        |                      | 2.59     | %                            |
| Velocity              |                      | 1.12     | m/s                          |
| Velocity Head         |                      | 0.06     | m                            |
| Specific Energy       |                      | 0.56     | m                            |
| Froude Number         |                      | 0.64     |                              |
| Flow Type             | Subcritical          |          |                              |
|                       |                      |          |                              |
| GVF Input Data        |                      |          |                              |
| Downstream Depth      |                      | 0.00     | m                            |
| Length                |                      | 0.00     | m                            |
| Number Of Steps       |                      | 0        |                              |
| GVF Output Data       |                      |          |                              |
| Upstream Depth        |                      | 0.00     | m                            |
| Profile Description   |                      |          |                              |
| Profile Headloss      |                      | 0.00     | m                            |
| Downstream Velocity   |                      | Infinity | m/s                          |
| Upstream Velocity     |                      | Infinity | m/s                          |
| Normal Depth          |                      | 0.50     | m                            |
| Critical Depth        |                      | 0.40     | m                            |
| Channel Slope         |                      | 1.00     | %                            |
|                       |                      |          |                              |

### Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

#### **GVF Output Data**

Critical Slope 2.59 %

#### Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 1.018cms and the 25mm Chicago Storm peak flow is 0.274cms.

Of the 2.94ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 28.9% of the above noted flows will be experienced within the EGS.

Pro-ration:

25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (1.018cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system.

## Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

|                       | ·               |       |     |  |
|-----------------------|-----------------|-------|-----|--|
| Project Description   |                 |       |     |  |
| Friction Method       | Manning Formula |       |     |  |
| Solve For             | Discharge       |       |     |  |
| Input Data            |                 |       |     |  |
| Roughness Coefficient |                 | 0.040 |     |  |
| Channel Slope         |                 | 1.00  | %   |  |
| Normal Depth          |                 | 0.50  | m   |  |
| Left Side Slope       |                 | 3.0   | H:V |  |
| Right Side Slope      |                 | 3.0   | H:V |  |
| Bottom Width          |                 | 1.00  | m   |  |

|                                    | Normal Depth (m)                                | Discharge (m³/s)                                   | Velocity (m/s)                                | Flow Area (m²)                                | Wetted Perimeter (m)                         | Top Width (m)                                |
|------------------------------------|---|--|---|---|--|--|
|                                    | Normal Depth (m)  0.00 0.01 0.02 0.03 0.04 0.05 | 0.001<br>0.004<br>0.007<br>0.012<br>0.018          | Velocity (m/s)  0.00 0.11 0.18 0.23 0.27 0.31 | Flow Area (m²)  0.00 0.01 0.02 0.03 0.04 0.06 | 1.00<br>1.06<br>1.13<br>1.19<br>1.25         | Top Width (m)  1.00 1.06 1.12 1.18 1.24 1.30 |
|                                    | 0.06<br>0.07<br>0.08<br>0.09                    | 0.024<br>0.032<br>0.040<br>0.050<br>0.060          | 0.35<br>0.38<br>0.41<br>0.44<br>0.46          | 0.07<br>0.08<br>0.10<br>0.11                  | 1.38<br>1.44<br>1.51<br>1.57                 | 1.36<br>1.42<br>1.48<br>1.54<br>1.60         |
| 25mm pea<br>the EGS is<br>0.079cms |   | 0.071<br>0.084<br>0.097<br>0.111<br>0.126<br>0.142 | 0.49<br>0.51<br>0.54<br>0.56<br>0.58<br>0.60  | 0.15<br>0.16<br>0.18<br>0.20<br>0.22<br>0.24  | 1.70<br>1.76<br>1.82<br>1.89<br>1.95<br>2.01 | 1.66<br>1.72<br>1.78<br>1.84<br>1.90<br>1.96 |
|                                    | 0.17<br>0.18<br>0.19<br>0.20<br>0.21<br>0.22    | 0.159<br>0.178<br>0.197<br>0.217<br>0.238<br>0.261 | 0.62<br>0.64<br>0.66<br>0.68<br>0.70          | 0.26<br>0.28<br>0.30<br>0.32<br>0.34<br>0.37  | 2.08<br>2.14<br>2.20<br>2.26<br>2.33<br>2.39 | 2.02<br>2.08<br>2.14<br>2.20<br>2.26<br>2.32 |

# Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

### Input Data

| Normal Depth (m)    | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
|---------------------|------------------|----------------|----------------|----------------------|---------------|
| 0.23                | 0.284            | 0.73           | 0.39           | 2.45                 | 2.38          |
| 0.24                | 0.309            | 0.75           | 0.41           | 2.52                 | 2.44          |
| 0.25                | 0.335            | 0.77           | 0.44           | 2.58                 | 2.50          |
| 0.26                | 0.362            | 0.78           | 0.46           | 2.64                 | 2.56          |
| 0.27                | 0.390            | 0.80           | 0.49           | 2.71                 | 2.62          |
| 0.28                | 0.420            | 0.81           | 0.52           | 2.77                 | 2.68          |
| 0.29                | 0.450            | 0.83           | 0.54           | 2.83                 | 2.74          |
| 0.30                | 0.482            | 0.85           | 0.57           | 2.90                 | 2.80          |
| 0.31                | 0.515            | 0.86           | 0.60           | 2.96                 | 2.86          |
| 0.32                | 0.549            | 0.88           | 0.63           | 3.02                 | 2.92          |
| 0.33                | 0.585            | 0.89           | 0.66           | 3.09                 | 2.98          |
| 0.34                | 0.622            | 0.91           | 0.69           | 3.15                 | 3.04          |
| 0.35                | 0.660            | 0.92           | 0.72           | 3.21                 | 3.10          |
| 0.36                | 0.700            | 0.93           | 0.75           | 3.28                 | 3.16          |
| 0.37                | 0.741            | 0.95           | 0.78           | 3.34                 | 3.22          |
| 0.38                | 0.783            | 0.96           | 0.81           | 3.40                 | 3.28          |
| 0.39                | 0.826            | 0.98           | 0.85           | 3.47                 | 3.34          |
| 0.40                | 0.871            | 0.99           | 0.88           | 3.53                 | 3.40          |
| 0.41                | 0.918            | 1.00           | 0.91           | 3.59                 | 3.46          |
| 0.42                | 0.966            | 1.02           | 0.95           | 3.66                 | 3.52          |
| 0.43                | 1.015            | 1.03           | 0.98           | 3.72                 | 3.58          |
| 0.44                | 1.066            | 1.04           | 1.02           | 3.78                 | 3.64          |
| 0.45                | 1.118            | 1.06           | 1.06           | 3.85                 | 3.70          |
| r peak flow to 0.46 | 1.172            | 1.07           | 1.09           | 3.91                 | 3.76          |
| is 1.018cms 0.47    | 1.227            | 1.08           | 1.13           | 3.97                 | 3.82          |
| ervative 0.48       | 1.283            | 1.10           | 1.17           | 4.04                 | 3.88          |
| ote) 0.49           | 1.342            | 1.11           | 1.21           | 4.10                 | 3.94          |
| 0.50                | 1.401            | 1.12           | 1.25           | 4.16                 | 4.00          |

## Cross Section for Trapezoidal Channel - North Enhanced Grass Swale

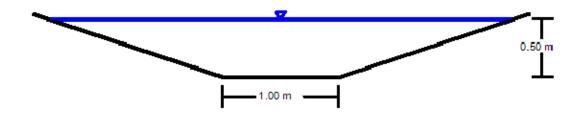
### **Project Description**

Friction Method Manning Formula
Solve For Discharge

### Input Data

| Roughness Coefficient | 0.040 |      |
|-----------------------|-------|------|
| Channel Slope         | 1.00  | %    |
| Normal Depth          | 0.50  | m    |
| Left Side Slope       | 3.0   | H:V  |
| Right Side Slope      | 3.0   | H:V  |
| Bottom Width          | 1.00  | m    |
| Discharge             | 1.401 | m³/s |

### **Cross Section Image**



V: 1 📐 H: 1

## Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

|                       | Trapezeraar errarmer |          | atti Etillatioca Crass Gwate |
|-----------------------|----------------------|----------|------------------------------|
| Project Description   |                      |          |                              |
| Friction Method       | Manning Formula      |          |                              |
| Solve For             | Discharge            |          |                              |
| Input Data            |                      |          |                              |
| приг рага             |                      |          |                              |
| Roughness Coefficient |                      | 0.040    |                              |
| Channel Slope         |                      | 1.00     | %                            |
| Normal Depth          |                      | 0.75     | m                            |
| Left Side Slope       |                      | 3.0      | H:V                          |
| Right Side Slope      |                      | 3.0      | H:V                          |
| Bottom Width          |                      | 1.00     | m                            |
| Results               |                      |          |                              |
| Discharge             |                      | 3.441    | m³/s                         |
| Flow Area             |                      | 2.44     | m²                           |
| Wetted Perimeter      |                      | 5.74     | m                            |
| Hydraulic Radius      |                      | 0.42     | m                            |
| Top Width             |                      | 5.50     | m                            |
| Critical Depth        |                      | 0.62     | m                            |
| Critical Slope        |                      | 2.30     | %                            |
| Velocity              |                      | 1.41     | m/s                          |
| Velocity Head         |                      | 0.10     | m                            |
| Specific Energy       |                      | 0.85     | m                            |
| Froude Number         |                      | 0.68     |                              |
| Flow Type             | Subcritical          |          |                              |
| GVF Input Data        |                      |          |                              |
| Downstream Depth      |                      | 0.00     | m                            |
| Length                |                      | 0.00     | m                            |
| Number Of Steps       |                      | 0        |                              |
|                       |                      |          |                              |
| GVF Output Data       |                      |          |                              |
| Upstream Depth        |                      | 0.00     | m                            |
| Profile Description   |                      |          |                              |
| Profile Headloss      |                      | 0.00     | m                            |
| Downstream Velocity   |                      | Infinity | m/s                          |
| Upstream Velocity     |                      | Infinity | m/s                          |
| Normal Depth          |                      | 0.75     | m                            |
| Critical Depth        |                      | 0.62     | m                            |
| Channel Slope         |                      | 1.00     | %                            |

### Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

#### **GVF Output Data**

Critical Slope 2.30 %

#### Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 1.018cms and the 25mm Chicago Storm peak flow is 0.274cms.

Of the 2.94ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 28.9% of the above noted flows will be experienced within the EGS.

Pro-ration:

25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (1.018cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system. The downstream portion of the EGS has been sized to convey the External By-pass Spill Overland Flow (0.506cms) and the governing 100-year design peak flow (1.018cms) from POST1 for a total of 1.524cms.

## Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

| Project Description   |                 |       |     |  |
|-----------------------|-----------------|-------|-----|--|
| Friction Method       | Manning Formula |       |     |  |
| Solve For             | Discharge       |       |     |  |
| Input Data            |                 |       |     |  |
| Roughness Coefficient |                 | 0.040 |     |  |
| Channel Slope         |                 | 1.00  | %   |  |
| Normal Depth          |                 | 0.75  | m   |  |
| Left Side Slope       |                 | 3.0   | H:V |  |
| Right Side Slope      |                 | 3.0   | H:V |  |
| Bottom Width          |                 | 1.00  | m   |  |

|                                    | Normal Donth (r  | m)   | Discharge (m³/s)  | Valacity (m/s)   | Flow Aroa (m²)   | Wetted Perimeter   | Top Width (m)   |
|------------------------------------|------------------|--|---|--|--|--|---|
|                                    | Normai Deptii (i | 11)  | Discharge (III /s)  | velocity (III/s)   | Flow Area (III )   | (111)  | Top Width (III)   |
| 25mm pea<br>the EGS is<br>0.079cms | ak flow to       | m)<br>0.00<br>0.01<br>0.02<br>0.03<br>0.04<br>0.05<br>0.06<br>0.07<br>0.08<br>0.09<br>0.11<br>0.12<br>0.13 | 0.001 0.004 0.007 0.012 0.018 0.024 0.032 0.040 0.050 0.060 0.071 0.084 0.097 0.111 | Velocity (m/s)  0.00 0.11 0.18 0.23 0.27 0.31 0.35 0.38 0.41 0.44 0.46 0.49 0.51 0.54 0.56 | Flow Area (m²)  0.00 0.01 0.02 0.03 0.04 0.06 0.07 0.08 0.10 0.11 0.13 0.15 0.16 0.18 0.20 | Wetted Perimeter (m)  1.00 1.06 1.13 1.19 1.25 1.32 1.38 1.44 1.51 1.57 1.63 1.70 1.76 1.82 1.89 | Top Width (m)  1.00 1.06 1.12 1.18 1.24 1.30 1.36 1.42 1.48 1.54 1.60 1.66 1.72 1.78 1.84 |
|                                    |                  | 0.15   | 0.126   | 0.58   | 0.22   | 1.95   | 1.90  |
|                                    |                  | 0.16   | 0.142   | 0.60   | 0.24   | 2.01   | 1.96  |
|                                    | C                | 0.17   | 0.159   | 0.62   | 0.26   | 2.08   | 2.02  |
|                                    | C                | 0.18   | 0.178   | 0.64   | 0.28   | 2.14   | 2.08  |
|                                    | C                | 0.19   | 0.197   | 0.66   | 0.30   | 2.20   | 2.14  |
|                                    | C                | 0.20   | 0.217   | 0.68   | 0.32   | 2.26   | 2.20  |
|                                    | C                | 0.21   | 0.238   | 0.70   | 0.34   | 2.33   | 2.26  |
|                                    | C                | 0.22   | 0.261   | 0.71   | 0.37   | 2.39   | 2.32  |

## Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

### Input Data

|                            |                  |                |                | Wetted Devise stan   |               |
|----------------------------|------------------|----------------|----------------|----------------------|---------------|
| Normal Depth (m)           | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | Wetted Perimeter (m) | Top Width (m) |
| 0.23                       | 0.284            | 0.73           | 0.39           | 2.45                 | 2.38          |
| 0.24                       | 0.309            | 0.75           | 0.41           | 2.52                 | 2.44          |
| 0.25                       | 0.335            | 0.77           | 0.44           | 2.58                 | 2.50          |
| 0.26                       | 0.362            | 0.78           | 0.46           | 2.64                 | 2.56          |
| 0.27                       | 0.390            | 0.80           | 0.49           | 2.71                 | 2.62          |
| 0.28                       | 0.420            | 0.81           | 0.52           | 2.77                 | 2.68          |
| 0.29                       | 0.450            | 0.83           | 0.54           | 2.83                 | 2.74          |
| 0.30                       | 0.482            | 0.85           | 0.57           | 2.90                 | 2.80          |
| 0.31                       | 0.515            | 0.86           | 0.60           | 2.96                 | 2.86          |
| 0.32                       | 0.549            | 0.88           | 0.63           | 3.02                 | 2.92          |
| 0.33                       | 0.585            | 0.89           | 0.66           | 3.09                 | 2.98          |
| 0.34                       | 0.622            | 0.91           | 0.69           | 3.15                 | 3.04          |
| 0.35                       | 0.660            | 0.92           | 0.72           | 3.21                 | 3.10          |
| 0.36                       | 0.700            | 0.93           | 0.75           | 3.28                 | 3.16          |
| 0.37                       | 0.741            | 0.95           | 0.78           | 3.34                 | 3.22          |
| 0.38                       | 0.783            | 0.96           | 0.81           | 3.40                 | 3.28          |
| 0.39                       | 0.826            | 0.98           | 0.85           | 3.47                 | 3.34          |
| 0.40                       | 0.871            | 0.99           | 0.88           | 3.53                 | 3.40          |
| 0.41                       | 0.918            | 1.00           | 0.91           | 3.59                 | 3.46          |
| 0.42                       | 0.966            | 1.02           | 0.95           | 3.66                 | 3.52          |
| 0.43                       | 1.015            | 1.03           | 0.98           | 3.72                 | 3.58          |
| 0.44                       | 1.066            | 1.04           | 1.02           | 3.78                 | 3.64          |
| 0.45                       | 1.118            | 1.06           | 1.06           | 3.85                 | 3.70          |
| 0.46                       | 1.172            | 1.07           | 1.09           | 3.91                 | 3.76          |
| 0.47                       | 1.227            | 1.08           | 1.13           | 3.97                 | 3.82          |
| 0.48                       | 1.283            | 1.10           | 1.17           | 4.04                 | 3.88          |
| 0.49                       | 1.342            | 1.11           | 1.21           | 4.10                 | 3.94          |
| 0.50                       | 1.401            | 1.12           | 1.25           | 4.16                 | 4.00          |
| 0.51                       | 1.463            | 1.13           | 1.29           | 4.23                 | 4.06          |
| 0.52                       | 1.526            | 1.15           | 1.33           | 4.29                 | 4.12          |
| 0.53                       | 1.590            | 1.16           | 1.37           | 4.35                 | 4.18          |
| 0.54                       | 1.656            | 1.17           | 1.41           | 4.42                 | 4.24          |
| peak flow to 0.55          | 1.724            | 1.18           | 1.46           | 4.48                 | 4.30          |
| s 1.524cms <sub>0.56</sub> | 1.793            | 1.19           | 1.50           | 4.54                 | 4.36          |
| ervative 0.57              | 1.864            | 1.21           | 1.54           | 4.60                 | 4.42          |
| ate) 0.58                  | 1.937            | 1.22           | 1.59           | 4.67                 | 4.48          |
| 0.59                       | 2.011            | 1.23           | 1.63           | 4.73                 | 4.54          |

## Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

### Input Data

|                  |                  |                |                | Wetted Perimeter |               |
|------------------|------------------|----------------|----------------|------------------|---------------|
| Normal Depth (m) | Discharge (m³/s) | Velocity (m/s) | Flow Area (m²) | (m)              | Top Width (m) |
| 0.60             | 2.087            | 1.24           | 1.68           | 4.79             | 4.60          |
| 0.61             | 2.165            | 1.25           | 1.73           | 4.86             | 4.66          |
| 0.62             | 2.245            | 1.27           | 1.77           | 4.92             | 4.72          |
| 0.63             | 2.326            | 1.28           | 1.82           | 4.98             | 4.78          |
| 0.64             | 2.409            | 1.29           | 1.87           | 5.05             | 4.84          |
| 0.65             | 2.494            | 1.30           | 1.92           | 5.11             | 4.90          |
| 0.66             | 2.580            | 1.31           | 1.97           | 5.17             | 4.96          |
| 0.67             | 2.668            | 1.32           | 2.02           | 5.24             | 5.02          |
| 0.68             | 2.759            | 1.33           | 2.07           | 5.30             | 5.08          |
| 0.69             | 2.851            | 1.35           | 2.12           | 5.36             | 5.14          |
| 0.70             | 2.944            | 1.36           | 2.17           | 5.43             | 5.20          |
| 0.71             | 3.040            | 1.37           | 2.22           | 5.49             | 5.26          |
| 0.72             | 3.138            | 1.38           | 2.28           | 5.55             | 5.32          |
| 0.73             | 3.237            | 1.39           | 2.33           | 5.62             | 5.38          |
| 0.74             | 3.338            | 1.40           | 2.38           | 5.68             | 5.44          |
| 0.75             | 3.441            | 1.41           | 2.44           | 5.74             | 5.50          |

### Cross Section for Trapezoidal Channel - South Enhanced Grass Swale

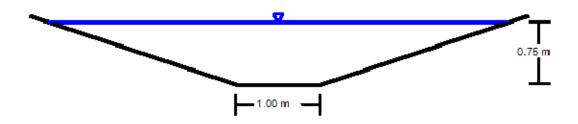
### **Project Description**

| Friction Method | Manning Formula |
|-----------------|-----------------|
| Solve For       | Discharge       |

### Input Data

| Roughness Coefficient | 0.040 |      |
|-----------------------|-------|------|
| Channel Slope         | 1.00  | %    |
| Normal Depth          | 0.75  | m    |
| Left Side Slope       | 3.0   | H:V  |
| Right Side Slope      | 3.0   | H:V  |
| Bottom Width          | 1.00  | m    |
| Discharge             | 3.441 | m³/s |

### Cross Section Image



## **Development Export Summary**

Development:15-319 Mansfield Ski Club

Updated : Sept 2014

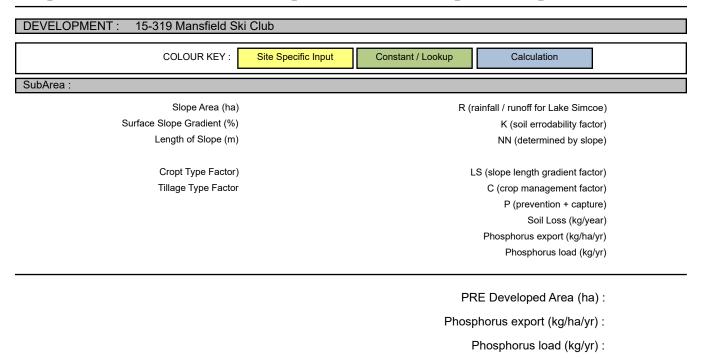
## Pre-Development Phosphorus Export

| DEVELOPMENT: 15-319 Mansfield Ski Club |                              |           |                    |                  |  |  |  |
|--|------------------------------|-----------|--------------------|------------------|--|--|--|
| Landuse                                |                              | Area (ha) | P coeff<br>(kg/ha) | Pload<br>(kg/yr) |  |  |  |
| Urban                                  |                              |           |                    |                  |  |  |  |
| Commercial                             |                              | 4.02      | 0.20               | 0.85             |  |  |  |
|  | Urban Land use Class Total : | 4.02      |                    | 0.85             |  |  |  |
|  | Development Total :          | 4.02      |                    | 0.85             |  |  |  |

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Updated : Sept 2014

# Cropland Site Sediment & Phosphorus Pre-Development Export



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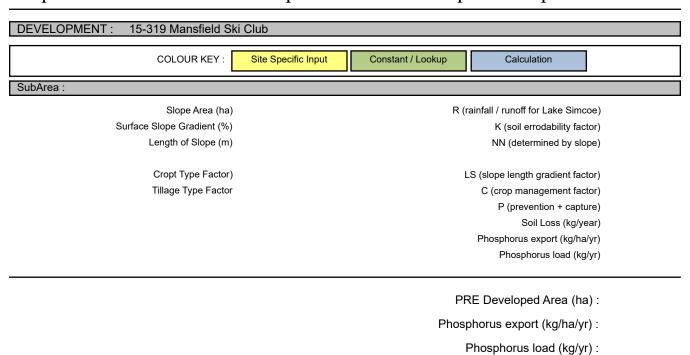
# Post-Development Phosphorus Export

| DEVELOPMENT: 15-319 Mansfield Ski Club |                              |           |                    |                  |  |  |  |
|--|------------------------------|-----------|--------------------|------------------|--|--|--|
| Landuse                                |                              | Area (ha) | P coeff<br>(kg/ha) | Pload<br>(kg/yr) |  |  |  |
| Urban                                  |                              |           |                    |                  |  |  |  |
| Commercial                             |                              | 4.02      | 0.20               | 1.24             |  |  |  |
|  | Urban Land use Class Total : | 4.02      |                    | 1.24             |  |  |  |
|  | Development Total :          | 4.02      |                    | 1.24             |  |  |  |

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Updated : Sept 2014

# Cropland Site Sediment & Phosphorus Post-Development Export



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# Post Dev BMP

| Area (ha)          | Treated<br>Area %  | P<br>coefficient  | P<br>coefficient | P Load<br>Reduction<br>(kg/yr) | Rationale   |
|--------------------|--------------------|-------------------|------------------|--------------------------------|---|
| Best Manageme      | ent Practices (BIV | (and Applied (and | Rationale)       |                                |   |
| Commercial         |                    |                   |                  |                                |   |
| 1.07<br>User Entry | 100                | 0.20              | 60 %             | 0.13                           | POST1. Treatment train of enhanced grass swales (55%), and dry detention basin (10%). Total Treatment Train efficiency of (60%) |
| Commercial         |                    |                   |                  |                                |   |
| 1.76               | 100                | 0.20              | 10 %             | 0.04                           | POST1   |
| Dry Detention Po   | onds               |                   |                  |                                |   |
| Commercial         |                    |                   |                  |                                |   |
| 0.34<br>User Entry | 100                | 0.20              | 69 %             | 0.05                           | POST1. Treatment train of grass filter strips (65%), and dry detention basin (10%). Total Treatment Train efficiency of (69%)   |
| Commercial         |                    |                   |                  |                                |   |
| 0.85               | 100                | 0.20              | 65 %             | 0.11                           | POST2   |
| Vegetated Filter   | Strips/Stream B    | uffers            |                  |                                |   |

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# Development Area P and BMP Summary

| Total PreDevelopment Area (ha):               | 4.02 |
|---|------|
| PreDevelopment Area excluding Wetlands (ha):  | 4.02 |
| Total PostDevelopment Area (ha):              | 4.02 |
| Total Area treated by BMP's (ha):             | 4.02 |
| Treated Area total:                           | 4.02 |
|   |      |
| Total PreDevelopment Load (kg/yr):            | 0.85 |
| Total PostDevelopment Load (kg/yr):           | 1.24 |
| Total P Load Reduction with BMP's (kg/yr):    | 0.33 |
| Minimum P Load Reduction Required:            | 0.39 |
| Total PostDevelopment Load with BMP's (kg/yr) | 0.91 |

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# Post Dev Construction

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### **APPENDIX D**

# HYDROLOGIC MODELING (SWMHYMO)

- Pre-Development ConditionPost-Development Condition

#### SENSITIVITY ANALYSIS COMPARISON CHARTS

#### 24HR SCS PRE DEVELOPMENT

| STORM   | PRE1  | EXT1  | PRE1 + EXT1 | PRE2  |
|---------|-------|-------|-------------|-------|
| STORIVI | cms   | cms   | cms         | cms   |
| 2       | 0.166 | 0.592 | 0.756       | 0.097 |
| 5       | 0.282 | 0.948 | 1.213       | 0.160 |
| 25      | 0.482 | 1.529 | 1.947       | 0.272 |
| 100     | 0.647 | 2.025 | 2.580       | 0.362 |

#### 24HR SCS

#### POST DEVELOPMENT

|   | STORM   | POST1 | EXT1  | SWM Facility | STORAGE | POST2 |
|---|---------|-------|-------|--------------|---------|-------|
|   | STORIVI | cms   | cms   | cms          | cum     | cms   |
| Ī | 2       | 0.406 | 0.604 | 0.722        | 863.0   | 0.070 |
| Ī | 5       | 0.564 | 0.966 | 1.158        | 1037.0  | 0.111 |
| Ī | 25      | 0.815 | 1.559 | 1.807        | 1279.0  | 0.183 |
|   | 100     | 1.018 | 2.065 | 2.389        | 1463.0  | 0.240 |

#### 12HR SCS PRE DEVELOPMENT

| STORM   | PRE1  | EXT1  | PRE1 + EXT1 | PRE2  |
|---------|-------|-------|-------------|-------|
| STORIVI | cms   | cms   | cms         | cms   |
| 2       | 0.110 | 0.438 | 0.547       | 0.063 |
| 5       | 0.191 | 0.728 | 0.916       | 0.107 |
| 25      | 0.331 | 1.218 | 1.536       | 0.181 |
| 100     | 0.453 | 1.643 | 2.072       | 0.245 |

#### 12HR SCS

#### POST DEVELOPMENT

| STORM | POST1 | EXT1  | SWM Facility | STORAGE | POST2 |
|-------|-------|-------|--------------|---------|-------|
| 310   | cms   | cms   | cms          | cum     | cms   |
| 2     | 0.271 | 0.446 | 0.532        | 784.5   | 0.047 |
| 5     | 0.374 | 0.742 | 0.916        | 941.8   | 0.077 |
| 25    | 0.535 | 1.241 | 1.515        | 1175.0  | 0.123 |
| 100   | 0.667 | 1.674 | 2.040        | 1356.0  | 0.163 |

#### 6HR SCS PRE DEVELOPMENT

| STORM   | PRE1  | EXT1  | PRE1 + EXT1 | PRE2  |
|---------|-------|-------|-------------|-------|
| STORIVI | cms   | cms   | cms         | cms   |
| 2       | 0.074 | 0.304 | 0.379       | 0.044 |
| 5       | 0.140 | 0.537 | 0.676       | 0.080 |
| 25      | 0.257 | 0.942 | 1.192       | 0.144 |
| 100     | 0.363 | 1.308 | 1.655       | 0.201 |

#### 6HR SCS

#### POST DEVELOPMENT

| Ì | STORM   | POST1 | EXT1  | SWM Facility | STORAGE | POST2 |
|---|---------|-------|-------|--------------|---------|-------|
|   | JIORIVI | cms   | cms   | cms          | cum     | cms   |
| ĺ | 2       | 0.237 | 0.310 | 0.344        | 701.6   | 0.035 |
| ĺ | 5       | 0.331 | 0.547 | 0.665        | 840.0   | 0.060 |
| ĺ | 25      | 0.477 | 0.960 | 1.171        | 1042.0  | 0.101 |
| ĺ | 100     | 0.599 | 1.333 | 1.618        | 1212.0  | 0.137 |

#### 4HR CHI PRE DEVELOPMENT

| STORM   | PRE1  | EXT1  | PRE1 + EXT1 | PRE2  |
|---------|-------|-------|-------------|-------|
| STORIVI | cms   | cms   | cms         | cms   |
| 2       | 0.058 | 0.224 | 0.281       | 0.035 |
| 5       | 0.127 | 0.425 | 0.538       | 0.077 |
| 25      | 0.273 | 0.795 | 1.005       | 0.163 |
| 100     | 0.419 | 1.147 | 1.439       | 0.248 |

#### 4HR CHI

#### POST DEVELOPMENT

| STORM   | POST1 | EXT1  | SWM Facility | STORAGE | POST2 |
|---------|-------|-------|--------------|---------|-------|
| JIONIVI | cms   | cms   | cms          | cum     | cms   |
| 2       | 0.385 | 0.229 | 0.230        | 646.9   | 0.031 |
| 5       | 0.554 | 0.433 | 0.487        | 765.0   | 0.062 |
| 25      | 0.830 | 0.810 | 0.928        | 946.2   | 0.115 |
| 100     | 1.062 | 1.168 | 1.332        | 1105.0  | 0.174 |

| Pre-Development Condition 24-hour SCS Type-II Storm Distribution |
|--|

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\24-hour SCS\2-CYRSCS.dat

```
Metric units
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#***********************
* Pre-Development Condition - Mansfield Ski Club
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
          TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
               ["2SCS24.stm"] <--storm filename
*%
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8-----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.66](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81].
               Pervious surfaces: IAper=[8.1](mm), SLPP=[10](%),
                              LGP=[80](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                             LGI=[100](m), MNI=[0.013], SCI=[0](min),
               RAINFALL=[ , , , , ](mm/hr) , END=-1
*$-----|
* EXTERNAL
CALIB NASHYD
               ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*$_____|
* TOTAL
ADD HYD
              IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.36](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81],
              Pervious surfaces: IAper=[8.0](mm), SLPP=[13](%),
                              LGP=[70](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[45](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START
              TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
*%
               ["5SCS24.stm"] <--storm filename
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.dat

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 $\label{thm:convent} $$\operatorname{Projects}2015\15-319\Design\storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.dat $$\operatorname{Projects}(2015\15-319\Design\Storm\1$ 8/17/2020 12:31:27 PM 3/3

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\24-hour SCS\2-CYRSCS.out \_\_\_\_\_\_ SSSSS W W M M H H Y Y M M OOO 222 000 11 77777 == S W W W MM MM H H Y Y MM MM O O 2 0 0 11 7 7 M M M O O 2 SSSSS W W W M M M ннннн Y 0 0 11 W W M M н н Y M M O O 222 0 0 11 S SSSSS M M 000 0 0 11 M M H H Y 2 0 0 11 7 # 2 000 11 7 == StormWater Management HYdrologic Model 222 \* \*\*\*\*\*\*\* A single event and continuous hydrologic simulation model \*\*\*\*\*\*\*\* \*\*\*\*\*\* based on the principles of HYMO and its successors \*\*\*\*\*\*\*\* OTTHYMO-83 and OTTHYMO-89. \* \*\*\*\*\*\*\*\*\* Distributed by: J.F. Sabourin and Associates Inc. Ottawa, Ontario: (613) 836-3884 Gatineau, Quebec: (819) 243-6858 \*\*\*\*\*\* +++++++++ E-Mail: swmhvmo@ifsa.com \* \*\*\*\*\* +++++ PROGRAM ARRAY DIMENSIONS ++++++ \*\*\*\*\*\* Maximum value for ID numbers : 11 \*\*\*\*\*\*\*\* +++++++++++++++ Max. number of rainfall points: 105408 +++++++++ Max. number of flow points : 105408 \* \* DETAILED OUTPUT \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* \*\*\*\*\* RUN DATE: 2020-04-16 TIME: 11:29:18 RUN COUNTER: 000040 \* \* Input file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\EX\24-hour\_SCS\2-CYRSCS.dat \* Output file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\EX\24-hour SCS\2-CYRSCS.out \* Summary file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\EX\24-hour\_SCS\2-CYRSCS.sum \* User comments: \* 1:\_\_ \* 2:\_ \* 3:\_ \*

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\*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] \*# Company : WMI & Associates Ltd. \*# License # : 2880720 \* Pre-Development Condition - Mansfield Ski Club START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\ TZERO = .00 hrs on Ω METOUT= 2 (output = METRIC) NRUN = 0001 NSTORM= 1 # 1=2SCS24.stm READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal = 54.70 mm | Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield, TIME RAIN TIME RAIN TIME RATN TIME RATN TIME RATN hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 0:12 .547 4:12 1.094 8:12 1.641 12:12 10.940 16:12 1.368 20:12 0:24 .547 4:24 1.094 8:24 1.641 12:24 6.838 16:24 1.367 20:24 0:36 547 4:36 1.094 8:36 1.641 12:36 4.923 16:36 1 367 .547 1.094 8:48 1.641 12:48 4.6501 1:00 .547 5:00 1.094 9:00 1.641 13:00 3.282 17:00 .8201 21:00 1:12 547 5:12 1.094 9:12 1.641 13:12 2 7351 17:12 821 l 21:12 2.735 17:24 1.094 1:24 .547 5:24 1.094 9:24 1.641 13:24 21:24 1:36 .547 5:36 1.094 9:36 1.641 13:36 2.735 17:36 .821 21:36 5:48 9:48 13:48 17:48 1:48 .547 1.094 1.641 2.735 1.094 21:48 2:00 .547 6:00 1.094 10:00 1.641 14:00 2.735 18:00 .821 22:00 2:12 .547 6:12 1 094 10:12 3 008 14:12 1.641 18:12 821 22:12 2:24 547 6:24 1 094 10:24 3 009 14:24 1 641 | 18:24 8201 22:24 2:36 .547 6:36 1.094 10:36 3.008 14:36 1.641 18:36 1.094 22:36 2:48 .547 6:48 1.094 | 10:48 3.009 14:48 1.641 18:48 .821 3:00 .547 7:00 1.094 11:00 3.008 15:00 1.641 19:00 .821 23:00 .547 1.094 3:12 7:12 1.094 11:12 4.102 15:12 1.367 19:12 23:12 7:24 1.094 15:24 1.367 3:24 5471 11:24 6 017 19:24 821 l 23:24 3:36 547 7:36 1.094 11:36 14.495 15:36 1.367 19:36 1.094 23:36 3:48 .547 7:48 1.094 11:48 30.085 15:48 1.367 | 19:48 . 821 | 23:48 4:00 .547 8:00 1.094 12:00 61.538 16:00 1.367 20:00 1.094 24:00 R0001:C00003-----\* To account for the existing packed gravel surfaces on-site, the TIMP value \* was calibrated (see design calcs)

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\24-hour SCS\2-CYRSCS.out

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

| CA | LIB STANDHYD  |            | Area (ha)=    | 2.66       |                    |
|----|---------------|------------|---------------|------------|--------------------|
| 01 | :PRE1 D'      | r= 1.00    | Total Imp(%)= | 24.00 D    | ir. Conn.(%)= 1.00 |
|    |               |            |               |            |                    |
|    |               |            | IMPERVIOUS    | PERVIOUS ( | i)                 |
|    | Surface Area  | (ha) =     | .64           | 2.02       |                    |
|    | Dep. Storage  | ( mm ) =   | 2.00          | 8.10       |                    |
|    | Average Slope | e (%)=     | 2.00          | 10.00      |                    |
|    | Length        | ( m ) =    | 100.00        | 80.00      |                    |
|    | Mannings n    | =          | .013          | .250       |                    |
|    |               |            |               |            |                    |
|    | Max.eff.Inter | n.(mm/hr)= | 61.54         | 45.14      |                    |
|    | 70            | ver (min)  | 3.00          | 12.00      |                    |
|    | Storage Coef  | f. (min)=  | 2.52 (ii)     | 11.59 (i   | i)                 |
|    | Unit Hyd. Tpe | eak (min)= | 3.00          | 12.00      |                    |
|    | Unit Hyd. pea | ak (cms)=  | .42           | .10        |                    |
|    |               |            |               |            | *TOTALS*           |
|    | PEAK FLOW     | (cms)=     | .00           | .17        | .166 (iii)         |
|    | TIME TO PEAK  | (hrs)=     | 12.00         | 12.10      | 12.100             |
|    | RUNOFF VOLUM  | E (mm)=    | 52.70         | 24.95      | 25.225             |
|    | TOTAL RAINFAL | LL (mm)=   | 54.70         | 54.70      | 54.700             |
|    | RUNOFF COEFF: | ICIENT =   | .96           | .46        | .461               |
|    |               |            |               |            |                    |

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

R0001:C00004-----

\* EXTERNAL

| CALIB NASHYD 02:EXT DT=   | 1.00             |                    | Curve Number (CN)= 83.00<br># of Linear Res.(N)= 3.00 |
|---------------------------|------------------|--------------------|---|
| Unit Hyd Qpeak            | (cms)=           | 1.864              |   |
| PEAK FLOW<br>TIME TO PEAK | (cms)=<br>(hrs)= | .592 (i)<br>12.150 |   |

DURATION (hrs)= 25.667, (dddd|hh:mm:)= 1|01:40

AVERAGE FLOW (cms)= .029

RUNOFF VOLUME (mm)= 22.962

TOTAL RAINFALL (mm)= 54.700

RUNOFF COEFFICIENT = .420

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

R0001:C00005-----

\* TOTAL

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|     |    |          | (ha)   | (cms)   | (hrs)  | (mm)   | (cms) |
|-----|----|----------|--------|---------|--------|--------|-------|
| ID  | 1  | 01:PRE1  | 2.660  | .166    | 12.100 | 25.225 | .000  |
| +ID | 2  | 02:EXT   | 11.710 | .592    | 12.150 | 22.962 | .000  |
| === | == |          |        | ======= |        |        |       |
| SUM |    | 03:TOTAL | 14.370 | .756    | 12.133 | 23.381 | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

D0001 - 700006

\* SITE

- $^{\star}$  To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| - | LIB STANDHYD<br>:PRE2 DT= 1 | 1.00     | Area ( Total Imp |          |          | Dir. | Conn.(%)= | 1.00  |
|---|-----------------------------|----------|------------------|----------|----------|------|-----------|-------|
|   |                             |          | IMPERVIO         | ous      | PERVIOUS | (i)  |           |       |
|   | Surface Area                | (ha)=    | .33              | 3        | 1.03     |      |           |       |
|   | Dep. Storage                | ( mm ) = | 2.00             | )        | 8.00     |      |           |       |
|   | Average Slope               | (%)=     | 3.50             | )        | 13.00    |      |           |       |
|   | Length                      | (m) =    | 45.00            | )        | 70.00    |      |           |       |
|   | Mannings n                  | =        | .013             | 3        | .250     |      |           |       |
|   | Max.eff.Inten.(r            | nm/hr)=  | 61.54            | <u>l</u> | 46.83    |      |           |       |
|   | over                        | (min)    | 1.00             | )        | 9.00     |      |           |       |
|   | Storage Coeff.              | (min)=   | 1.32             | 2 (ii)   | 8.95     | (ii) |           |       |
|   | Unit Hyd. Tpeak             | (min) =  | 1.00             | )        | 9.00     |      |           |       |
|   | Unit Hyd. peak              | (cms)=   | .90              | )        | .13      |      |           |       |
|   |                             |          |                  |          |          |      | *TOTALS*  |       |
|   | PEAK FLOW                   | (cms)=   | .00              | )        | .10      |      | .097      | (iii) |
|   | TIME TO PEAK                | (hrs)=   | 11.95            | 5        | 12.07    |      | 12.067    |       |
|   | RUNOFF VOLUME               | (mm) =   | 52.58            | 3        | 25.01    |      | 25.281    |       |
|   | TOTAL RAINFALL              | ( mm ) = | 54.70            | )        | 54.70    |      | 54.700    |       |
|   | RUNOFF COEFFICIA            | ENT =    | .96              | 5        | .46      |      | .462      |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 81.0 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.

R0001:C00007-----\*
\*\* END OF RUN : 0

START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\

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```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\24-hour_SCS\2-CYRSCS.out
    ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
       TZERO = .00 hrs on
                         Ω
       METOUT= 2 (output = METRIC)
       NRUN = 0002
       NSTORM= 1
            # 1=5SCS24.stm
    *#***********************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
              : 07-31-2017
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
    *# License # : 2880720
    *#***************************
    * Pre-Development Condition - Mansfield Ski Club
     READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
     Ptotal= 72.10 mm | Comments: 5-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
        TIME RAIN TIME RAIN
                               TIME
                                      RAIN TIME RAIN TIME RAIN
       hh:mm
              mm/hr| hh:mm
                         mm/hr|
                                hh:mm mm/hr| hh:mm mm/hr| hh:mm
                                                              mm/hr|
                                                                    hh:mm
        0:12
             .721
                   4:12 1.442
                                8:12 2.163
                                            12:12 14.420
                                                        16:12 1.803
                                                                    20:12
                                8:24 2.163 12:24 9.013 16:24 1.802
        0:24
              .721
                   4:24 1.442
                                                                    20:24
        0:36
              .721
                   4:36 1.442
                                8:36 2.163 12:36 6.489 16:36 1.802 20:36
         0:48
              .721
                   4:48 1.442
                                8:48 2.163 12:48 6.129 16:48 1.802
        1:00
              .721
                   5:00 1.442
                                9:00 2.163 13:00 4.326 17:00 1.081
                                                                    21:00
        1:12
              .721
                   5:12 1.442
                                9:12 2.163 13:12 3.605 17:12 1.082
                                                                    21:12
              .721
                                9:24 2.163 13:24 3.605
                                                        17:24
        1:24
                   5:24 1.442
                                                              1.442
                                                                    21:24
        1:36
              .721
                    5:36
                         1.442
                                9:36 2.163
                                            13:36 3.605
                                                        17:36
                                                              1.082
                                                                    21:36
         1:48
                    5:48
                         1.442
                                9:48
                                      2.163
                                            13:48
                                                  3.605
                                                        17:48
              .721
         2:00
               .721
                    6:00
                         1.442
                                10:00
                                      2.163
                                            14:00 3.605
                                                        18:00
                                                              1.082
                                                                    22:00
                                            14:12 2.163
        2:12
               .721
                    6:12
                         1.442
                               10:12 3.965
                                                        18:12
                                                              1.082
                                                                    22:12
        2:24
                   6:24 1.442 10:24 3.966 14:24 2.163 18:24 1.081
                                                                    22:24
              721
        2:36
              .721
                   6:36 1.442 10:36 3.965 14:36 2.163 18:36 1.442 22:36
         2:48
              .721
                   6:48
                         1.082 22:48
        3:00
              .721
                   7:00 1.442 11:00 3.965 15:00 2.163 19:00 1.082 23:00
        3:12
             .721
                   7:12 1.442 11:12 5.408 15:12 1.802 19:12 1.442 23:12
             .721
                   7:24 1.442 11:24 7.931 15:24 1.802
        3:24
                                                        19:24
                                                              1 082
                                                                    23:24
         3:36
              .721
                    7:36 1.442 11:36 19.106 15:36 1.802
                                                        19:36
                                                              1.442 23:36
         3:48
              .721
                    7:48 1.442 11:48 39.655 15:48 1.802 19:48 1.082 23:48
         4:00
              .721 8:00 1.442 12:00 81.113 16:00 1.802 20:00 1.442 24:00
    R0002:C00003-----
    * To account for the existing packed gravel surfaces on-site, the TIMP value
```

- \* was calibrated (see design calcs)

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| CALIB STANDHYD   | Area (ha)=      | 2 66      |                               |
|--|-----------------|-----------|-------------------------------|
| 01:PRE1 DT= 1.00   | Total Tmp(%)=   | 24.00     | Dir. Conn.(%)= 1.00           |
|  |                 |           |                               |
|  | IMPERVIOUS      | PERVIOUS  | (i)                           |
| Surface Area (ha)=   | .64             | 2.02      | • •                           |
| Dep. Storage (mm)=   | 2.00            | 8.10      |                               |
| Average Slope (%)=   | 2.00            | 10.00     |                               |
| Length (m)=  | 100.00          | 80.00     |                               |
| Mannings n =   |                 |           |                               |
| 3  |                 |           |                               |
| Max.eff.Inten.(mm/hr)=   | 81.11           | 71.18     |                               |
| over (min)   | 2.00            | 10.00     |                               |
| Storage Coeff. (min)=  | 2.26 (ii)       | 9.82      | (ii)                          |
| Unit Hyd. Tpeak (min)=   | 2.00            | 10.00     |                               |
| Unit Hyd. peak (cms)=  | .52             | .11       |                               |
|  |                 |           | *TOTALS*                      |
| PEAK FLOW (cms)=   | .01             | .28       | .282 (iii)                    |
| TIME TO PEAK (hrs)=  | 12.00           | 12.07     | 12.067                        |
| RUNOFF VOLUME (mm)=  | 70.10           | 38.88     | 39.198                        |
| TOTAL RAINFALL (mm)=   | 72.10           | 72.10     | 72.101                        |
| RUNOFF COEFFICIENT =   | .97             | .54       | .544                          |
| CN* = 81.0 Ia<br>(ii) TIME STEP (DT) SH<br>(iii) PEAK FLOW DOES NO | OULD BE SMALLER | OR EQUAL  | THAN THE STORAGE COEFFICIENT. |
| D0000.g00004   |                 |           |                               |
| R0002:C00004 * EXTERNAL  |                 |           |                               |
| " EXIERNAL   |                 |           |                               |
|  | Area (ha)=      | 11 710    | Curve Number (CN)= 83.00      |
|  |                 |           | # of Linear Res.(N)= 3.00     |
|  |                 |           |                               |
|  | 0.m. 1p(m.b)    | .210      |                               |
| Unit Hyd Qpeak (cms)=  | 1.864           |           |                               |
| PEAK FLOW (cms)=   | .948 (i)        |           |                               |
| TIME TO PEAK (hrs)=  | 12.133          |           |                               |
| DURATION (hrs)=  | 25.667, (dddd   | hh:mm:)=  | 1   01:40                     |
| AVERAGE FLOW (cms)=  |                 |           | '                             |
| RUNOFF VOLUME (mm)=  | 36.345          |           |                               |
| TOTAL RAINFALL (mm)=   |                 |           |                               |
| RUNOFF COEFFICIENT =   | .504            |           |                               |
|  |                 |           |                               |
| (i) PEAK FLOW DOES NOT   | INCLUDE BASEFLO | W IF ANY. |                               |
|  |                 |           |                               |

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AREA OPEAK TPEAK

RV

DWF

R0002:C00005-----

ID:NHYD

DD HYD 03:TOTAL \wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

|       | (ha)      | (cms)  | (hrs) | ( mm ) | (cms)  |       |  |
|-------|-----------|--------|-------|--------|--------|-------|--|
| ID :  | 01:PRE1   | 2.660  | .282  | 12.067 | 39.198 | .000  |  |
| +ID : | 02:EXT    | 11.710 | .948  | 12.133 | 36.345 | .000  |  |
| ====  | .======== |        |       |        |        | ===== |  |
| SUM   | 03:TOTAL  | 14.370 | 1.213 | 12.117 | 36.873 | .000  |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

D0002-000006

#### \* SITE

- $^{\star}$  To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| CALIB STANDHYD<br>  04:PRE2 DT= 1.0 |         | (ha)=<br>Imp(%)= |          | Dir. | Conn.(%)= | 1.00  |
|-------------------------------------|---------|------------------|----------|------|-----------|-------|
|                                     |         |                  |          |      |           |       |
|                                     | IMPE    | RVIOUS           | PERVIOUS | (i)  |           |       |
| Surface Area (1                     | ha)=    | .33              | 1.03     |      |           |       |
| Dep. Storage (1                     | mm ) =  | 2.00             | 8.00     |      |           |       |
| Average Slope                       | (%)=    | 3.50             | 13.00    |      |           |       |
| Length                              | (m) = 4 | 5.00             | 70.00    |      |           |       |
| Mannings n                          | =       | .013             | .250     |      |           |       |
|                                     |         |                  |          |      |           |       |
| Max.eff.Inten.(mm/                  | hr)= 8  | 1.11             | 72.46    |      |           |       |
| over (m.                            | in)     | 1.00             | 8.00     |      |           |       |
| Storage Coeff. (m                   | in)=    | 1.18 (ii)        | 7.59     | (ii) |           |       |
| Unit Hyd. Tpeak (m                  | in)=    | 1.00             | 8.00     |      |           |       |
| Unit Hyd. peak (c                   | ms)=    | .97              | .15      |      |           |       |
|                                     |         |                  |          |      | *TOTALS*  |       |
| PEAK FLOW (C                        | ms)=    | .00              | .16      |      | .160      | (iii) |
| TIME TO PEAK (h:                    | rs)= 1  | 1.93             | 12.05    |      | 12.033    |       |
| RUNOFF VOLUME (1                    | mm) = 7 | 0.02             | 38.95    |      | 39.260    |       |
| TOTAL RAINFALL (1                   | mm) = 7 | 2.10             | 72.10    |      | 72.101    |       |
| RUNOFF COEFFICIENT                  | =       | .97              | .54      |      | .545      |       |

- (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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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

\*# Date : 07-31-2017

\*# Modeller : [J. Lightheart]

\*# Company : WMI & Associates Ltd.
\*# License # : 2880720

\*
\* Pre-Development Condition - Mansfield Ski Club

R0003:C00002-----

| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal= 98.40 mm | Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield,

| TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN    | TIME  | RAIN   | TIME  | RAIN  | TIME  |
|-------|-------|-------|-------|-------|---------|-------|--------|-------|-------|-------|
| hh:mm | mm/hr | hh:mm | mm/hr | hh:mm | mm/hr   | hh:mm | mm/hr  | hh:mm | mm/hr | hh:mm |
| 0:12  | .984  | 4:12  | 1.968 | 8:12  | 2.952   | 12:12 | 19.680 | 16:12 | 2.460 | 20:12 |
| 0:24  | .984  | 4:24  | 1.968 | 8:24  | 2.952   | 12:24 | 12.300 | 16:24 | 2.460 | 20:24 |
| 0:36  | .984  | 4:36  | 1.968 | 8:36  | 2.952   | 12:36 | 8.856  | 16:36 | 2.460 | 20:36 |
| 0:48  | .984  | 4:48  | 1.968 | 8:48  | 2.952   | 12:48 | 8.364  | 16:48 | 2.460 | 20:48 |
| 1:00  | .984  | 5:00  | 1.968 | 9:00  | 2.952   | 13:00 | 5.904  | 17:00 | 1.476 | 21:00 |
| 1:12  | .984  | 5:12  | 1.968 | 9:12  | 2.952   | 13:12 | 4.920  | 17:12 | 1.476 | 21:12 |
| 1:24  | .984  | 5:24  | 1.968 | 9:24  | 2.952   | 13:24 | 4.920  | 17:24 | 1.968 | 21:24 |
| 1:36  | .984  | 5:36  | 1.968 | 9:36  | 2.952   | 13:36 | 4.920  | 17:36 | 1.476 | 21:36 |
| 1:48  | .984  | 5:48  | 1.968 | 9:48  | 2.952   | 13:48 | 4.920  | 17:48 | 1.968 | 21:48 |
| 2:00  | .984  | 6:00  | 1.968 | 10:00 | 2.952   | 14:00 | 4.920  | 18:00 | 1.476 | 22:00 |
| 2:12  | .984  | 6:12  | 1.968 | 10:12 | 5.412   | 14:12 | 2.952  | 18:12 | 1.476 | 22:12 |
| 2:24  | .984  | 6:24  | 1.968 | 10:24 | 5.412   | 14:24 | 2.952  | 18:24 | 1.476 | 22:24 |
| 2:36  | .984  | 6:36  | 1.968 | 10:36 | 5.412   | 14:36 | 2.952  | 18:36 | 1.968 | 22:36 |
| 2:48  | .984  | 6:48  | 1.968 | 10:48 | 5.412   | 14:48 | 2.952  | 18:48 | 1.476 | 22:48 |
| 3:00  | .984  | 7:00  | 1.968 | 11:00 | 5.412   | 15:00 | 2.952  | 19:00 | 1.476 | 23:00 |
| 3:12  | .984  | 7:12  | 1.968 | 11:12 | 7.380   | 15:12 | 2.460  | 19:12 | 1.968 | 23:12 |
| 3:24  | .984  | 7:24  | 1.968 | 11:24 | 10.824  | 15:24 | 2.460  | 19:24 | 1.476 | 23:24 |
| 3:36  | .984  | 7:36  | 1.968 | 11:36 | 26.076  | 15:36 | 2.460  | 19:36 | 1.968 | 23:36 |
| 3:48  | .984  | 7:48  | 1.968 | 11:48 | 54.120  | 15:48 | 2.460  | 19:48 | 1.476 | 23:48 |
| 4:00  | .984  | 8:00  | 1.968 | 12:00 | 110.700 | 16:00 | 2.460  | 20:00 | 1.968 | 24:00 |
|       |       |       |       |       |         |       |        |       |       |       |

R0003:C00003-----

\* SITE

\* To account for the existing packed gravel surfaces on-site, the TIMP value

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

\* was calibrated (see design calcs)

\_\_\_\_\_\_

| CALIB STANDHYD   01:PRE1 DT= 1.00 | Area (ha)=<br>Total Imp(%)= |            | ir. Conn.(%)= 1.00 |
|-----------------------------------|-----------------------------|------------|--------------------|
|                                   | IMPERVIOUS                  | PERVIOUS ( | 2 \                |
| a                                 |                             |            | 1)                 |
| Surface Area (ha)=                |                             |            |                    |
| Dep. Storage (mm)=                | 2.00                        | 8.10       |                    |
| Average Slope (%)=                | 2.00                        | 10.00      |                    |
| Length (m)=                       | 100.00                      | 80.00      |                    |
| Mannings n =                      | .013                        | .250       |                    |
| Max.eff.Inten.(mm/hr)=            | 110.70                      | 112.01     |                    |
|                                   | 2.00                        |            |                    |
| Storage Coeff. (min)=             |                             |            | i)                 |
| Unit Hyd. Tpeak (min)=            |                             |            | 1)                 |
|                                   |                             |            |                    |
| Unit Hyd. peak (cms)=             | .56                         | .14        |                    |
|                                   |                             |            | *TOTALS*           |
| PEAK FLOW (cms)=                  | .01                         | .48        | .482 (iii)         |
| TIME TO PEAK (hrs)=               | 12.00                       | 12.05      | 12.033             |
| RUNOFF VOLUME (mm)=               | 96.40                       | 61.61      | 61.961             |
| TOTAL RAINFALL (mm)=              |                             |            | 98.399             |
| RUNOFF COEFFICIENT =              |                             | .63        | .630               |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 81.0 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.

R0003:C00004-----

| * | EXTERNAL |
|---|----------|
|---|----------|

| Area (ha)= 11.710 Curve Number (CN)= 83.00<br>Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 |
|--|
| U.H. $Tp(hrs) = .240$  |
| = 1.864  |
| = 1.529 (i)  |
| = 12.133   |
| = 25.667, (dddd hh:mm:)= 1 01:40   |
| 074  |
| = 58.420   |
| 98.399   |
| -     -   -   -   -   -   -   -   -   -  |

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

RUNOFF COEFFICIENT = .594

R0003:C00005-----

\* TOTAL

\_\_\_\_

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

| ADD HYD  |       |          |        |       |        |        |       |
|----------|-------|----------|--------|-------|--------|--------|-------|
| 03:TOTAL |       | ID:NHYD  | AREA   | QPEAK | TPEAK  | R.V.   | DWF   |
|          |       |          | (ha)   | (cms) | (hrs)  | ( mm ) | (cms) |
|          | ID 1  | 01:PRE1  | 2.660  | .482  | 12.033 | 61.961 | .000  |
|          | +ID 2 | 02:EXT   | 11.710 | 1.529 | 12.133 | 58.420 | .000  |
|          | ===== |          |        |       |        |        |       |
|          | SUM   | 03:TOTAL | 14.370 | 1.947 | 12.100 | 59.075 | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0003:C00006-----

\* SITE

- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

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| CALIB STANDHYD  <br>  04:PRE2 DT= 1.00 |            |              | . Conn.(%)= 1.00 |
|--|------------|--------------|------------------|
|  | IMPERVIOUS | PERVIOUS (i) |                  |
| Surface Area (ha)=                     | .33        | 1.03         |                  |
| Dep. Storage (mm)=                     | 2.00       | 8.00         |                  |
| Average Slope (%)=                     | 3.50       | 13.00        |                  |
| Length (m)=                            | 45.00      | 70.00        |                  |
| Mannings n =                           | .013       | .250         |                  |
|  |            |              |                  |
| Max.eff.Inten.(mm/hr)=                 | 110.70     | 113.33       |                  |
| over (min)                             | 1.00       | 6.00         |                  |
| Storage Coeff. (min)=                  | 1.04 (ii)  | 6.40 (ii)    |                  |
| Unit Hyd. Tpeak (min)=                 | 1.00       | 6.00         |                  |
| Unit Hyd. peak (cms)=                  | 1.05       | .18          |                  |
|  |            |              | *TOTALS*         |
| PEAK FLOW (cms)=                       | .00        | .27          | .272 (iii)       |
| TIME TO PEAK (hrs)=                    | 11.92      | 12.02        | 12.017           |
| RUNOFF VOLUME (mm)=                    | 96.28      | 61.68        | 62.027           |
| TOTAL RAINFALL (mm)=                   | 98.40      | 98.40        | 98.399           |
| RUNOFF COEFFICIENT =                   | .98        | .63          | .630             |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 81.0 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.

10/17

```
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
-----Bainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = .00 hrs on 0
  METOUT= 2 (output = METRIC)
  NRUN = 0004
  NSTORM= 1
     # 1=100SCS24.stm
R0004:C00002-----
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#***************************
* Pre-Development Condition - Mansfield Ski Club
R0004:C00002-----
 READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
| Ptotal = 120.00 mm | Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
    TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME
   hh:mm mm/hr | hh:mm mm/hr | hh:mm mm/hr | hh:mm mm/hr | hh:mm
                          8:12 3.600 12:12 24.000 16:12 3.000 20:12
    0:12 1.200
              4:12 2.400
    0:24 1.200
              4:24 2.400|
                          8:24 3.600 12:24 15.000 16:24
                                                       3.000|
                                                            20:24
    0:36
               4:36
                    2.400
                           8:36
                                3.600
                                      12:36 10.800
        1.200
                                                 16:36
                                                             20:36
    0:48
        1.200
               4:48
                    2.400
                          8:48
                                3.600|
                                      12:48 10.200
                                                 16:48
                                                       3.000|
                                                             20:48
    1:00
        1.200
               5:00
                    2.400
                          9:00 3.600 13:00 7.200
                                                 17:00
                                                       1.800
                                                            21:00
    1:12 1 200
              5:12 2 400
                          9:12 3 600 | 13:12 6 000 | 17:12 1 800 | 21:12
    1:24 1.200
              5:24 2.400
                          9:24 3.600 13:24 6.000 17:24 2.400 21:24
    1:36 1.200
              5:36
                    2.400
                          9:36 3.600 13:36 6.000 17:36
                                                      1.800 | 21:36
    1:48 1.200
              5:48 2.400
                          9:48 3.600 13:48 6.000 17:48
                                                      2.400 | 21:48
    2:00 1.200
              6:00 2.400 10:00 3.600 14:00 6.000 18:00 1.800 22:00
              6:12 2.400 10:12 6.600 14:12 3.600
    2:12 1.200
                                                 18:12
                                                      1 800 |
                                                            22:12
    2:24
        1.200
               6:24 2.400
                          10:24 6.600 14:24 3.600
                                                 18:24
                                                       1.800
                                                             22:24
    2:36
        1.200
               6:36
                    2.400
                          10:36 6.600
                                      14:36 3.600
                                                 18:36
                                                       2.400
                                                             22:36
    2:48
        1.200
               6:48
                    2.400
                          10:48 6.600
                                     14:48
                                           3.600|
                                                 18:48
                                                       1.800|
                                                             22:48
    3:00 1.200
               7:00 2.400 11:00 6.600 15:00 3.600
                                                 19:00 1.800| 23:00
    3:12 1.200
               7:12 2.400 11:12 9.000 15:12 3.000 19:12 2.400 23:12
              7:24 2.400 11:24 13.200 15:24 3.000 19:24 1.800 23:24
    3:24 1.200
    3:48 1.200 7:48 2.400 11:48 66.000 15:48 3.000 19:48 1.800 23:48
    4:00 1.200 8:00 2.400 12:00 135.000 16:00 3.000 20:00 2.400 24:00
```

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R0004:000003-----

- \* SITE
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| CALIB STANDHYD 01:PRE1 DT= 1 |          | Area (1<br>Total Imp |      |         | Dir. | Conn.(%)= | 1.00  |
|------------------------------|----------|----------------------|------|---------|------|-----------|-------|
|                              |          | IMPERVIO             | JS P | ERVIOUS | (i)  |           |       |
| Surface Area                 | (ha)=    | .64                  |      | 2.02    |      |           |       |
| Dep. Storage                 | ( mm ) = | 2.00                 |      | 8.10    |      |           |       |
| Average Slope                | (%)=     | 2.00                 |      | 10.00   |      |           |       |
| Length                       | (m)=     | 100.00               |      | 80.00   |      |           |       |
| Mannings n                   | =        | .013                 |      | .250    |      |           |       |
| Max.eff.Inten.(mr            | m/hr)=   | 135.00               |      | 145.09  |      |           |       |
| over                         | (min)    | 2.00                 |      | 8.00    |      |           |       |
| Storage Coeff.               | (min)=   | 1.84                 | (ii) | 7.53    | (ii) |           |       |
| Unit Hyd. Tpeak              | (min)=   | 2.00                 |      | 8.00    |      |           |       |
| Unit Hyd. peak               | (cms)=   | .59                  |      | .15     |      |           |       |
|                              |          |                      |      |         |      | *TOTALS*  |       |
| PEAK FLOW                    | (cms)=   | .01                  |      | .64     |      | .647      | (iii) |
| TIME TO PEAK                 |          |                      |      |         |      | 12.033    |       |
| RUNOFF VOLUME                |          |                      |      |         |      |           |       |
| TOTAL RAINFALL               | ( mm ) = |                      |      | 120.00  |      | 120.000   |       |
| RUNOFF COEFFICIEN            | TV =     | .98                  |      | .68     |      | .679      |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 81.0 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.

R0004:C00004-----

\* EXTERNAL

Unit Hyd Qpeak (cms)= 1.864

PEAK FLOW (cms)= 2.025 (i)
TIME TO PEAK (hrs)= 12.133

DURATION (hrs) = 25.667, (dddd|hh:mm:) = 1 | 01:40

AVERAGE FLOW (cms)= .098
RUNOFF VOLUME (mm)= 77.557
TOTAL RAINFALL (mm)= 120.000
RUNOFF COEFFICIENT = .646

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

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

R0004:C00005-----\* TOTAL ADD HYD ID:NHYD 03:TOTAL AREA OPEAK TPEAK R.V. \_\_\_\_\_\_ (ha) (cms) (hrs) (mm) (cms) TD 1 01:PRE1 2.660 .647 12.033 81.527 000 +ID 2 02:EXT 11.710 2.025 12.133 77.557 \_\_\_\_\_\_ SUM 03:TOTAL 14.370 2.580 12.100 78.292 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0004:C00006-----

- \* SITE
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| CALIB STANDHYD   04:PRE2 DT= 1.00 | Area (ha)=<br>Total Imp(%)= |              | . Conn.(%)= 1.00 |
|-----------------------------------|-----------------------------|--------------|------------------|
|                                   | IMPERVIOUS                  | PERVIOUS (i) |                  |
| Surface Area (ha)=                | .33                         | 1.03         |                  |
| Dep. Storage (mm)=                | 2.00                        | 8.00         |                  |
| Average Slope (%)=                | 3.50                        | 13.00        |                  |
| Length (m)=                       | 45.00                       | 70.00        |                  |
| Mannings n =                      | .013                        | .250         |                  |
| Max.eff.Inten.(mm/hr)=            | 135.00                      | 146.45       |                  |
| over (min)                        | 1.00                        | 6.00         |                  |
| Storage Coeff. (min)=             | .96 (ii)                    | 5.80 (ii)    |                  |
| Unit Hyd. Tpeak (min)=            | 1.00                        | 6.00         |                  |
| Unit Hyd. peak (cms)=             | 1.10                        | .19          |                  |
|                                   |                             |              | *TOTALS*         |
| PEAK FLOW (cms)=                  | .01                         | .36          | .362 (iii)       |
| TIME TO PEAK (hrs)=               | 11.92                       | 12.02        | 12.017           |
| RUNOFF VOLUME (mm)=               | 117.91                      | 81.22        | 81.596           |
| TOTAL RAINFALL (mm)=              | 120.00                      | 120.00       | 120.000          |
| RUNOFF COEFFICIENT =              | .98                         | .68          | .680             |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 81.0 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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```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\24-hour_SCS\2-CYRSCS.out
   R0004:C00002-----
     ** END OF RUN : 3
    ************************
    START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\
      TZERO = .00 hrs on
      METOUT= 2 (output = METRIC)
      NRUN = 0005
      NSTORM= 1
        # 1=12regtim.o89
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
    *# Date
              : 07-31-2017
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
*# License # : 2880720
    *#***********************
    * Pre-Development Condition - Mansfield Ski Club
   R0005:C00002----
    READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    | Ptotal= 193.00 mm | Comments: TIMMINS REGIONAL STORM (12-hour)
       TIME RAIN TIME RAIN
                             TIME
                                  RAIN
                                         TIME
                                             RAIN TIME RAIN TIME
       hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr hh:mm
       1:00 15.000 3:00 10.000 5:00 5.000 7:00 43.000 9:00 23.000 11:00
       2:00 20.000 | 4:00 3.000 | 6:00 20.000 | 8:00 20.000 | 10:00 13.000 | 12:00
   R0005:C00003-----
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
    ______
    | CALIB STANDHYD | Area (ha)= 2.66
    | 01:PRE1 | DT= 1.00 | Total Imp(%)= 24.00 | Dir. Conn.(%)= 1.00
                        IMPERVIOUS PERVIOUS (i)
       Surface Area (ha)=
                           .64
                                    2 02
       Dep. Storage (mm)=
                           2.00
                                    8.10
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\24-hour\_SCS\2-CYRSCS.out

| Average Slope    | (%)=     | 2.00   | 10.00      |         |       |
|------------------|----------|--------|------------|---------|-------|
| Length           | (m)=     | 100.00 | 80.00      |         |       |
| Mannings n       | =        | .013   | .250       |         |       |
|                  |          |        |            |         |       |
| Max.eff.Inten.(r | mm/hr)=  | 43.00  | 50.88      |         |       |
| over             | (min)    | 3.00   | 12.00      |         |       |
| Storage Coeff.   | (min) =  | 2.91   | (ii) 11.56 | (ii)    |       |
| Unit Hyd. Tpeak  | (min) =  | 3.00   | 12.00      |         |       |
| Unit Hyd. peak   | (cms)=   | .39    | .10        |         |       |
|                  |          |        |            | *TOTALS | *     |
| PEAK FLOW        | (cms)=   | .00    | .28        | .284    | (iii) |
| TIME TO PEAK     | (hrs)=   | 6.97   | 7.00       | 7.000   |       |
| RUNOFF VOLUME    | ( mm ) = | 191.00 | 150.04     | 150.449 |       |
| TOTAL RAINFALL   | ( mm ) = | 193.00 | 193.00     | 193.000 |       |
| RUNOFF COEFFICIE | ENT =    | .99    | .78        | .780    |       |
|                  |          |        |            |         |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 81.0 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.

R0005:C00004-----

#### \* EXTERNAL

| CALIB NASHYI | ) | Area   | (ha)=   | 11.710 | Curve Number (CN)=   | 83.00 |
|--------------|---|--------|---------|--------|----------------------|-------|
|              |   |        |         |        | # of Linear Res.(N)= |       |
|              |   | U.H. T | p(hrs)= | . 240  |                      |       |

Unit Hyd Qpeak (cms)= 1.864

PEAK FLOW (cms)= 1.215 (i)
TIME TO PEAK (hrs)= 7.017

DURATION (hrs) = 13.667, (dddd|hh:mm:) = 0 |13:40

AVERAGE FLOW (cms)= .346 RUNOFF VOLUME (mm)= 145.537 TOTAL RAINFALL (mm)= 193.000

TOTAL RAINFALL (mm) = 193.000 RUNOFF COEFFICIENT = .754

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

R0005:C00005-----

#### \* TOTAL

| ADD HYD |       | ID:NHYD   | AREA   | QPEAK | TPEAK | R.V.    | DWF   |
|---------|-------|-----------|--------|-------|-------|---------|-------|
| ·       |       |           | (ha)   | (cms) | (hrs) | ( mm )  | (cms) |
|         | ID :  | 1 01:PRE1 | 2.660  | .284  | 7.000 | 150.449 | .000  |
|         | +ID 2 | 2 02:EXT  | 11.710 | 1.215 | 7.017 | 145.537 | .000  |
|         | ====  |           |        |       |       |         |       |
|         | SUM   | 03:TOTAL  | 14.370 | 1.498 | 7.017 | 146.446 | .000  |

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0005:C00006-----

- \* ST
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

-----

| CALIB STANDHYD   |          | Area (ha)=    | 1.36     |                     |
|------------------|----------|---------------|----------|---------------------|
| 04:PRE2 DT= 1    | .00      | Total Imp(%)= | 24.00    | Dir. Conn.(%)= 1.00 |
| <br>             |          |               |          |                     |
|                  |          | IMPERVIOUS    | PERVIOUS | (i)                 |
| Surface Area     | (ha) =   | .33           | 1.03     |                     |
| Dep. Storage     | (mm) =   | 2.00          | 8.00     |                     |
| Average Slope    | (%)=     | 3.50          | 13.00    |                     |
| Length           | (m) =    | 45.00         | 70.00    |                     |
| Mannings n       | =        | .013          | .250     |                     |
|                  |          |               |          |                     |
| Max.eff.Inten.(m | nm/hr)=  | 43.00         | 50.96    |                     |
| over             | (min)    | 2.00          | 9.00     |                     |
| Storage Coeff.   | (min) =  | 1.52 (ii)     | 8.90     | (ii)                |
| Unit Hyd. Tpeak  | (min) =  | 2.00          | 9.00     |                     |
| Unit Hyd. peak   | (cms)=   | .66           | .13      |                     |
|                  |          |               |          | *TOTALS*            |
| PEAK FLOW        | (cms)=   | .00           | .14      | .146 (iii)          |
| TIME TO PEAK     | (hrs)=   | 6.85          | 7.00     | 7.000               |
| RUNOFF VOLUME    | ( mm ) = | 191.00        | 150.12   | 150.522             |
| TOTAL RAINFALL   | ( mm ) = | 193.00        | 193.00   | 193.000             |
| RUNOFF COEFFICIE | ENT =    | .99           | .78      | .780                |
|                  |          |               |          |                     |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 81.0 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.

Simulation ended on 2020-04-16 at 11:29:18

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| server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMH | YMO\EX\24-hour_SCS\2-CYRSCS.ou |
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| Pre-Development Condition 12-hour SCS Type-II Storm Distribution |
|--|

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\12-hour SCS\2-CYRSCS.dat

```
Metric units
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#***********************
* Pre-Development Condition - Mansfield Ski Club
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
           TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
               ["2SCS12.stm"] <--storm filename
*%
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8-----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
              ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.66](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81].
               Pervious surfaces: IAper=[8.1](mm), SLPP=[10](%),
                              LGP=[80](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                             LGI=[100](m), MNI=[0.013], SCI=[0](min),
               RAINFALL=[ , , , , ](mm/hr) , END=-1
*$-----|
* EXTERNAL
CALIB NASHYD
               ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*$_____|
* TOTAL
ADD HYD
              IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
              ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.36](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81],
              Pervious surfaces: IAper=[8.0](mm), SLPP=[13](%),
                              LGP=[70](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[45](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START
              TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
*%
               ["5SCS12.stm"] <--storm filename
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.dat

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

|                        |                   | =========        |              |        | =======   |
|------------------------|-------------------|------------------|--------------|--------|-----------|
|                        |                   |                  | 222          | 000    |           |
| SSSSS W W M S W W W MM | M H H Y Y         | M M OOO          | 999<br>9 9   | 999    | =======   |
|                        | MM HHHHH Y        | MM M O O         | ## 9 9       |        | Ver 4.05  |
| S WW M                 | M H H Y           | M M O O          | 9999         |        | Sept 2011 |
| SSSSS W W M            | M H H Y           | M M 000          | 9            |        | =======   |
|                        |                   | 000              | 9 9          | -      | # 2880720 |
| StormWater             | Management HYdrol | ogic Model       | 999          |        | =======   |
|                        |                   |                  |              |        |           |
| ******                 | ******            | ******           | ******       | ****** | *****     |
| *******                | ******** SWMHY    | MO Ver/4.05 ***  | ********     | ****** | *****     |
| ****** A singl         | e event and conti | nuous hydrologic | simulation   | model  | *****     |
|                        | d on the principl | es of HYMO and i | ts successo  | ors    | *****     |
| ******                 |                   | 3 and OTTHYMO-89 |              |        | *****     |
| ******                 | ******            | ******           | *********    | ****** | *****     |
| ****** Distribu        |                   | ourin and Associ |              |        | *****     |
| ******                 | Ottawa,           | Ontario: (613)   | 836-3884     |        | *****     |
| ******                 |                   | , Quebec: (819)  |              |        | *****     |
| ******                 |                   | swmhymo@jfsa.Com |              |        | *****     |
| **********             | ******            | ******           | *********    | ****** | *****     |
|                        |                   |                  |              |        |           |
| ++++++++++++++++       |                   |                  | +++++++++    |        |           |
| ++++++++ Licensed      |                   |                  |              |        | +++++++   |
| +++++++                | Barrie            |                  | IAL#:2880720 |        | +++++++   |
| ++++++++++++++++       | ++++++++++++++    | +++++++++++++    | +++++++++    | ++++++ | +++++++   |
| ******                 | ******            | ******           | ******       | ****** | *****     |
| ******                 |                   | ARRAY DIMENSIONS |              |        | ****      |
| ******                 |                   | or ID numbers    |              |        | *****     |
| ******                 |                   | rainfall points: |              |        | *****     |
| ******                 | Max. number of    |                  | 105408       |        | *****     |
| *******                |                   |                  |              | ****** | *****     |
|                        |                   |                  |              |        |           |
|                        |                   |                  |              |        |           |
| ******                 | **** DETAI        | LED OUTP         | U T ****     | ****** | *****     |
| ******                 | ******            | ******           | ******       | ****** | *****     |
| * DATE: 20             | 17-08-08 TIME     | : 15:46:19 F     | RUN COUNTER: | 000329 | *         |
| *******                | ******            | ******           | *********    | ****** | *****     |
| * Input filename       | : C:\TEMP\15-319\ | EX\12-HOU~1\2-CY | RSCS.dat     |        | *         |
| * Output filename      | : C:\TEMP\15-319\ | EX\12-HOU~1\2-CY | RSCS.out     |        | *         |
| * Summary filename     | : C:\TEMP\15-319\ | EX\12-HOU~1\2-C  | RSCS.sum     |        | *         |
| * User comments:       |                   |                  |              |        | *         |
| * 1:                   |                   |                  |              |        | *         |
| * 2:                   |                   |                  |              |        | *         |
| * 3:                   |                   |                  |              |        | *         |
| **********             | ******            | ******           | *********    | ****** | *****     |
|                        |                   |                  |              |        |           |
|                        |                   |                  |              |        |           |
| 001:0001               |                   |                  |              |        |           |
| *#*******              |                   |                  |              |        | *****     |
|                        | Mansfield Ski Clu | ıb] Project Nı   | umber: [15-3 | 319]   |           |
| *# Date : 0            | 7-31-2017         |                  |              |        |           |
|                        |                   |                  |              |        |           |

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(cms)=

PEAK FLOW

.00

.11

```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\12-hour_SCS\2-CYRSCS.out
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
    *# License # : 2880720
    * Pre-Development Condition - Mansfield Ski Club
   ----- Rainfall dir.: C:\TEMP\15-319\EX\12-HOU~1\
     TZERO = .00 hrs on
                         0
      METOUT= 2 (output = METRIC)
      NRUN = 001
      NSTORM= 1
          # 1=2SCS12.stm
    READ STORM | Filename: 2-Year SCS Type-II Storm Distribution (1
    | Ptotal= 44.40 mm | Comments: 2-Year SCS Type-II Storm Distribution (1
    _____
             TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
                                    hrs mm/hr
             hrs mm/hr
                        hrs mm/hr |
                                                hrs
                                                     mm/hr
             .50 .888
                        3.50 1.776
                                    6.50 7.992
                                                9.50
                                                     1.776
             1.00
                  .888
                        4.00 1.776
                                    7.00
                                         3.552
                                               10.00
             1.50
                  .888 | 4.50 2.664 |
                                    7.50 2.664 | 10.50
                                                      .888
             2.00
                  .888 | 5.00 3.552 |
                                    8.00 2.664 | 11.00
                                                      .888
             2.50 1.776 | 5.50 5.328 | 8.50 1.776 | 11.50
                                                     . 888
             3.00 1.776 | 6.00 39.960 | 9.00 1.776 | 12.00 .888
   ______
   001:0003-----
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
    _____
    | CALIB STANDHYD | Area (ha)= 2.66
    01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                        IMPERVIOUS PERVIOUS (i)
                                2.02
       Surface Area (ha)=
                        .64
                           2.00
                                   8.10
       Dep. Storage (mm)=
       Average Slope (%)=
                          2.00
                                   10.00
                 (m) = 100.00
       Length
                                  80.00
       Mannings n
                          .013
                                  .250
       Max.eff.Inten.(mm/hr)=
                          39.96
                                  26.88
                                   14.00
              over (min)
                          3.00
                          2.99 (ii) 14.16 (ii)
       Storage Coeff. (min)=
       Unit Hyd. Tpeak (min)=
                        3.00 14.00
       Unit Hyd. peak (cms)=
```

\*TOTALS\*

.110 (iii)

```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\12-hour_SCS\2-CYRSCS.out
        TIME TO PEAK (hrs)=
                              5.97
                                       6.10
                                                  6.100
        RUNOFF VOLUME (mm)=
                             42.40
                                       17 37
                                                  17 622
                             44.40
                                                  44.400
        TOTAL RAINFALL (mm) =
                                       44.40
        RUNOFF COEFFICIENT =
                              .95
                                       .39
                                                   .397
         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN^* = 81.0 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.
    001:0004-----
    * EXTERNAL.
     CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00
     02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
    ----- U.H. Tp(hrs)=
                                   . 240
       Unit Hyd Qpeak (cms)= 1.864
                            .438 (i)
        PEAK FLOW
                    (cms)=
        TIME TO PEAK
                   (hrs)=
                           6 117
        RUNOFF VOLUME
                    (mm) = 15.774
        TOTAL RAINFALL (mm) = 44.400
        RUNOFF COEFFICIENT =
                           .355
        (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
    * TOTAL
    -----
    ADD HYD (TOTAL ) | ID: NHYD
                                  AREA
                                           OPEAK TPEAK R.V. DWF
                                    (ha)
                                           (cms)
                                                 (hrs) (mm)
                                                            (cms)
                    ID1 01:PRE1
                                    2.66
                                           .110
                                                 6.10 17.62
                                                             .000
                                    11.71
                   +TD2 02:EXT
                                           .438 6.12 15.77
                                                             .000
                    ______
                    SUM 03:TOTAL
                                    14.37 .547 6.12 16.12 .000
      NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
    001:0006-----
    * SITE
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
     CALIB STANDHYD | Area (ha)= 1.36
     04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                           IMPERVIOUS PERVIOUS (i)
       Surface Area (ha)=
                           .33
                                       1 03
```

8/17/2020 12:37:00 PM

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

8.00

13 00

70.00

.250

27.73

11.00

11.00

.10

.06

6.07

17.42

44.40

.39

\*TOTALS\*

6.067

17.675

44.400

.398

.063 (iii)

1.57 (ii) 10.97 (ii)

2.00

3 50

45.00

.013

39.96

2.00

2.00

.00

5.75

42.40

44.40

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

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

CN\* = 81.0 Ia = Dep. Storage (Above)

START | Project dir.: C:\TEMP\15-319\EX\12-HOU~1\

----- Rainfall dir.: C:\TEMP\15-319\EX\12-HOU~1\

\*# Project Name: [Mansfield Ski Club] Project Number: [15-319]

.95

\*#\*

Dep. Storage

Length

Mannings n

PEAK FLOW

RUNOFF VOLUME

\*\* END OF RUN : 1

NRUN = 002 NSTORM= 1

Average Slope

Max.eff.Inten.(mm/hr)=

Storage Coeff. (min)=

Unit Hyd. Tpeak (min)=

Unit Hyd. peak (cms)=

TIME TO PEAK (hrs)=

TOTAL RAINFALL (mm) =

RUNOFF COEFFICIENT =

TZERO = .00 hrs on 0

METOUT= 2 (output = METRIC)

# 1=5SCS12.stm

\*# Date : 07-31-2017

\*# License # : 2880720

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\*# Modeller : [J. Lightheart]
\*# Company : WMI & Associates Ltd.

(mm) =

(%)=

(m) =

(cms)=

( mm ) =

over (min)

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

002:0002-----

1 ---- 1

| READ STORM | Filename: 5-Year SCS Type-II Storm Distribution (1 | Ptotal= 58.50 mm | Comments: 5-Year SCS Type-II Storm Distribution (1

|      | -     |      |        |      |        |       |       |
|------|-------|------|--------|------|--------|-------|-------|
| TIME | RAIN  | TIME | RAIN   | TIME | RAIN   | TIME  | RAIN  |
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr  | hrs   | mm/hr |
| .50  | 1.170 | 3.50 | 2.340  | 6.50 | 10.530 | 9.50  | 2.340 |
| 1.00 | 1.170 | 4.00 | 2.340  | 7.00 | 4.680  | 10.00 | 1.170 |
| 1.50 | 1.170 | 4.50 | 3.510  | 7.50 | 3.510  | 10.50 | 1.170 |
| 2.00 | 1.170 | 5.00 | 4.680  | 8.00 | 3.510  | 11.00 | 1.170 |
| 2.50 | 2.340 | 5.50 | 7.020  | 8.50 | 2.340  | 11.50 | 1.170 |
| 3.00 | 2.340 | 6.00 | 52.650 | 9.00 | 2.340  | 12.00 | 1.170 |

002:0003-----

\* SITE

- st To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| _ |                  |          |           |         |          |          |       |
|---|------------------|----------|-----------|---------|----------|----------|-------|
| l | CALIB STANDHYD   | Area     | (ha)=     | 2.66    |          |          |       |
|   | 01:PRE1 DT= 1.00 | Total    | Imp(%)=   | 24.00   | Dir. Com | a.(%)=   | 1.00  |
| - |                  |          |           |         |          |          |       |
|   |                  |          | IMPERVIOU | JS PERV | IOUS (i) |          |       |
|   | Surface Area     | (ha)=    | .64       | 2       | .02      |          |       |
|   | Dep. Storage     | ( mm ) = | 2.00      | 8       | .10      |          |       |
|   | Average Slope    | (%)=     | 2.00      | 10      | .00      |          |       |
|   | Length           | (m)=     | 100.00    | 80      | .00      |          |       |
|   | Mannings n       | =        | .013      | .:      | 250      |          |       |
|   |                  |          |           |         |          |          |       |
|   | Max.eff.Inten.(  | mm/hr)=  | 52.65     | 43      | .09      |          |       |
|   | over             | (min)    | 3.00      | 12      | .00      |          |       |
|   | Storage Coeff.   | (min)=   | 2.68      | (ii) 11 | .93 (ii) |          |       |
|   | Unit Hyd. Tpeak  | (min) =  | 3.00      | 12      | .00      |          |       |
|   | Unit Hyd. peak   | (cms)=   | .40       |         | .09      |          |       |
|   |                  |          |           |         |          | *TOTALS* | k     |
|   | PEAK FLOW        | (cms)=   | .00       |         | .19      | .191     | (iii) |
|   | TIME TO PEAK     | (hrs)=   | 5.95      | 6       | .07      | 6.067    |       |
|   | RUNOFF VOLUME    | ( mm ) = | 56.50     | 27      | .88      | 28.172   |       |
|   | TOTAL RAINFALL   | ( mm ) = | 58.50     | 58      | .50      | 58.500   |       |
|   | RUNOFF COEFFICI  | ENT =    | .97       |         | .48      | .482     |       |
|   |                  |          |           |         |          |          |       |

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

002:0004-----

\* EXTERNAL

\_\_\_\_\_

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

002:0005-----

\* TOTAL

| ADD HYD (TOTAL | )   ID: NHYD  | AREA  | QPEAK | TPEAK | R.V.  | DWF   |
|----------------|---------------|-------|-------|-------|-------|-------|
|                |               | (ha)  | (cms) | (hrs) | (mm)  | (cms) |
|                | ID1 01:PRE1   | 2.66  | .191  | 6.07  | 28.17 | .000  |
|                | +ID2 02:EXT   | 11.71 | .728  | 6.10  | 25.77 | .000  |
|                | ===========   |       |       |       |       |       |
|                | SIIM 03:TOTAL | 14 37 | 916   | 6 10  | 26 21 | 000   |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

2:0006----

- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

| CALIB STANDHYD   |          | (ha)=     |            | - (4)       |          |
|------------------|----------|-----------|------------|-------------|----------|
| 04:PRE2 DT= 1.00 | Total    | Imp(%)=   | 24.00 Dir  | . Conn.(%)= | 1.00     |
|                  | -        | TMPERVIOU | S PERVIOUS | : (i)       |          |
| Surface Area     |          |           |            | , (1)       |          |
| Dep. Storage     | ( mm ) = | 2.00      | 8.00       |             |          |
| Average Slope    | (%)=     | 3.50      | 13.00      |             |          |
| Length           | (m)=     | 45.00     | 70.00      |             |          |
| Mannings n       | =        | .013      | .250       |             |          |
|                  |          |           |            |             |          |
| Max.eff.Inten.(n |          |           |            |             |          |
| over             | (min)    | 1.00      | 9.00       |             |          |
| Storage Coeff.   | (min)=   | 1.40      | (ii) 9.22  | (ii)        |          |
| Unit Hyd. Tpeak  | (min)=   | 1.00      | 9.00       |             |          |
| Unit Hyd. peak   | (cms)=   | .87       | .12        |             |          |
|                  |          |           |            | *TOTALS*    | <b>t</b> |
| PEAK FLOW        | (cms)=   | .00       | .11        | .107        | (iii)    |
| TIME TO PEAK     | (hrs)=   | 5.73      | 6.03       | 6.033       |          |
| RUNOFF VOLUME    | ( mm ) = | 56.50     | 27.94      | 28.232      |          |
| TOTAL RAINFALL   | ( mm ) = | 58.50     | 58.50      | 58.500      |          |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\12-hour SCS\2-CYRSCS.out RUNOFF COEFFICIENT = .97 . 48 . 483 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 81.0$  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. \*\* END OF RUN : 2 \* START Project dir.: C:\TEMP\15-319\EX\12-HOU~1\ ----- Rainfall dir.: C:\TEMP\15-319\EX\12-HOU~1\ TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 003NSTORM= 1 # 1=25SCS12.stm \*+\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] : 07-31-2017 \*# Date \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \*#\* \* Pre-Development Condition - Mansfield Ski Club 0.03:0.002-----READ STORM Filename: 25-Year SCS Type-II Storm Distribution ( Ptotal= 79.90 mm Comments: 25-Year SCS Type-II Storm Distribution ( TIME RAIN | TIME RAIN | TIME RAIN TIME RAIN hrs mm/hr | hrs mm/hr hrs mm/hr | hrs mm/hr .50 1.598 | 3.50 3.196 | 6.50 14.382 | 9.50 3.196 1.00 1.598 4.00 3.196 7.00 6.392 | 10.00 1.598 1.50 1.598 | 4.50 4.794 | 7.50 4.794 | 10.50 1.598

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2.50 3.196 | 5.50 9.588 | 8.50 3.196 | 11.50 1.598

8.00 4.794 | 11.00 1.598

2.00 1.598 | 5.00 6.392 |

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

```
3.00 3.196 | 6.00 71.910 | 9.00 3.196 | 12.00 1.598
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
| CALIB STANDHYD | Area (ha)= 2.66
| 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                        IMPERVIOUS PERVIOUS (i)
   Surface Area (ha)=
                            . 64
                                      2.02
   Dep. Storage
                  ( mm ) =
                            2 00
                                       8 10
   Average Slope
                  ( % ) =
                            2.00
                                      10.00
   Length
                   (m)=
                          100.00
                                      80.00
                           .013
                                      .250
   Mannings n
   Max.eff.Inten.(mm/hr)=
                           71.91
                                      69.07
            over (min)
                           2.00
                                      10.00
   Storage Coeff. (min)=
                           2.37 (ii) 10.02 (ii)
   Unit Hyd. Tpeak (min)=
                           2.00
                                      10.00
   Unit Hyd. peak (cms)=
                           .50
                                                 *TOTALS*
    PEAK FLOW
                 (cms)=
                            .01
                                       .33
                                                   .331 (iii)
   TIME TO PEAK (hrs)=
                                     6.03
                           5.90
                                                  6 033
   RUNOFF VOLUME (mm)=
                           77.90
                                      45.46
                                                  45.786
   TOTAL RAINFALL (mm)=
                                      79.90
                                                 79.900
                           79.90
   RUNOFF COEFFICIENT =
                           .97
                                                  .573
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 81.0 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.
003:0004-----
* EXTERNAL
| CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00
02:EXT DT= 1.00 | Ia
                        (mm) = 6.800 \# of Linear Res.(N) = 3.00
----- U.H. Tp(hrs)= .240
   Unit Hyd Qpeak (cms)= 1.864
```

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(cms)= 1.218 (i)

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

TIME TO PEAK (hrs) = 6.100

RUNOFF VOLUME (mm) = 42.707

TOTAL RAINFALL (mm) = 79.900

RUNOFF COEFFICIENT = .534

PEAK FLOW

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

003:0006-----

- \* SITE
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

RUNOFF COEFFICIENT =

|      | TANDHYD DT= 1.00 |          | (ha)=<br>. Imp(%)= |            | r. Conn.(%)= | 1.00    |
|------|------------------|----------|--------------------|------------|--------------|---------|
|      |                  |          | IMPERVIOU          | S PERVIOUS | S (i)        |         |
| Surf | ace Area         | (ha)=    | .33                | 1.03       |              |         |
| Dep. | Storage          | ( mm ) = | 2.00               | 8.00       |              |         |
| Aver | age Slope        | (%)=     | 3.50               | 13.00      |              |         |
| Leng | th               | (m)=     | 45.00              | 70.00      |              |         |
| Mann | ings n           | =        | .013               | .250       |              |         |
|      |                  |          |                    |            |              |         |
| Max. | eff.Inten.(r     | nm/hr)=  | 71.91              | 69.80      |              |         |
|      | over             | (min)    | 1.00               | 8.00       |              |         |
| Stor | age Coeff.       | (min)=   | 1.24               | (ii) 7.74  | (ii)         |         |
| Unit | Hyd. Tpeak       | (min)=   | 1.00               | 8.00       |              |         |
| Unit | Hyd. peak        | (cms)=   | .94                | .14        |              |         |
|      |                  |          |                    |            | *TOTALS      | S*      |
| PEAK | FLOW             | (cms)=   | .00                | .18        | .183         | l (iii) |
| TIME | TO PEAK          | (hrs)=   | 5.72               | 6.02       | 6.000        | 0       |
| RUNO | FF VOLUME        | ( mm ) = | 77.90              | 45.52      | 45.85        | 1       |
| TOTA | L RAINFALL       | ( mm ) = | 79.90              | 79.90      | 79.900       | 0       |

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

.97

- CN\* = 81.0 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.

003:0007-----

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.57

.574

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\12-hour_SCS\2-CYRSCS.out
   003:0002-----
    ** END OF RIN : 3
   ************************
   START Project dir.: C:\TEMP\15-319\EX\12-HOU~1\
   ----- Rainfall dir.: C:\TEMP\15-319\EX\12-HOU~1\
     TZERO = .00 hrs on
                        0
      METOUT= 2 (output = METRIC)
      NRUN = 004
      NSTORM= 1
       # 1=100SCS12.stm
   ______
   *#*********************
   *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
   *# Date : 07-31-2017
   *# Modeller : [J. Lightheart]
   *# Company : WMI & Associates Ltd.
   *# License # : 2880720
   * Pre-Development Condition - Mansfield Ski Club
   0.04:0.002-----
   | READ STORM | Filename: 100-Year SCS Type-II Storm Distribution
    | Ptotal= 97.40 mm | Comments: 100-Year SCS Type-II Storm Distribution
            TIME RAIN | TIME RAIN |
                                  TIME RAIN
                                             TIME
                                                   RAIN
             hrs mm/hr
                        hrs mm/hr
                                   hrs mm/hr |
                                              hrs
                                                   mm/hr
             .50 1.948 | 3.50 3.896 | 6.50 17.532 |
                                             9 50 3 896
            1.00 1.948 | 4.00 3.896 | 7.00 7.792 | 10.00 1.948
            1.50 1.948 | 4.50 5.844 | 7.50 5.844 | 10.50 1.948
            2.00 1.948 | 5.00 7.792 | 8.00 5.844 | 11.00 1.948
            2.50 3.896 | 5.50 11.688 | 8.50 3.896 | 11.50 1.948
            3.00 3.896 | 6.00 87.660 | 9.00 3.896 | 12.00 1.948
   0.04:0.003-----
   * SITE
   ^{\star} To account for the existing packed gravel surfaces on-site, the TIMP value
   * was calibrated (see design calcs)
   | CALIB STANDHYD | Area (ha)= 2.66
   | 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

|                 |          | TMDEDITTOTIC | DEDITIONS (:) |            |
|-----------------|----------|--------------|---------------|------------|
|                 |          | IMPERVIOUS   | PERVIOUS (i)  |            |
| Surface Area    | (ha) =   | .64          | 2.02          |            |
| Dep. Storage    | ( mm ) = | 2.00         | 8.10          |            |
| Average Slope   | ( % ) =  | 2.00         | 10.00         |            |
| Length          | (m)=     | 100.00       | 80.00         |            |
| Mannings n      | =        | .013         | .250          |            |
|                 |          |              |               |            |
| Max.eff.Inten.( | mm/hr)=  | 87.66        | 90.73         |            |
| over            | (min)    | 2.00         | 9.00          |            |
| Storage Coeff.  | (min) =  | 2.19 (ii)    | 9.05 (ii)     |            |
| Unit Hyd. Tpeak | (min) =  | 2.00         | 9.00          |            |
| Unit Hyd. peak  | (cms)=   | .53          | .13           |            |
|                 |          |              |               | *TOTALS*   |
| PEAK FLOW       | (cms)=   | .01          | .45           | .453 (iii) |
| TIME TO PEAK    | (hrs)=   | 5.88         | 6.02          | 6.017      |
| RUNOFF VOLUME   | ( mm ) = | 95.40        | 60.72         | 61.070     |
| TOTAL RAINFALL  | ( mm ) = | 97.40        | 97.40         | 97.400     |
| RUNOFF COEFFICI | ENT =    | .98          | .62           | .627       |

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

\* EXTERNAL

| CALIB NASHYD    | Area (ha)=    | 11.71 | Curve Number (CN)=83.00   |
|-----------------|---------------|-------|---------------------------|
| 02:EXT DT= 1.00 | Ia (mm)=      | 6.800 | # of Linear Res.(N)= 3.00 |
|                 | U.H. Tp(hrs)= | .240  |                           |

Unit Hyd Qpeak (cms)= 1.864

PEAK FLOW (cms)= 1.643 (i)
TIME TO PEAK (hrs)= 6.083
RUNOFF VOLUME (mm)= 57.552
TOTAL RAINFALL (mm)= 97.400
RUNOFF COEFFICIENT = .591

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

\* TOTAL

| ADD HYD (TOTAL | )    | ID: NHYD | AREA    | QPEAK | TPEAK | R.V.  | DWF   |
|----------------|------|----------|---------|-------|-------|-------|-------|
|                |      |          | (ha)    | (cms) | (hrs) | (mm)  | (cms) |
|                | ID1  | 01:PRE1  | 2.66    | .453  | 6.02  | 61.07 | .000  |
|                | +ID2 | 02:EXT   | 11.71   | 1.643 | 6.08  | 57.55 | .000  |
|                | ==== |          | ======= |       |       |       |       |
|                | SUM  | 03:TOTAL | 14.37   | 2.072 | 6.07  | 58.20 | .000  |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

004:0006-----

\* SITE

 $^{\star}$  To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

| CALIB STANDHYD | Area (ha)= 1.36 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 -----IMPERVIOUS PERVIOUS (i) Surface Area (ha)= .33 1.03 Dep. Storage (mm) =2.00 8.00 Average Slope (%)= 3.50 13.00 45.00 70.00 Length (m) =Mannings n .013 . 250 = Max.eff.Inten.(mm/hr)= 87.66 91.47 over (min) 1.00 7.00 1.15 (ii) 6.98 (ii) Storage Coeff. (min)= Unit Hyd. Tpeak (min)= 1.00 7.00 Unit Hyd. peak (cms)= .99 .16 \*TOTALS\* .00 .245 (iii) PEAK FLOW (cms)= .24 TIME TO PEAK (hrs)= 5.83 6.00 6.000 RUNOFF VOLUME (mm)= 95.40 60.79 61.137 TOTAL RAINFALL (mm)= 97.400 97.40 97.40 RUNOFF COEFFICIENT = .98 .62 .628

- (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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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\12-hour SCS\2-CYRSCS.out

```
START Project dir.: C:\TEMP\15-319\EX\12-HOU~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\12-HOU~1\
  TZERO = .00 hrs on
                    0
  METOUT= 2 (output = METRIC)
  NRUN = 005
  NSTORM= 1
      # 1=12regtim.o89
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
          : WMI & Associates Ltd.
*# License # : 2880720
*#****************************
* Pre-Development Condition - Mansfield Ski Club
005:0002-----
 READ STORM
               Filename: TIMMINS REGIONAL STORM (12-hour)
 Ptotal= 193.00 mm|
                Comments: TIMMINS REGIONAL STORM (12-hour)
         TIME RAIN | TIME RAIN |
                                 TIME RAIN TIME RAIN
         hrs mm/hr
                     hrs mm/hr |
                                  hrs mm/hr
                                            hrs mm/hr
         1.00 15.000 | 4.00 3.000 |
                                  7.00 43.000 | 10.00 13.000
         2.00 20.000 | 5.00 5.000 |
                                  8.00 20.000 | 11.00 13.000
         3.00 10.000 | 6.00 20.000 | 9.00 23.000 | 12.00 8.000
______
005:0003-----
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
 CALIB STANDHYD | Area (ha)= 2.66
 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                     IMPERVIOUS PERVIOUS (i)
                        .64
   Surface Area (ha)=
                               2 02
   Dep. Storage (mm)=
                        2.00
                                 8 10
   Average Slope
               (%)=
                       2.00
                                10.00
   Length
               (m)=
                      100.00
                                80.00
   Mannings n
                      .013
                                .250
   Max.eff.Inten.(mm/hr)=
                     43.00
                                50.88
          over (min)
                      3.00
                                12.00
   Storage Coeff. (min)=
                      2.91 (ii) 11.56 (ii)
   Unit Hyd. Tpeak (min)=
                       3.00
                                12 00
   Unit Hyd. peak (cms)=
                       3.8
                                1.0
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\12-hour\_SCS\2-CYRSCS.out

```
*TOTALS*
                         .00
                                  .28
                                             .284 (iii)
   PEAK FLOW
               (cms)=
                        7.00
                                             7.000
   TIME TO PEAK (hrs)=
                                 7.00
   RUNOFF VOLUME (mm)=
                       191.00
                                 150.02
                                            150.449
   TOTAL RAINFALL (mm)=
                       193.00
                                 193.00
                                           193.000
   RUNOFF COEFFICIENT =
                       .99
                                 .78
                                             . 780
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN^* = 81.0 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.
* EXTERNAL
______
CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00
02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= .240
   Unit Hyd Qpeak (cms)= 1.864
   PEAK FLOW
                      1.216 (i)
               (cms)=
   TIME TO PEAK
               (hrs) = 7.017
   RUNOFF VOLUME (mm) = 145.537
   TOTAL RAINFALL (mm) = 193.000
   RUNOFF COEFFICIENT = .754
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
005:0005-----
* TOTAL
| ADD HYD (TOTAL ) | ID: NHYD
                              AREA
                                      OPEAK TPEAK R.V.
_____
                              (ha)
                                     (cms) (hrs) (mm) (cms)
              TD1 01:PRE1
                               2 66
                                     .284 7.00 150.45 .000
              +ID2 02:EXT
                              11.71 1.216 7.02 145.54 .000
               ______
               SUM 03:TOTAL
                              14.37 1.499 7.02 146.45 .000
  NOTE: PEAK FLOWS DO NOT INCLIDE BASEFLOWS IF ANY
0.05:00.06-----
* SITE
^{\star} To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
| CALIB STANDHYD | Area (ha)= 1.36
| 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
```

8/17/2020 12:37:00 PM 14/15

 $\label{thm:lissue_No1\SWMHYMO} EX\l2-hour_SCS\l2-CYRSCS.out $$ \operatorname{LSO}(15^15^319\Design\Storm\Issue_No1\SWMHYMO\EX\l2-hour_SCS\l2-CYRSCS.out $$ \end{tikzpicture} $$ \end{tikzpi$ 

|                 |          | IMPERVIOUS | PERVIOUS (i) |            |
|-----------------|----------|------------|--------------|------------|
| Surface Area    | (ha) =   | .33        | 1.03         |            |
| Dep. Storage    | ( mm ) = | 2.00       | 8.00         |            |
| Average Slope   | (%)=     | 3.50       | 13.00        |            |
| Length          | ( m ) =  | 45.00      | 70.00        |            |
| Mannings n      | =        | .013       | .250         |            |
|                 |          |            |              |            |
| Max.eff.Inten.( | mm/hr)=  | 43.00      | 50.96        |            |
| over            | (min)    | 2.00       | 9.00         |            |
| Storage Coeff.  | (min) =  | 1.52 (ii)  | 8.90 (ii)    |            |
| Unit Hyd. Tpeak | (min) =  | 2.00       | 9.00         |            |
| Unit Hyd. peak  | (cms)=   | .66        | .13          |            |
|                 |          |            |              | *TOTALS*   |
| PEAK FLOW       | (cms)=   | .00        | .14          | .146 (iii) |
| TIME TO PEAK    | (hrs)=   | 6.87       | 7.00         | 7.000      |
| RUNOFF VOLUME   | ( mm ) = | 191.00     | 150.11       | 150.522    |
| TOTAL RAINFALL  | ( mm ) = | 193.00     | 193.00       | 193.000    |
| RUNOFF COEFFICI | ENT =    | .99        | .78          | .780       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 81.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

Simulation ended on 2017-08-08 at 15:46:19

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

| 005:0007                  |
|---------------------------|
| 005:0002                  |
| 005:0002                  |
| 005:0002                  |
| 005:0002FINISH            |
| WARNINGS / ERRORS / NOTES |

8/17/2020 12:37:00 PM 15/15

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.dat

```
Metric units
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#***********************
* Pre-Development Condition - Mansfield Ski Club
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
          TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
               ["2SCS6.stm"] <--storm filename
*%
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8-----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.66](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81].
               Pervious surfaces: IAper=[8.1](mm), SLPP=[10](%),
                              LGP=[80](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                             LGI=[100](m), MNI=[0.013], SCI=[0](min),
               RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
* EXTERNAL
CALIB NASHYD
               ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*$_____|
* TOTAL
ADD HYD
              IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.36](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81],
              Pervious surfaces: IAper=[8.0](mm), SLPP=[13](%),
                              LGP=[70](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[45](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START
              TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
*%
               ["5SCS6.stm"] <--storm filename
```

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.dat

```
*8------
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
          TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3]
            ["25SCS6.stm"] <--storm filename
*8------
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
TART
            TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4]
            ["100SCS6.stm"] <--storm filename
*%------
*% Timmins Regional Storm (12-hr)
          TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5]
            ["12regtim.o89"] <--storm filename
```

2/3

 $\label{lem:reconstruction} $$R\mathrm{\nol}\sum_server\Data\Projects\2015\15-319\Design\Storm\Issue_Nol\SWMHYMO\EX\6-hour_SCS\2-CYRSCS.dat$ 8/17/2020 12:37:15 PM 3/3

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.out

| SSSSS W W M M H H Y Y M M OOO 999 999 ======<br>S W W W MM MM H H Y Y MM MM O O 9 9 9 9 9  |               |
|--|---------------|
|  |               |
| 0 " " " " " " " " " " " " " " " " " " "  |               |
| SSSSS W W W M M M HHHHH Y M M M O O ## 9 9 9 Ver 4.  | 0.5           |
| S W W M M H H Y M M O O 9999 9999 Sept 20  |               |
| SSSS WW M M H H Y M M OOO 9 9 ======   |               |
| 9 9 9 9 # 28807  | 20            |
| StormWater Management HYdrologic Model 999 999 ======  | ==            |
|  |               |
| **********************   | **            |
| **************************************   | *             |
| ****** A single event and continuous hydrologic simulation model ******  | **            |
| ******* based on the principles of HYMO and its successors ******  | **            |
| ****** OTTHYMO-83 and OTTHYMO-89.  |               |
| ******************   | **            |
| ****** Distributed by: J.F. Sabourin and Associates Inc.   |               |
| ******** Ottawa, Ontario: (613) 836-3884 ******  |               |
| ******* Gatineau, Quebec: (819) 243-6858 ******  |               |
| ******  E-Mail: swmhymo@jfsa.Com   |               |
| ***********************  | **            |
|  |               |
| ***************************************  | ++            |
| ++++++ Licensed user: WMI & Associates Ltd. ++++++   |               |
| +++++++ Barrie SERIAL#:2880720 ++++++  |               |
| ***************************************  | ++            |
| ******************   |               |
|  |               |
| TTTTTT PROGRAM ARRAI DIMENSIONS TTTTTT   |               |
| Maximum value for 15 nambers . 10  |               |
| Max. Humber of faintail points. 103406   | ++            |
| ****** Max. number of flow points : 105408   | ++            |
|  |               |
|  |               |
| ******** DETAILED OUTPUT **********************************  | **            |
| ***************************************  | **            |
| * DATE: 2017-08-08 TIME: 15:47:43 RUN COUNTER: 000332  | *             |
| ***************************************  | **            |
| + Thrush filename: G:\MEMD\15 210\EV\6 HOVD 1\2 GVDGG 4ct  | *             |
|  | *             |
| * Input filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.dat  * Output filename: C:\TEMP\15-319\FY\6-HOUR~1\2-CYPSCS.out  | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out   | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum   |               |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum * User comments:  | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum * User comments: * 1:   | _*<br>*       |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  * 2:  | _*<br>_*<br>* |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum * User comments: * 1:   | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  * 2:  * 3:                                  | *             |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  * 2:  * 3:  ******************************* |               |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  * 2:  * 3:  ******************************* |               |
| * Output filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.out  * Summary filename: C:\TEMP\15-319\EX\6-HOUR~1\2-CYRSCS.sum  * User comments:  * 1:  * 2:  * 3:  ******************************* |               |

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RUNOFF VOLUME (mm)=

TOTAL RAINFALL (mm)=

```
R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.out
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
    *# License # : 2880720
    * Pre-Development Condition - Mansfield Ski Club
    | START | Project dir.: C:\TEMP\15-319\EX\6-HOUR~1\
     ----- Rainfall dir.: C:\TEMP\15-319\EX\6-HOUR~1\
      TZERO = .00 hrs on
                            0
      METOUT= 2 (output = METRIC)
       NRUN = 001
      NSTORM= 1
           # 1=2SCS6.stm
    READ STORM | Filename: 2-Year SCS Type-II Storm Distribution (6
    | Ptotal= 36.00 mm | Comments: 2-Year SCS Type-II Storm Distribution (6
    _____
              TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
                          hrs mm/hr
                                        hrs mm/hr
              hrs mm/hr
                                                     hrs mm/hr
                                        3.50 9.360
               .50 1.440 | 2.00 2.880 |
                                                     5.00 2.160
              1.00 1.440 | 2.50 5.040 |
                                        4.00 4.320
                                                     5.50 1.440
              1.50 2.880 | 3.00 36.720 | 4.50 2.880 | 6.00 1.440
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
    | CALIB STANDHYD | Area (ha)= 2.66
    01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
    _____
                           IMPERVIOUS PERVIOUS (i)
        Surface Area (ha)=
                           64
                                      2.02
        Dep. Storage (mm)=
                              2.00
                                       8.10
        Average Slope
                    (%)=
                           2.00 10.00
        Length
                     (m) = 100.00 80.00
        Mannings n
                     = .013
                                      .250
        Max.eff.Inten.(mm/hr)=
                             36.72
                                      19.68
                over (min)
                             3.00
                                       16.00
                             3.10 (ii) 15.74 (ii)
        Storage Coeff. (min)=
        Unit Hyd. Tpeak (min)=
                             3.00 16.00
        Unit Hyd. peak (cms)=
                             .37
                                       .07
                                                *TOTALS*
        PEAK FLOW
                    (cms)=
                             .00
                                       .07
                                                  .074 (iii)
                             2.98 3.17
        TIME TO PEAK (hrs)=
                                                 3.167
```

34.00 11.74

36.00

36.00

11.967

36.000

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.out RUNOFF COEFFICIENT = .94 . 33 . 332 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 81.0$  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. \* EXTERNAL CALIB NASHYD Area (ha)= 11.71 Curve Number (CN)=83.00 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= .240 Unit Hyd Qpeak (cms)= 1.864 PEAK FLOW (cms)= .304 (i) TIME TO PEAK (hrs)= 3.150 RUNOFF VOLUME (mm) = 10.497 TOTAL RAINFALL (mm) = 36.000 RUNOFF COEFFICIENT = .292 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 001:0005-----ADD HYD (TOTAL ) | ID: NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) 2.66 .074 3.17 11.97 .000 TD1 01:PRE1 .304 3.15 10.50 .000 +ID2 02:EXT 11.71 \_\_\_\_\_ SUM 03:TOTAL 14.37 .379 3.15 10.77 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. 0.01 : 0.0.06 ------\* SITE \* To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs) \_\_\_\_\_ CALIB STANDHYD | Area (ha)= 1.36 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= .33 Dep. Storage (mm)= 2.00 8.00 Average Slope (%)= 3.50 13 00 Length (m)= 45.00 70.00

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 $\label{lem:reconstruction} $$R\mathrm{Projects}_{2015}_{15-319}\operatorname{lssue\_Nol\sum_NO\EX}_6-hour\_SCS\\_2-CYRSCS.out$ 

```
Mannings n = .013
                             . 250
                              20.95
   Max.eff.Inten.(mm/hr)=
                     36.72
          over (min)
                      2.00
                              12.00
                      1.62 (ii) 12.14 (ii)
   Storage Coeff. (min)=
   Unit Hyd. Tpeak (min)=
                      2.00
                              12.00
   Unit Hyd. peak (cms)=
                      .64
                              .09
                                       *TOTALS*
   PEAK FLOW
                      .00
                              .04
                                        .044 (iii)
             (cms)=
   TIME TO PEAK (hrs)=
                      2.75
                             3.10
                                        3.100
   RUNOFF VOLUME (mm)=
                     34.00 11.79
                                       12.015
   TOTAL RAINFALL (mm) =
                     36.00 36.00
                                      36.000
                              .33
   RUNOFF COEFFICIENT =
                    .94
                                        .334
    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN* = 81.0 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.
001:0007-----
 ** END OF RIN : 1
******************
START Project dir.: C:\TEMP\15-319\EX\6-HOUR~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\6-HOUR~1\
  TZERO = .00 hrs on
  METOUT= 2 (output = METRIC)
  NRUN = 002
  NSTORM= 1
    # 1=5SCS6 stm
*#*********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
* Pre-Development Condition - Mansfield Ski Club
002:0002-----
```

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| READ STORM       | File: | name: 5- | -Year SCS | Type-II | Storm Dis | stribution | 1 (6  |
|------------------|-------|----------|-----------|---------|-----------|------------|-------|
| Ptotal= 47.50 mm | Comm  | ents: 5- | -Year SCS | Type-II | Storm Dis | stribution | ı (6  |
|                  | -     |          |           |         |           |            |       |
| TIME             | RAIN  | TIME     | RAIN      | TIME    | RAIN      | TIME       | RAIN  |
| hrs              | mm/hr | hrs      | mm/hr     | hrs     | mm/hr     | hrs        | mm/hr |
| .50              | 1.900 | 2.00     | 3.800     | 3.50    | 12.350    | 5.00       | 2.850 |
| 1.00             | 1.900 | 2.50     | 6.650     | 4.00    | 5.700     | 5.50       | 1.900 |
| 1.50             | 3.800 | 3.00     | 48.450    | 4.50    | 3.800     | 6.00       | 1.900 |

002:0003-----

CALIB STANDHYD Area (ha)= 2.66

\* SITE

\* To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

| - 1 |                  | 1        | . (,       |             |            |            |
|-----|------------------|----------|------------|-------------|------------|------------|
|     | 01:PRE1 DT= 1.00 | Tota     | al Imp(%)= | 24.00 Dir   | . Conn.(%) | = 1.00     |
| -   |                  |          | IMPERVIOU  | JS PERVIOUS | S (i)      |            |
|     |                  | (1)      |            |             | ,          |            |
|     | Surface Area     |          |            |             |            |            |
|     | Dep. Storage     | ( mm ) = | 2.00       | 8.10        |            |            |
|     | Average Slope    | (%)=     | 2.00       | 10.00       |            |            |
|     | Length           | (m)=     | 100.00     | 80.00       |            |            |
|     | Mannings n       | =        | .013       | .250        |            |            |
|     | Max.eff.Inten.(  | mm/hr)=  | 48.45      | 33.98       |            |            |
|     | over             | (min)    | 3.00       | 13.00       |            |            |
|     | Storage Coeff.   |          |            |             | (ii)       |            |
|     | Unit Hyd. Tpeak  | (min) =  | 3.00       | 13.00       |            |            |
|     | Unit Hyd. peak   | (cms)=   | .39        | .09         |            |            |
|     |                  |          |            |             | *TO        | TALS*      |
|     | PEAK FLOW        | (cms)=   | .00        | .14         |            | .140 (iii) |
|     | TIME TO PEAK     | (hrs)=   | 2.95       | 3.10        | 3 .        | .100       |
|     | RUNOFF VOLUME    | ( mm ) = | 45.50      | 19.58       | 19         | .843       |
|     | TOTAL RAINFALL   |          |            |             |            | .500       |
|     | RUNOFF COEFFICI  |          |            |             |            | .418       |
|     |                  |          |            |             |            |            |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 81.0 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.

\* EXTERNAL

\_\_\_\_\_\_ CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)=

Unit Hyd Qpeak (cms) = 1.864

8/17/2020 12:37:27 PM 5/15 R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.out

PEAK FLOW (cms)= .537 (i) TIME TO PEAK (hrs)= 3.133 RUNOFF VOLUME (mm) = 17.865 TOTAL RAINFALL (mm) = 47.500 RUNOFF COEFFICIENT =

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

\* TOTAL

| ADD HYD (TOTAL | )    | ID: NHYD | AREA      | QPEAK   | TPEAK | R.V.    | DWF    |  |  |  |  |  |
|----------------|------|----------|-----------|---------|-------|---------|--------|--|--|--|--|--|
|                |      |          | (ha)      | (cms)   | (hrs) | ( mm )  | (cms)  |  |  |  |  |  |
|                | ID1  | 01:PRE1  | 2.66      | .140    | 3.10  | 19.84   | .000   |  |  |  |  |  |
|                | +ID2 | 02:EXT   | 11.71     | .537    | 3.13  | 17.86   | .000   |  |  |  |  |  |
|                | ==== |          | ========= | ======= |       | ======= | ====== |  |  |  |  |  |

SUM 03:TOTAL NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

002:0006-----

14.37

.676 3.12 18.23 .000

19.898

.419

47.500

\* To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

RUNOFF VOLUME

TOTAL RAINFALL (mm)=

RUNOFF COEFFICIENT =

| CALIB STANDHYD | Area (ha)= 1.36 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= .33 1 03 2.00 8.00 Dep. Storage (mm)= Average Slope (%)= 3.50 13.00 Length (m)= 45.00 70.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 48.45 35.13 over (min) 1.00 10.00 Storage Coeff. (min)= 1.45 (ii) 10.01 (ii) Unit Hyd. Tpeak (min)= 1.00 10.00 Unit Hyd. peak (cms)= .85 .11 \*TOTALS\* PEAK FLOW (cms)= .00 .08 .080 (iii) TIME TO PEAK (hrs)= 2.88 3.07 3.050

45.50

.96

47.50

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 81.0 Ia = Dep. Storage (Above)

( mm ) =

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

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19.64

47.50

```
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
 ** END OF RUN : 2
*************************
START Project dir.: C:\TEMP\15-319\EX\6-HOUR~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\6-HOUR~1\
  TZERO = .00 hrs on 0
  METOUT= 2 (output = METRIC)
  NRUN = 003
  NSTORM= 1
       # 1=25SCS6.stm
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
         : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
         : WMI & Associates Ltd.
*# License # : 2880720
*#**************************
* Pre-Development Condition - Mansfield Ski Club
003:0002-----
 READ STORM | Filename: 25-Year SCS Type-II Storm Distribution (
| Ptotal= 64.80 mm | Comments: 25-Year SCS Type-II Storm Distribution (
         TIME RAIN | TIME RAIN |
                               TIME RAIN TIME RAIN
         hrs mm/hr |
                    hrs mm/hr
                                hrs mm/hr
                                            hrs mm/hr
         .50 2.592
                    2.00 5.184
                                3.50 16.848
                                            5.00 3.888
         1.00 2.592
                    2.50 9.072
                                4.00 7.776
                                            5.50 2.592
         1.50 5.184 | 3.00 66.096 |
                               4.50 5.184 | 6.00 2.592
003:0003-----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
_____
| CALIB STANDHYD | Area (ha)= 2.66
```

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\6-hour\_SCS\2-CYRSCS.out

```
| 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                         IMPERVIOUS PERVIOUS (i)
    Surface Area
                  (ha) =
                            .64
                                       2.02
    Dep. Storage
                  ( mm ) =
                            2.00
                                       8.10
    Average Slope
                  (%)=
                            2.00
                                      10.00
                   (m)=
                           100.00
                                      80.00
    Length
                           .013
    Mannings n
                                      250
    Max.eff.Inten.(mm/hr)=
                           66.10
                                      56.93
             over (min)
                           2.00
                                      11.00
                            2.45 (ii) 10.72 (ii)
    Storage Coeff. (min)=
    Unit Hyd. Tpeak (min) =
                            2.00
                                    11.00
    Unit Hyd. peak (cms)=
                            .49
                                                  *TOTALS*
    PEAK FLOW
                 (cms)=
                             .00
                                        .25
                                                    .257 (iii)
    TIME TO PEAK (hrs)=
                                       3.07
                                                   3.067
                            2.92
    RUNOFF VOLUME (mm)=
                                    32.90
                           62.80
                                                  33.196
    TOTAL RAINFALL (mm)=
                           64.80
                                      64.80
                                                  64.800
    RUNOFF COEFFICIENT =
                                                    .512
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN^* = 81.0 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 NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00
\mid 02:EXT DT= 1.00 \mid Ia \quad \text{(mm)} = \text{ 6.800} \quad \text{\# of Linear Res.(N)} = 3.00
----- U.H. Tp(hrs)=
                                  .240
    Unit Hyd Qpeak (cms)= 1.864
    PEAK FLOW
                 (cms)=
                          942 (i)
    TIME TO PEAK (hrs) = 3.117
    RUNOFF VOLUME (mm) = 30.575
    TOTAL RAINFALL (mm) = 64.800
    RUNOFF COEFFICIENT = .472
    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
0.03:0.005-----
ADD HYD (TOTAL ) | ID: NHYD AREA
                                           OPEAK TPEAK R.V.
                                  (ha)
                                           (cms) (hrs) (mm) (cms)
                 ID1 01:PRE1
                                           .257 3.07 33.20
                                  2.66
                                                               .000
                 +ID2 02:EXT
                                   11.71
                                          .942 3.12 30.58
                                                               .000
```

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SUM 03:TOTAL 14.37 1.192 3.10 31.06 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

003:0006-----

\* SITE

\* To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

|   |                  |          | IMPERVIOUS | PERVIOUS  | (i)      |      |
|---|------------------|----------|------------|-----------|----------|------|
| ٤ | Surface Area     | (ha)=    | .33        | 1.03      |          |      |
| Ι | Dep. Storage     | ( mm ) = | 2.00       | 8.00      |          |      |
| I | Average Slope    | (%)=     | 3.50       | 13.00     |          |      |
| Ι | Length           | (m)=     | 45.00      | 70.00     |          |      |
| N | Mannings n       | =        | .013       | .250      |          |      |
|   |                  |          |            |           |          |      |
| N | Max.eff.Inten.(m | nm/hr)=  | 66.10      | 58.26     |          |      |
|   | over             | (min)    | 1.00       | 8.00      |          |      |
| ٤ | Storage Coeff.   | (min)=   | 1.28 (ii   | i) 8.27 ( | ii)      |      |
| τ | Jnit Hyd. Tpeak  | (min) =  | 1.00       | 8.00      |          |      |
| τ | Jnit Hyd. peak   | (cms)=   | .92        | .14       |          |      |
|   |                  |          |            |           | *TOTALS* |      |
| Ε | PEAK FLOW        | (cms)=   | .00        | .14       | .144 (   | iii) |
| 1 | TIME TO PEAK     | (hrs)=   | 2.80       | 3.03      | 3.017    |      |
| F | RUNOFF VOLUME    | ( mm ) = | 62.80      | 32.96     | 33.257   |      |
| 7 | OTAL RAINFALL    | ( mm ) = | 64.80      | 64.80     | 64.800   |      |
| F | NUNOFF COEFFICIE | ENT =    | .97        | .51       | .513     |      |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 81.0 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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```
START Project dir.: C:\TEMP\15-319\EX\6-HOUR~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\6-HOUR~1\
  TZERO = .00 hrs on
                     0
  METOUT= 2 (output = METRIC)
  NRUN = 004
  NSTORM= 1
      # 1=100SCS6 stm
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
          : 07-31-2017
*# Date
*# Modeller : [J. Lightheart]
*# Company
         : WMI & Associates Ltd.
*# License # : 2880720
* Pre-Development Condition - Mansfield Ski Club
004:0002-----
READ STORM | Filename: 100-Year SCS Type-II Storm Distribution
| Ptotal= 79.10 mm | Comments: 100-Year SCS Type-II Storm Distribution
         TIME RAIN | TIME RAIN | TIME RAIN |
                                            TIME RAIN
         hrs mm/hr
                    hrs mm/hr |
                                hrs mm/hr |
                                             hrs mm/hr
         .50 3.164 | 2.00 6.328 | 3.50 20.566 | 5.00 4.746
         1.00 3.164 | 2.50 11.074 | 4.00 9.492 |
                                             5.50 3.164
         1.50 6.328 | 3.00 80.682 | 4.50 6.328 | 6.00 3.164
______
004:0003----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
| CALIB STANDHYD | Area (ha)= 2.66
| 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                    IMPERVIOUS PERVIOUS (i)
                              2.02
   Surface Area (ha)=
                       64
   Dep. Storage
               ( mm ) =
                       2.00
                                8 10
   Average Slope
               (%)=
                       2.00
                                10.00
   Length
               (m)=
                      100.00
                                80.00
                               .250
   Mannings n
                      .013
   Max.eff.Inten.(mm/hr)=
                      80.68
                               76.65
          over (min)
                       2.00
                               10.00
   Storage Coeff. (min)=
                       2.26 (ii) 9.60 (ii)
   Unit Hyd. Tpeak (min)=
                       2.00 10.00
   Unit Hyd. peak (cms)=
                       52
                                12
```

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```
*TOTALS*
   PEAK FLOW
                           .01
                                     .36
                                                  .363 (iii)
                (cms)=
                           2.88
                                                 3.033
    TIME TO PEAK
                (hrs)=
                                     3.05
                                                45.103
    RUNOFF VOLUME (mm)=
                          77.10
                                     44.78
    TOTAL RAINFALL (mm) =
                          79.10
                                     79.10
                                                79.100
   RUNOFF COEFFICIENT =
                           .97
                                     .57
                                                 .570
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 81.0 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.
004:0004-----
* EXTERNAL
 CALIB NASHYD Area
                        (ha)= 11.71 Curve Number (CN)=83.00
 02:EXT DT= 1.00 | Ia
                          (mm) = 6.800 \# of Linear Res.(N) = 3.00
 ----- U.H. Tp(hrs)=
   Unit Hyd Qpeak (cms) = 1.864
   PEAK FLOW
                        1.308 (i)
                (cms)=
                (hrs)=
    TIME TO PEAK
                        3.117
   RUNOFF VOLUME
                 ( mm ) =
                        42.046
   TOTAL RAINFALL (mm) = 79.100
```

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

. 532

004:0005-----

\* TOTAL

| ADD HYD (TOTAL | )    | ID: NHYD | AREA  | QPEAK | TPEAK  | R.V.  | DWF   |
|----------------|------|----------|-------|-------|--------|-------|-------|
|                |      |          | (ha)  | (cms) | (hrs)  | (mm)  | (cms) |
|                | ID1  | 01:PRE1  | 2.66  | .363  | 3.03   | 45.10 | .000  |
|                | +ID2 | 02:EXT   | 11.71 | 1.308 | 3.12   | 42.05 | .000  |
|                | ===: |          |       |       | ====== |       |       |
|                | SUM  | 03:TOTAL | 14.37 | 1.655 | 3.08   | 42.61 | .000  |

NOTE: PEAK FLOWS DO NOT INCLIDE BASEFLOWS IF ANY

004:0006-----

\* SITE

 $^{\star}$  To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

RUNOFF COEFFICIENT =

CALIB STANDHYD Area (ha)= 1.36 | 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00

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|                  |          | IMPERVIOUS | PERVIOUS (i) |            |
|------------------|----------|------------|--------------|------------|
| Surface Area     | (ha) =   | .33        | 1.03         |            |
| Dep. Storage     | ( mm ) = | 2.00       | 8.00         |            |
| Average Slope    | (%)=     | 3.50       | 13.00        |            |
| Length           | (m)=     | 45.00      | 70.00        |            |
| Mannings n       | =        | .013       | .250         |            |
| Max.eff.Inten.(r | nm/hr)=  | 80.68      | 78.04        |            |
| over             | (min)    | 1.00       | 7.00         |            |
| Storage Coeff.   | (min) =  | 1.18 (ii   | ) 7.40 (ii)  |            |
| Unit Hyd. Tpeak  | (min) =  | 1.00       | 7.00         |            |
| Unit Hyd. peak   | (cms)=   | .97        | .16          |            |
|                  |          |            |              | *TOTALS*   |
| PEAK FLOW        | (cms)=   | .00        | .20          | .201 (iii) |
| TIME TO PEAK     | (hrs)=   | 2.70       | 3.02         | 3.000      |
| RUNOFF VOLUME    | ( mm ) = | 77.10      | 44.84        | 45.167     |
| TOTAL RAINFALL   | ( mm ) = | 79.10      | 79.10        | 79.100     |
| RUNOFF COEFFICIE | ENT =    | .97        | .57          | .571       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 81.0 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.

```
004:0002----
** END OF RUN : 4
*********************
```

```
START Project dir.: C:\TEMP\15-319\EX\6-HOUR~1\
 ----- Rainfall dir.: C:\TEMP\15-319\EX\6-HOUR~1\
  TZERO = .00 hrs on
  METOUT= 2 (output = METRIC)
  NRUN = 005
  NSTORM= 1
       # 1=12reqtim.o89
*#*****************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
```

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```
*# Date
            : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#****************************
* Pre-Development Condition - Mansfield Ski Club
 READ STORM
                  Filename: TIMMINS REGIONAL STORM (12-hour)
Ptotal= 193.00 mm | Comments: TIMMINS REGIONAL STORM (12-hour)
          TIME RAIN
                        TIME RAIN
                                       TIME RAIN
                                                     TIME
           hrs mm/hr
                         hrs mm/hr
                                       hrs
                                            mm/hr
                                                     hrs mm/hr
          1.00 15.000 | 4.00 3.000 |
                                       7.00 43.000 | 10.00 13.000
           2.00 20.000 | 5.00 5.000 |
                                       8.00 20.000 | 11.00 13.000
          3.00 10.000 | 6.00 20.000 | 9.00 23.000 | 12.00 8.000
005:0003-----
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
 CALIB STANDHYD | Area (ha)= 2.66
 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                        IMPERVIOUS PERVIOUS (i)
   Surface Area
                (ha) =
                            .64
                                    2.02
   Dep. Storage (mm)=
                           2.00
                                     8 10
                          2.00
   Average Slope (%)=
                                     10.00
                                   80.00
   Length
                  (m)=
                         100.00
   Mannings n
                           .013
                                     .250
   Max.eff.Inten.(mm/hr)=
                         43.00
                                     50 88
           over (min)
                          3 00
                                     12.00
   Storage Coeff. (min)=
                          2.91 (ii) 11.56 (ii)
   Unit Hyd. Tpeak (min) =
                                     .10
   Unit Hyd. peak (cms)=
                           .38
                                                *TOTALS*
                                     .28
                                                  .284 (iii)
   PEAK FLOW
                (cms)=
                           .00
    TIME TO PEAK
                (hrs)=
                           7.00
                                     7.00
                                                 7.000
    RUNOFF VOLUME
                 ( mm ) =
                          191.00
                                    150.02
                                                150.449
   TOTAL RAINFALL (mm) =
                         193.00
                                    193.00
                                                193.000
   RUNOFF COEFFICIENT =
                                     .78
                                                 .780
                          .99
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN^* = 81.0 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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9.00

9 00

13

8.90 (ii)

14/15

2.00

2 00

66

1.52 (ii)

over (min)

Storage Coeff. (min)=

Unit Hyd. Tpeak (min)=

Unit Hyd. peak (cms)=

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\6-hour SCS\2-CYRSCS.out 0.05:00.04-----CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= .240 Unit Hyd Qpeak (cms)= 1.864 (cms)= 1.216 (i) PEAK FLOW TIME TO PEAK (hrs)= 7.017 RUNOFF VOLUME (mm) = 145.537TOTAL RAINFALL (mm) = 193.000 RUNOFF COEFFICIENT = .754 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 0.05:0.005------\* TOTAL ADD HYD (TOTAL ) | ID: NHYD AREA OPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) ID1 01:PRE1 2.66 .284 7.00 150.45 .000 11.71 1.216 7.02 145.54 +ID2 02:EXT \_\_\_\_\_\_ SUM 03:TOTAL 14.37 1.499 7.02 146.45 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. 005:0006-----\* SITE \* To account for the existing packed gravel surfaces on-site, the TIMP value \* was calibrated (see design calcs) | CALIB STANDHYD | Area (ha)= 1.36 | 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 IMPERVIOUS PERVIOUS (i) 1.03 Surface Area (ha)= 33 Dep. Storage ( mm ) = 2 00 8 00 Average Slope (%)= 3.50 13.00 Length (m) =45.00 70 00 .013 .250 Mannings n Max.eff.Inten.(mm/hr)= 43.00 50.96

|                 |          |        |        | *TOTALS*   |
|-----------------|----------|--------|--------|------------|
| PEAK FLOW       | (cms)=   | .00    | .14    | .146 (iii) |
| TIME TO PEAK    | (hrs)=   | 6.87   | 7.00   | 7.000      |
| RUNOFF VOLUME   | ( mm ) = | 191.00 | 150.11 | 150.522    |
| TOTAL RAINFALL  | ( mm ) = | 193.00 | 193.00 | 193.000    |
| RUNOFF COEFFICI | ENT =    | .99    | .78    | .780       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 81.0 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.

| 005:0007                                   |
|--|
| 005:000/                                   |
| 005:0002                                   |
|  |
| 005:0002                                   |
|  |
| 005:0002                                   |
| 005:0002                                   |
| FINISH                                     |
|  |
| ******************************             |
| WARNINGS / ERRORS / NOTES                  |
|  |
| Simulation ended on 2017-08-08 at 15:47:43 |
|  |

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| Pre-Development Condition 4-hour Chicago Storm Distribution |
|---|

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\4-hour Chic\2-CYRCHI.dat

```
Metric units
*#*************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#***********************
* Pre-Development Condition - Mansfield Ski Club
*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
               ["2CHI4.stm"] <--storm filename
*%
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.66](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81].
               Pervious surfaces: IAper=[8.1](mm), SLPP=[10](%),
                              LGP=[80](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                             LGI=[100](m), MNI=[0.013], SCI=[0](min),
               RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
* EXTERNAL
CALIB NASHYD
               ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*$_____|
* TOTAL
ADD HYD
              IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD
             ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.36](ha),
              XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[81],
              Pervious surfaces: IAper=[8.0](mm), SLPP=[13](%),
                              LGP=[70](m), MNP=[0.25], SCP=[0](min),
               Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[45](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*$_____|
*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START
              TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
* %
               ["5CHI4.stm"] <--storm filename
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\4-hour Chic\2-CYRCHI.dat

```
*8------
*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3]
            ["25CHI4.stm"] <--storm filename
*8------
*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
TART
           TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4]
            ["100CHI4.stm"] <--storm filename
*%------
*% Timmins Regional Storm (12-hr)
          TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5]
            ["12regtim.o89"] <--storm filename
```

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| SSSSS W W M S W W W MM | M H H Y Y                               | M M 000                                 | 999 999<br>9 9 9 9 | =======   |
|------------------------|---|---|--------------------|-----------|
|                        | M M HHHHHH Y                            | MM M O O ##                             |                    | Ver 4.05  |
| S W W M                | м н н ч                                 | M M O O                                 | 9999 9999          | Sept 2011 |
| SSSSS W W M            | M H H Y                                 | M M 000                                 | 9 9                | =======   |
|                        |   |   | 9 9 9 9            | # 2880720 |
| StormWater             | Management HYdrol                       | ogic Model                              | 999 999            | =======   |
|                        |   |   |                    |           |
| *******                |   |   |                    |           |
| ******                 |   |   |                    |           |
|                        |   | nuous hydrologic s                      |                    | ******    |
|                        |   | es of HYMO and its                      | successors         | ******    |
| ******                 |   | 3 and OTTHYMO-89.                       |                    | ******    |
| ******                 |   |   |                    | ******    |
| ******* Distribu       | •                                       | ourin and Associat<br>Ontario: (613) 83 |                    | *******   |
| ******                 |   |   |                    | ******    |
| *****                  |   | , Quebec: (819) 24<br>swmhymo@jfsa.Com  | 13-0000            | *****     |
| ******                 |   |   | *****              |           |
|                        |   |   |                    |           |
| +++++++++++++++        | ++++++++++++++                          | +++++++++++++++                         | -+++++++++++++     | ++++++++  |
| +++++++ Licensed       |   |   |                    | +++++++   |
| +++++++                | Barrie                                  |   | #:2880720          | +++++++   |
| +++++++++++++++        | ++++++++++++++                          | +++++++++++++++                         | +++++++++++++      | ++++++++  |
|                        |   |   |                    |           |
| ******                 | ******                                  | ******                                  | ******             | *****     |
| ******                 | ++++++ PROGRAM                          | ARRAY DIMENSIONS +                      | ++++               | ******    |
| ******                 | Maximum value f                         | or ID numbers :                         | 10                 | *****     |
| ******                 |   | rainfall points: 1                      |                    | *****     |
| ******                 | Max. number of                          |   |                    | ******    |
| ******                 | ******                                  | *******                                 | ******             | *****     |
|                        |   |   |                    |           |
| *******                | **** DETAI                              | LED OUTPU                               | т ********         |           |
| *******                | DEIAI                                   |   | 1                  |           |
| * DATE: 20             |   |   | COUNTER: 00033     |           |
| **************         |   |   |                    |           |
| * Input filename       | : C:\TEMD\15-319\                       | EX\4-HOUR~1\2-CYRC                      | THI dat            | *         |
| * Output filename      |   |   |                    | *         |
| * Summary filename     |   |   |                    | *         |
| * User comments:       | . , , , , , , , , , , , , , , , , , , , | ,                                       |                    | *         |
| * 1:                   |   |   |                    | *         |
| * 2:                   |   |   |                    | *         |
| * 3:                   |   |   |                    | *         |
| ******                 | ******                                  | *******                                 | ******             | *****     |
|                        |   |   |                    |           |
|                        |   |   |                    |           |
| 001:0001               |   |   |                    |           |
| *#*******              |   |   |                    | *****     |
|                        |   | b] Project Numb                         | er: [15-319]       |           |
| *# Date : 0            | 7-31-2017                               |   |                    |           |
|                        |   |   |                    |           |

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(cms)=

PEAK FLOW

```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\4-hour_Chic\2-CYRCHI.out
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
    *# License # : 2880720
    * Pre-Development Condition - Mansfield Ski Club
   ----- Rainfall dir.: C:\TEMP\15-319\EX\4-HOUR~1\
     TZERO = .00 hrs on
                         0
      METOUT= 2 (output = METRIC)
      NRUN = 001
      NSTORM= 1
          # 1=2CHI4.stm
    READ STORM | Filename: 2-Year Chicago Storm Distribution (4-hou
    | Ptotal= 32.37 mm | Comments: 2-Year Chicago Storm Distribution (4-hou
             TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
                                    hrs mm/hr
             hrs mm/hr
                        hrs mm/hr
                                                hrs mm/hr
                                    2.17 5.281
              .17 2.552 | 1.17 14.171 |
                                                3.17
                                                      2.963
              .33 2.869
                        1.33 73.380 |
                                    2.33 4.618
                                                 3.33
                                                      2.781
              .50 3.301 | 1.50 17.908 | 2.50 4.124 |
                                                3.50 2.623
              .67 3.928 | 1.67 10.450 | 2.67 3.740 |
                                                3.67 2.485
              .83 4.945 | 1.83 7.709 | 2.83 3.431 | 3.83 2.364
             1.00 6.961 | 2.00 6.227 | 3.00 3.177 | 4.00 2.255
   ______
   001:0003-----
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
    _____
    | CALIB STANDHYD | Area (ha)= 2.66
    01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                        IMPERVIOUS PERVIOUS (i)
                                2.02
       Surface Area (ha)=
                         .64
                           2.00
                                   8.10
       Dep. Storage (mm)=
       Average Slope (%)=
                          2.00
                                   10.00
                 (m) = 100.00
       Length
                                  80.00
       Mannings n
                          .013
                                   .250
       Max.eff.Inten.(mm/hr)=
                          73.38
                                  17 06
              over (min)
                          2.00
                                   16.00
                          2.35 (ii) 15.74 (ii)
       Storage Coeff. (min)=
       Unit Hyd. Tpeak (min)=
                          2.00 16.00
       Unit Hyd. peak (cms)=
                        .50
```

\*TOTALS\*

.058 (iii)

.06

.01

```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\4-hour_Chic\2-CYRCHI.out
        TIME TO PEAK (hrs)=
                              1.33
                                      1.58
                                                  1.583
                             30.37
                                       9 52
                                                  9 724
        RUNOFF VOLUME (mm)=
                             32.37
                                       32.37
                                                  32.374
        TOTAL RAINFALL (mm) =
        RUNOFF COEFFICIENT =
                                                   .300
         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN^* = 81.0 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.
    001:0004-----
    * EXTERNAL.
     CALIB NASHYD Area
                           (ha)= 11.71 Curve Number (CN)=83.00
     02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
    ----- U.H. Tp(hrs)=
                                   . 240
       Unit Hyd Qpeak (cms)= 1.864
                            .224 (i)
        PEAK FLOW
                    (cms)=
        TIME TO PEAK
                   (hrs)=
                           1 617
        RUNOFF VOLUME
                           8.428
                    ( mm ) =
        TOTAL RAINFALL
                    (mm) = 32.374
        RUNOFF COEFFICIENT =
                            260
        (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
    * TOTAL
    -----
    ADD HYD (TOTAL ) | ID: NHYD
                                  AREA
                                           OPEAK TPEAK R.V.
                                                             DWF
                                    (ha)
                                           (cms)
                                                 (hrs)
                                                       (mm)
                                                             (cms)
                    ID1 01:PRE1
                                    2.66
                                           .058
                                                  1.58 9.72
                                                              .000
                                    11.71
                   +TD2 02:EXT
                                           .224 1.62 8.43
                                                             .000
                    ______
                    SUM 03:TOTAL
                                    14.37 .281 1.62 8.67 .000
      NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
    001:0006-----
    * SITE
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
     CALIB STANDHYD | Area (ha)= 1.36
     04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                           IMPERVIOUS PERVIOUS (i)
       Surface Area (ha)=
                           .33
                                       1 03
```

```
Dep. Storage
                 (mm) =
                (%)=
                         3 50
                                   13 00
   Average Slope
                                   70.00
   Length
                 (m) =
                         45.00
   Mannings n
                         .013
                                   .250
   Max.eff.Inten.(mm/hr)=
                         73.38
                                   19.64
                                   12.00
            over (min)
                         1.00
   Storage Coeff. (min)=
                         1.23 (ii) 12.03 (ii)
   Unit Hyd. Tpeak (min)=
                         1.00
                                   12.00
   Unit Hyd. peak (cms)=
                         .95
                                              *TOTALS*
   PEAK FLOW
                (cms)=
                          .00
                                    .03
                                               .035 (iii)
   TIME TO PEAK (hrs)=
                         1.33
                                   1.52
                                               1.500
   RUNOFF VOLUME
                ( mm ) =
                         30.37
                                    9.56
                                               9.769
   TOTAL RAINFALL (mm) =
                         32.37
                                   32.37
                                              32.374
   RUNOFF COEFFICIENT =
                          .94
                                    .30
                                               .302
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 81.0 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.
 ** END OF RUN : 1
START | Project dir.: C:\TEMP\15-319\EX\4-HOUR~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\4-HOUR~1\
  TZERO = .00 hrs on 0
  METOUT= 2 (output = METRIC)
  NRUN = 002
  NSTORM= 1
       # 1=5CHI4.stm
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#****************************
* Pre-Development Condition - Mansfield Ski Club
```

8.00

2.00

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002:0002-----

READ STORM

| READ STORM | Filename: 5-Year Chicago Storm Distribution (4-hou | Ptotal= 42.60 mm | Comments: 5-Year Chicago Storm Distribution (4-hou

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .17  | 3.347 | 1.17 | 18.640 | 2.17 | 6.934 | 3.17 | 3.887 |
| .33  | 3.764 | 1.33 | 96.860 | 2.33 | 6.062 | 3.33 | 3.648 |
| .50  | 4.331 | 1.50 | 23.565 | 2.50 | 5.413 | 3.50 | 3.441 |
| .67  | 5.155 | 1.67 | 13.736 | 2.67 | 4.908 | 3.67 | 3.260 |
| .83  | 6.492 | 1.83 | 10.128 | 2.83 | 4.502 | 3.83 | 3.100 |
| 1.00 | 9.144 | 2.00 | 8.178  | 3.00 | 4.168 | 4.00 | 2.957 |

002:0003-----

\* SITE

CALIB STANDHYD | Area (ha)= 2.66

|   | 01:PRE1 DT= 1.00 | Total    | Imp(%)=    | 24.00 D | ir. Conn. | (%)=     | 1.00  |
|---|------------------|----------|------------|---------|-----------|----------|-------|
| - |                  |          |            |         |           |          |       |
|   |                  |          | IMPERVIOUS | PERVIO  | US (i)    |          |       |
|   | Surface Area     |          |            |         |           |          |       |
|   | Dep. Storage     | ( mm ) = | 2.00       | 8.1     | 0         |          |       |
|   | Average Slope    | (%)=     | 2.00       | 10.0    | 0         |          |       |
|   | Length           | (m)=     | 100.00     | 80.0    | 0         |          |       |
|   | Mannings n       | =        | .013       | .25     | 0         |          |       |
|   | Max.eff.Inten.(r | nm/hr)=  | 96.86      | 36.2    | 6         |          |       |
|   | over             | (min)    | 2.00       | 12.0    | 0         |          |       |
|   | Storage Coeff.   | (min)=   | 2.10 (i    | i) 12.0 | 1 (ii)    |          |       |
|   | Unit Hyd. Tpeak  | (min)=   | 2.00       | 12.0    | 0         |          |       |
|   | Unit Hyd. peak   | (cms)=   | .54        | .0      | 9         |          |       |
|   |                  |          |            |         |           | *TOTALS* | •     |
|   | PEAK FLOW        | (cms)=   | .01        | .1      | 3         | .127     | (iii) |
|   | TIME TO PEAK     | (hrs)=   | 1.33       | 1.5     | 0         | 1.500    |       |
|   | RUNOFF VOLUME    | ( mm ) = | 40.60      | 16.1    | 2         | 16.365   |       |
|   | TOTAL RAINFALL   | ( mm ) = | 42.60      | 42.6    | 0         | 42.603   |       |
|   | RUNOFF COEFFICIA | ENT =    | .95        | .3      | 8         | .384     |       |
|   |                  |          |            |         |           |          |       |

<sup>(</sup>i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN\* = 81.0 Ia = Dep. Storage (Above)

002:0004-----

-----

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

\* TOTAL

| ADD HYD (TOTAL | )    | ID: NHYD | AREA  | QPEAK | TPEAK | R.V.   | DWF   |
|----------------|------|----------|-------|-------|-------|--------|-------|
|                |      |          | (ha)  | (cms) | (hrs) | ( mm ) | (cms) |
|                | ID1  | 01:PRE1  | 2.66  | .127  | 1.50  | 16.37  | .000  |
|                | +ID2 | 02:EXT   | 11.71 | .425  | 1.60  | 14.60  | .000  |
|                | ==== |          |       |       |       | ====== |       |
|                | SUM  | 03:TOTAL | 14.37 | .538  | 1.57  | 14.92  | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

::0006-----

\* To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

CALIB STANDHYD | Area (ha)= 1.36 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 \_\_\_\_\_ IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 33 1.03 Dep. Storage (mm)= 2.00 8.00 Average Slope (%)= 3.50 13.00 Length (m)= 45.00 70.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 96.86 43.46 over (min) 1.00 9.00 1.10 (ii) 8.96 (ii) Storage Coeff. (min)= Unit Hyd. Tpeak (min)= 1.00 9.00 Unit Hyd. peak (cms)= 1.01 .13 \*TOTALS\* PEAK FLOW (cms)= .00 .077 (iii) TIME TO PEAK (hrs)= 1.33 1.45 1.450 RUNOFF VOLUME (mm)= 40.60 16.17 16.418 TOTAL RAINFALL (mm)= 42.60 42.60 42.603

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st To account for the existing packed gravel surfaces on-site, the TIMP value

<sup>\*</sup> was calibrated (see design calcs)

<sup>(</sup>ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

<sup>(</sup>iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

<sup>\*</sup> EXTERNAL

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\EX\4-hour Chic\2-CYRCHI.out RUNOFF COEFFICIENT = . 95 . 38 . 385 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 81.0$  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. \*\* END OF RUN : 2 \* START | Project dir.: C:\TEMP\15-319\EX\4-HOUR~1\ ----- Rainfall dir.: C:\TEMP\15-319\EX\4-HOUR~1\ TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 003NSTORM= 1 # 1=25CHI4.stm \*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] : 07-31-2017 \*# Date \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \*#\* \* Pre-Development Condition - Mansfield Ski Club 0.03:0.002-----READ STORM Filename: 25-Year Chicago Storm Distribution (4-ho Ptotal= 58.08 mm Comments: 25-Year Chicago Storm Distribution (4-ho TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr hrs mm/hr | hrs mm/hr .17 4.562 | 1.17 25.411 | 2.17 9.453 | 3.17 5.299 .33 5.131 | 1.33 132.047 | 2.33 8.265 | 3.33 4.973 .50 5.904 | 1.50 32.125 | 2.50 7.379 | 3.50 4.691 .67 7.028 | 1.67 18.726 | 2.67 6.691 | 3.67 4.444 .83 8.850 | 1.83 13.807 | 2.83 6.138 | 3.83 4.225

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\4-hour\_Chic\2-CYRCHI.out

1.00 12.466 | 2.00 11.148 | 3.00 5.682 | 4.00 4.031

- \* 0177
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

```
| CALIB STANDHYD | Area (ha)= 2.66
| 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                         IMPERVIOUS PERVIOUS (i)
   Surface Area (ha)=
                            . 64
                                       2.02
   Dep. Storage
                  ( mm ) =
                            2 00
                                       8 10
   Average Slope
                  ( % ) =
                            2.00
                                       10.00
                   (m)=
   Length
                          100.00
                                      80.00
                           .013
                                       .250
   Mannings n
   Max.eff.Inten.(mm/hr)= 132.05
                                      79.60
            over (min)
                           2.00
                                       9.00
   Storage Coeff. (min)=
                            1.86 (ii) 9.09 (ii)
   Unit Hyd. Tpeak (min) =
                            2.00
                                       9.00
                           .59
   Unit Hyd. peak (cms)=
                                        12
                                                  *TOTALS*
   PEAK FLOW
                 (cms)=
                             .01
                                        .27
                                                    .273 (iii)
   TIME TO PEAK (hrs)=
                                      1.43
                            1.33
                                                   1.433
   RUNOFF VOLUME (mm)=
                           56.08
                                      27.56
                                                   27.843
   TOTAL RAINFALL (mm)=
                                                  58.079
                           58.08
                                      58.08
   RUNOFF COEFFICIENT =
                                                    .479
```

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 81.0 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.

003:0004-----

\* EXTERNAL

PEAK FLOW (cms) = .795 (i)

TIME TO PEAK (hrs) = 1.583

RUNOFF VOLUME (mm) = 25.455

TOTAL RAINFALL (mm) = 58.079

RUNOFF COEFFICIENT = .438

Unit Hyd Qpeak (cms)= 1.864

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

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD | Area (ha)= 1.36

003:0006-----

SUM 03:TOTAL 14.37 1.005 1.53 25.90 .000

- \* SITE
- \* To account for the existing packed gravel surfaces on-site, the TIMP value
- \* was calibrated (see design calcs)

RUNOFF COEFFICIENT =

| - 1 |                   |          | (,        |          |           |         |       |
|-----|-------------------|----------|-----------|----------|-----------|---------|-------|
|     | 04:PRE2 DT= 1.00  | Total    | Imp(%)=   | 24.00 I  | oir. Conn | . (%)=  | 1.00  |
| -   |                   | -        | IMPERVIOU | C DEDUTO | OUS (i)   |         |       |
|     |                   |          |           |          | ( )       |         |       |
|     | Surface Area      | (ha)=    | .33       | 1.0      | 13        |         |       |
|     | Dep. Storage      | ( mm ) = | 2.00      | 8.0      | 00        |         |       |
|     | Average Slope     | (%)=     | 3.50      | 13.0     | 00        |         |       |
|     | Length            | ( m ) =  | 45.00     | 70.0     | 00        |         |       |
|     | Mannings n        | =        | .013      | . 25     | 50        |         |       |
|     | Max.eff.Inten.(mr | m/hr)=   | 132.05    | 86.8     | 35        |         |       |
|     | over              | (min)    | 1.00      | 7.0      | 00        |         |       |
|     | Storage Coeff.    | (min)=   | .97       | (ii) 6.9 | 3 (ii)    |         |       |
|     | Unit Hyd. Tpeak   | (min)=   | 1.00      | 7.0      | 00        |         |       |
|     | Unit Hyd. peak    | (cms)=   | 1.09      | .1       | .6        |         |       |
|     |                   |          |           |          |           | *TOTALS | *     |
|     | PEAK FLOW         | (cms)=   | .00       | .1       | .6        | .163    | (iii) |
|     | TIME TO PEAK      | (hrs)=   | 1.33      | 1.4      | 10        | 1.400   |       |
|     | RUNOFF VOLUME     | ( mm ) = | 56.08     | 27.6     | 52        | 27.902  |       |
|     | TOTAL RAINFALL    | ( mm ) = | 58.08     | 58.0     | 18        | 58.079  |       |

.97

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 81.0 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.

003:0007-----

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.48

.480

```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\EX\4-hour_Chic\2-CYRCHI.out
   003:0002-----
     ** END OF RIN : 3
   ************************
   START Project dir.: C:\TEMP\15-319\EX\4-HOUR~1\
   ----- Rainfall dir.: C:\TEMP\15-319\EX\4-HOUR~1\
      TZERO = .00 hrs on
                         0
      METOUT= 2 (output = METRIC)
      NRUN = 004
      NSTORM= 1
        # 1=100CHI4.stm
    *#*****************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
    *# Date : 07-31-2017
    *# Modeller : [J. Lightheart]
    *# Company : WMI & Associates Ltd.
    *# License # : 2880720
    * Pre-Development Condition - Mansfield Ski Club
   0.04:0.002-----
    | READ STORM | Filename: 100-Year Chicago Storm Distribution (4-h
    Ptotal= 70.93 mm Comments: 100-Year Chicago Storm Distribution (4-h
             TIME RAIN | TIME RAIN | TIME RAIN |
                                               TIME
                                                     RAIN
             hrs mm/hr |
                         hrs mm/hr
                                    hrs mm/hr |
                                                hrs
                                                     mm/hr
             .17 5.571 | 1.17 31.032 | 2.17 11.544 | 3.17
                                                     6 472
             .33 6.266 | 1.33 161.254 | 2.33 10.093 | 3.33 6.073
             .50 7.210 | 1.50 39.231 | 2.50 9.012 | 3.50 5.728
             .67 8.582 | 1.67 22.869 | 2.67 8.171 |
                                               3.67 5.427
             .83 10.808 | 1.83 16.861 | 2.83 7.495 | 3.83 5.160
             1.00 15.223 | 2.00 13.614 | 3.00 6.939 | 4.00 4.923
   0.04:0.003-----
   * SITE
   ^{\star} To account for the existing packed gravel surfaces on-site, the TIMP value
   * was calibrated (see design calcs)
    | CALIB STANDHYD | Area (ha)= 2.66
    | 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
```

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|                  |          | IMPERVIOUS | PERVIOUS (i) |            |
|------------------|----------|------------|--------------|------------|
| Surface Area     | (ha) =   | .64        | 2.02         |            |
| Dep. Storage     | ( mm ) = | 2.00       | 8.10         |            |
| Average Slope    | (%)=     | 2.00       | 10.00        |            |
| Length           | ( m ) =  | 100.00     | 80.00        |            |
| Mannings n       | =        | .013       | .250         |            |
|                  |          |            |              |            |
| Max.eff.Inten.(m | m/hr)=   | 161.25     | 117.56       |            |
| over             | (min)    | 2.00       | 8.00         |            |
| Storage Coeff.   | (min) =  | 1.71 (ii)  | 7.90 (ii)    |            |
| Unit Hyd. Tpeak  | (min) =  | 2.00       | 8.00         |            |
| Unit Hyd. peak   | (cms)=   | .62        | .14          |            |
|                  |          |            |              | *TOTALS*   |
| PEAK FLOW        | (cms)=   | .01        | .42          | .419 (iii) |
| TIME TO PEAK     | (hrs)=   | 1.33       | 1.42         | 1.417      |
| RUNOFF VOLUME    | ( mm ) = | 68.93      | 37.91        | 38.221     |
| TOTAL RAINFALL   | ( mm ) = | 70.93      | 70.93        | 70.926     |
| RUNOFF COEFFICIE | CNT =    | .97        | .53          | .539       |
|                  |          |            |              |            |

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

\* EXTERNAL

| CALIB NASHYD    | Area (ha)=    | 11.71 | Curve Number (CN)=83.00   |
|-----------------|---------------|-------|---------------------------|
| 02:EXT DT= 1.00 | Ia (mm)=      | 6.800 | # of Linear Res.(N)= 3.00 |
|                 | U.H. Tp(hrs)= | .240  |                           |

Unit Hyd Qpeak (cms) = 1.864

PEAK FLOW (cms)= 1.147 (i)
TIME TO PEAK (hrs)= 1.567
RUNOFF VOLUME (mm)= 35.404
TOTAL RAINFALL (mm)= 70.926
RUNOFF COEFFICIENT = .499

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

\* TOTAL

| ADD HYD (TOTAL | )    | ID: NHYD | AREA  | QPEAK | TPEAK | R.V.   | DWF   |
|----------------|------|----------|-------|-------|-------|--------|-------|
|                |      |          | (ha)  | (cms) | (hrs) | ( mm ) | (cms) |
|                | ID1  | 01:PRE1  | 2.66  | .419  | 1.42  | 38.22  | .000  |
|                | +ID2 | 02:EXT   | 11.71 | 1.147 | 1.57  | 35.40  | .000  |
|                | ==== |          |       |       |       | ====== |       |
|                | SUM  | 03:TOTAL | 14.37 | 1.439 | 1.53  | 35.93  | .000  |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\4-hour\_Chic\2-CYRCHI.out

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

004:0006-----

\* SITE

 $^{\star}$  To account for the existing packed gravel surfaces on-site, the TIMP value

\* was calibrated (see design calcs)

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| CALIB STANDHYD | Area (ha)= 1.36 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00 -----IMPERVIOUS PERVIOUS (i) Surface Area (ha)= .33 1.03 Dep. Storage (mm) =2.00 8.00 Average Slope (%)= 3.50 13.00 45.00 70.00 Length (m) =Mannings n .013 . 250 = Max.eff.Inten.(mm/hr)= 161.25 125.47 over (min) 1.00 6.00 Storage Coeff. (min)= .90 (ii) 6.04 (ii) 1.00 Unit Hyd. Tpeak (min)= 6.00 Unit Hyd. peak (cms)= 1.14 .19 \*TOTALS\* .01 PEAK FLOW (cms)= . 25 .248 (iii) TIME TO PEAK (hrs)= 1.33 1.38 1.383 RUNOFF VOLUME (mm)= 68.93 37.97 38.284 TOTAL RAINFALL (mm)= 70.93 70.93 70.926 RUNOFF COEFFICIENT = .97 .54 .540

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

004:0007-----004:0002----004:0002----\*\* END OF RUN: 4

\*

12/15

```
START Project dir.: C:\TEMP\15-319\EX\4-HOUR~1\
----- Rainfall dir.: C:\TEMP\15-319\EX\4-HOUR~1\
  TZERO = .00 hrs on
                    0
  METOUT= 2 (output = METRIC)
  NRUN = 005
  NSTORM= 1
      # 1=12regtim.o89
*#**************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
          : WMI & Associates Ltd.
*# License # : 2880720
*#*****************************
* Pre-Development Condition - Mansfield Ski Club
005:0002-----
 READ STORM
               Filename: TIMMINS REGIONAL STORM (12-hour)
 Ptotal= 193.00 mm|
                Comments: TIMMINS REGIONAL STORM (12-hour)
         TIME RAIN | TIME RAIN |
                                 TIME RAIN TIME RAIN
         hrs mm/hr
                     hrs mm/hr |
                                  hrs mm/hr
                                             hrs mm/hr
         1.00 15.000 | 4.00 3.000 |
                                  7.00 43.000 | 10.00 13.000
         2.00 20.000 | 5.00 5.000 |
                                  8.00 20.000 | 11.00 13.000
         3.00 10.000 | 6.00 20.000 | 9.00 23.000 | 12.00 8.000
______
005:0003-----
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
 CALIB STANDHYD | Area (ha)= 2.66
 01:PRE1 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
                     IMPERVIOUS PERVIOUS (i)
                        .64
   Surface Area (ha)=
                               2 02
   Dep. Storage (mm)=
                        2.00
                                 8 10
   Average Slope
               (%)=
                       2.00
                                10.00
   Length
               (m)=
                      100.00
                                80.00
   Mannings n
                      .013
                                .250
   Max.eff.Inten.(mm/hr)=
                     43.00
                                50.88
          over (min)
                      3.00
                                12.00
   Storage Coeff. (min)=
                      2.91 (ii) 11.56 (ii)
   Unit Hyd. Tpeak (min)=
                       3.00
                                12 00
   Unit Hyd. peak (cms)=
                       3.8
                                1.0
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\EX\4-hour\_Chic\2-CYRCHI.out

```
*TOTALS*
                        .00
                                  .28
                                             .284 (iii)
   PEAK FLOW
               (cms)=
                        7.00
                                             7.000
   TIME TO PEAK (hrs)=
                                 7.00
   RUNOFF VOLUME (mm)=
                       191.00
                                 150.02
                                            150.449
   TOTAL RAINFALL (mm)=
                       193.00
                                 193.00
                                           193.000
   RUNOFF COEFFICIENT =
                       .99
                                 .78
                                             . 780
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN^* = 81.0 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.
* EXTERNAL
______
CALIB NASHYD | Area (ha)= 11.71 Curve Number (CN)=83.00
02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= .240
   Unit Hyd Qpeak (cms)= 1.864
   PEAK FLOW
                      1.216 (i)
               (cms)=
   TIME TO PEAK
               (hrs) = 7.017
   RUNOFF VOLUME (mm) = 145.537
   TOTAL RAINFALL (mm) = 193.000
   RUNOFF COEFFICIENT = .754
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
005:0005-----
* TOTAL
| ADD HYD (TOTAL ) | ID: NHYD
                              AREA
                                      OPEAK TPEAK R.V.
_____
                              (ha)
                                     (cms) (hrs) (mm)
                                                       (cms)
              TD1 01:PRE1
                               2 66
                                     .284 7.00 150.45 .000
              +ID2 02:EXT
                              11.71 1.216 7.02 145.54 .000
               ______
               SUM 03:TOTAL
                              14.37 1.499 7.02 146.45 .000
  NOTE: PEAK FLOWS DO NOT INCLIDE BASEFLOWS IF ANY
0.05:00.06-----
* SITE
^{\star} To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
| CALIB STANDHYD | Area (ha)= 1.36
| 04:PRE2 DT= 1.00 | Total Imp(%)= 24.00 Dir. Conn.(%)= 1.00
```

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|                  |          | IMPERVIOUS | PERVIOUS (i) |            |
|------------------|----------|------------|--------------|------------|
| Surface Area     | (ha) =   | .33        | 1.03         |            |
| Dep. Storage     | ( mm ) = | 2.00       | 8.00         |            |
| Average Slope    | (%)=     | 3.50       | 13.00        |            |
| Length           | ( m ) =  | 45.00      | 70.00        |            |
| Mannings n       | =        | .013       | .250         |            |
|                  |          |            |              |            |
| Max.eff.Inten.(r | nm/hr)=  | 43.00      | 50.96        |            |
| over             | (min)    | 2.00       | 9.00         |            |
| Storage Coeff.   | (min) =  | 1.52 (i:   | i) 8.90 (ii) |            |
| Unit Hyd. Tpeak  | (min) =  | 2.00       | 9.00         |            |
| Unit Hyd. peak   | (cms)=   | .66        | .13          |            |
|                  |          |            |              | *TOTALS*   |
| PEAK FLOW        | (cms)=   | .00        | .14          | .146 (iii) |
| TIME TO PEAK     | (hrs)=   | 6.87       | 7.00         | 7.000      |
| RUNOFF VOLUME    | ( mm ) = | 191.00     | 150.11       | 150.522    |
| TOTAL RAINFALL   | (mm) =   | 193.00     | 193.00       | 193.000    |
| RUNOFF COEFFICIA | ENT =    | .99        | .78          | .780       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 81.0 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.

| 005:0007                       |               |
|--------------------------------|---------------|
|                                |               |
| 005:0002                       |               |
|                                |               |
| 005:0002                       |               |
|                                |               |
| 005:0002                       |               |
|                                |               |
| 005:0002                       |               |
| FINISH                         |               |
|                                |               |
|                                |               |
| *********                      | ************* |
| WARNINGS / ERRORS / NOTES      |               |
|                                |               |
| Simulation ended on 2017-08-08 | at 15:47:14   |

\_\_\_\_\_\_

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| Post-Development Condition 24-hour SCS Type-II Storm Distribution |
|---|

```
Metric units
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#*****************
* Post-Development Condition - Mansfield Ski Club
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
            TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
* %
               ["25mm4hr.stm"] <--storm filename
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8------
* SITE (POST1 - Controlled Area)
            ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.94](ha),
CALIB STANDHYD
              XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[84],
              Pervious surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                              LGP=[6](m), MNP=[0.25], SCP=[0](min),
              Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[300](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*&-----
* EXTERNAL (Routed through SWM Facility)
              ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*%------
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
ADD HYD
*%------
* SWM Facility
ROUTE RESERVOIR
              IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                  TABLE of ( OUTFLOW-STORAGE ) values
                         (cms) - (ha-m)
                        [ 0.000 , 0.00000 ]
                        [0.0015 , 0.00095]
                        [0.0031 , 0.00196]
                        [0.0041 , 0.00305]
                        [0.0050 , 0.00422]
                        [0.0057 , 0.00547]
                        [0.0063 , 0.00681]
                        [0.0069 , 0.00823]
                        [0.0074 . 0.00975]
                        [0.0079 , 0.01136]
                        [0.0084 , 0.01308]
                        [0.0088 , 0.01489]
                        [0.0092 , 0.01682]
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.dat

```
[0.0096 , 0.01885]
                              [0.0100 , 0.02100]
                              [0.0104 , 0.02327]
                              [0.0108 , 0.02566]
                              [0.0111 , 0.02818]
                              [0.0114 , 0.03083]
                              [0.0118 , 0.03361]
                              [0.0121 , 0.03653]
                              [0.0124 , 0.03958]
                              [0.0127 , 0.04279]
                              [0.0130 , 0.04614]
                              [0.0133 , 0.04964]
                              [0.0377 , 0.05293]
                              [0.0822 , 0.05634]
                              [0.1396 , 0.05989]
                              [0.2076 , 0.06357]
                              [0.2847 , 0.06738]
                              [0.3698 , 0.07134]
                              [0.4624 , 0.07545]
                              [0.5619 , 0.07970]
                              [0.6677 , 0.08411]
                              [0.7796 , 0.08867]
                              [0.8972 , 0.09339]
                              [1.0202 , 0.09827]
                              [1.1485 , 0.10332]
                              [1.2819 , 0.10854]
                              [1.4214 , 0.11394]
                              [1.5706 , 0.11951]
                              [1.7315 , 0.12526]
                              [1.9058 , 0.13120]
                              [2.0945 , 0.13732]
                              [2.2989 , 0.14363]
                              [2.5199 , 0.15014]
                              [2.7584 . 0.15655]
                              [3.0154 , 0.16308]
                              [3.2914 , 0.16974]
                              [3.5875 , 0.17653]
                              [3.9042 , 0.18344]
                              [4.2422 , 0.19049]
                              [ -1 , -1 ] (maximum one hundred pairs of points)
                              IDovf=[ ], NHYDovf=[" "],
*&_____|____
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
* SITE (POST2 - Uncontrolled Area)
                  ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.85](ha),
                  XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[84].
                  Pervious surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                     LGP=[50](m), MNP=[0.25], SCP=[0](min),
                  Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                     LGI=[120](m), MNI=[0.013], SCI=[0](min),
                  RAINFALL=[ , , , , ](mm/hr) , END=-1
```

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\*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2] ["2SCS24.stm"] <--storm filename \*8------\*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3] START \*% ["5SCS24.stm"] <--storm filename \*8-----\*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] ["25SCS24.stm"] <--storm filename \*8------\*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr) START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5] ["100SCS24.stm"] <--storm filename \*\*-----

TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[6]

["12reqtim.o89"] <--storm filename

\*% Timmins Regional Storm (12-hr)

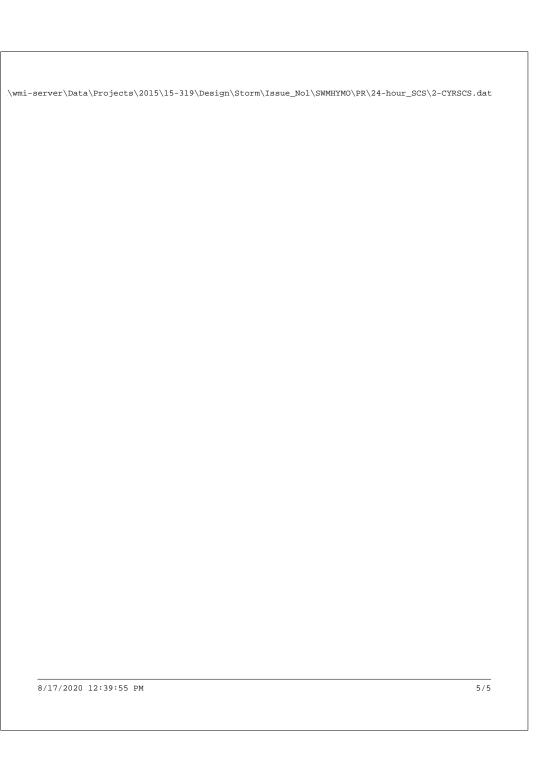
START

FINISH

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.dat

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.dat

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\24-hour SCS\2-CYRSCS.out \_\_\_\_\_\_ SSSSS W W M M H H Y Y M M 000 222 000 11 77777 == S WWW MM MM H H YY MM MM O O 2. 0 0 11 7 7 ннннн Y M M M 2 0 0 11 SSSSS W W W M M M 0 0 7 ww M M H H Y M M O O 222 Ω 0 11 S 7 == SSSSS 000 0 11 M M H H Y M M 2 Λ 0 0 11 7 # 2 StormWater Management HYdrologic Model 222 000 11 7 == \* \*\*\*\*\*\*\* A single event and continuous hydrologic simulation model \*\*\*\*\*\*\*\* \*\*\*\*\*\*\* based on the principles of HYMO and its successors OTTHYMO-83 and OTTHYMO-89. \* \*\*\*\*\*\*\*\*\*\*\*\* Distributed by: J.F. Sabourin and Associates Inc. Ottawa, Ontario: (613) 836-3884 Gatineau, Quebec: (819) 243-6858 \*\*\*\*\*\* +++++++++ E-Mail: swmhvmo@ifsa.com \* Barrie SERIAL#:2880720 \*\*\*\*\* ++++++ PROGRAM ARRAY DIMENSIONS ++++++ \*\*\*\*\*\*\*\*\*\*\* Maximum value for ID numbers : 11 +++++++++++++++ Max. number of rainfall points: 105408 +++++++++ Max. number of flow points : 105408 \* \* DETAILED OUTPUT \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* \*\*\*\*\* \* \* Input file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\24-hour\_SCS\2-CYRSCS.dat \* Output file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\24-hour SCS\2-CYRSCS out \* Summary file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\24-hour\_SCS\2-CYRSCS.sum \* User comments: \* 1:\_\_ \* 2:\_ \* 3:\_ \*

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\*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \*#\* \* Post-Development Condition - Mansfield Ski Club | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\ TZERO = .00 hrs on METOUT= 2 (output = METRIC) NRUN = 0001 NSTORM= 1 # 1=25mm4hr.stm | READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON. TIME RAIN TIME RATN TIME RATN TIME RATN TIME RATN TIME hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr| hh:mm mm/hr| hh:mm 1:30 13.830 2:10 0:10 1.970 0:50 3.820 4.080 2:50 2.650 3:30 1:40 8.070 2.450 3:40 0:20 2.220 1:00 5.380 2:20 3.570 3:00 0:30 2.550 1:10 10.940 1:50 5.950 2:30 3.190 3:10 2.290 3:50 0:40 3.030 1:20 56.670 2:00 4.810 2:40 2.890 3:20 2.150 R0001:C00003-----\* SITE (POST1 - Controlled Area) CALIB STANDHYD (ha)= 2.94 | 01:POST1 | DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 2.03 .91 Dep. Storage (mm) =2 00 5 00 3 50 33 30 Average Slope (%)= 300.00 6.00 Length (m) =Mannings n 013 250 Max.eff.Inten.(mm/hr)= 56.67 23 86 over (min) 4 00 6 00 Storage Coeff. (min)= 4.26 (ii) 5.98 (ii) Unit Hvd. Tpeak (min)= 6.00 4.00 Unit Hyd. peak (cms)= \*TOTALS\* PEAK FLOW (cms)= 2.4 0.4 .274 (iii) TIME TO PEAK (hrs)= 1.33 1.40 1.350

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\24-hour SCS\2-CYRSCS.out

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out RUNOFF VOLUME (mm)= 23.01 7.79 16.768 25.01 25 01 25.005 TOTAL RAINFALL (mm)= .31 .671 RUNOFF COEFFICIENT = .92 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. \_\_\_\_\_\_ R0001:C00004-----\* EXTERNAL (Routed through SWM Facility) CALIB NASHYD | Area (ha)= 11.940 Curve Number (CN)= 83.00 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= .240 Unit Hyd Qpeak (cms)= 1.900 PEAK FLOW (cms)= .115 (i) TIME TO PEAK (hrs)= 1.650 (hrs) = 5.667, (dddd|hh:mm:) = 0 | 05:40 DURATION AVERAGE FLOW (cms)= 028 RUNOFF VOLUME (mm)= 4.719 TOTAL RAINFALL (mm) = 25.005 RUNOFF COEFFICIENT = .189 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. R0001:C00005-----\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT) ADD HYD ID:NHYD 03:POST1+EXT AREA QPEAK TPEAK R.V. ( mm ) (ha) (cms) (hrs) (cms) ID 1 01:POST1 2.940 .274 1.350 16.768 000 11 940 .115 1.650 4.719 +TD 2 02:EXT \_\_\_\_\_\_ SUM 03:POST1+EXT 14.880 .300 1.367 7.100 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0001:C00006-----

\* SWM Facility

\_\_\_\_\_

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

| .002 .9500E-03 | .010 .2100E-01 | .140 .5989E-01  | 1.571 . |
|----------------|----------------|-----------------|---------|
| .003 .1960E-02 | .010 .2327E-01 | .208 .6357E-01  | 1.732 . |
| .004 .3050E-02 | .011 .2566E-01 | .285 .6738E-01  | 1.906 . |
| .005 .4220E-02 | .011 .2818E-01 | .370 .7134E-01  | 2.095 . |
| .006 .5470E-02 | .011 .3083E-01 | .462 .7545E-01  | 2.299 . |
| .006 .6810E-02 | .012 .3361E-01 | .562 .7970E-01  | 2.520 . |
| .007 .8230E-02 | .012 .3653E-01 | .668 .8411E-01  | 2.758 . |
| .007 .9750E-02 | .012 .3958E-01 | .780 .8867E-01  | 3.015 . |
| .008 .1136E-01 | .013 .4279E-01 | .897 .9339E-01  | 3.291 . |
| .008 .1308E-01 | .013 .4614E-01 | 1.020 .9827E-01 | 3.588 . |
| .009 .1489E-01 | .013 .4964E-01 | 1.148 .1033E+00 | 3.904 . |
| .009 .1682E-01 | .038 .5293E-01 | 1.282 .1085E+00 | 4.242 . |
|                |                |                 |         |
|                |                |                 |         |

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK | R.V.   |
|-------------------------|--------|-------|-------|--------|
|                         | (ha)   | (cms) | (hrs) | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | .300  | 1.367 | 7.100  |
| OUTFLOW < 04:SWM Facili | 14.880 | .083  | 2.300 | 7.100  |

PEAK FLOW REDUCTION [Qout/Qin](%)= 27.688
TIME SHIFT OF PEAK FLOW (min)= 56.00
MAXIMUM STORAGE USED (ha.m.)=.5640E-01

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001:C00007-

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|  | CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha) = Total Imp(%) = |              | Conn.(%)= 10.50 |
|--|------------------------------------|----------------------------|--------------|-----------------|
|  |                                    | IMPERVIOUS                 | PERVIOUS (i) |                 |
|  | Surface Area (ha)=                 | .18                        | .67          |                 |
|  | Dep. Storage (mm)=                 | 2.00                       | 5.00         |                 |
|  | Average Slope (%)=                 | 6.00                       | 11.10        |                 |
|  | Length (m)=                        | 120.00                     | 50.00        |                 |
|  | Mannings n                         | .013                       | .250         |                 |
|  | Max.eff.Inten.(mm/hr)=             | 56.67                      | 11.01        |                 |
|  | over (min)                         | 2.00                       | 14.00        |                 |
|  | Storage Coeff. (min)=              | 2.09 (ii)                  | 13.75 (ii)   |                 |
|  | Unit Hyd. Tpeak (min)=             | 2.00                       | 14.00        |                 |
|  | Unit Hyd. peak (cms)=              | .54                        | .08          |                 |
|  |                                    |                            |              | *TOTALS*        |
|  | PEAK FLOW (cms)=                   | .01                        | .01          | .017 (iii)      |
|  | TIME TO PEAK (hrs)=                | : 1.33                     | 1.55         | 1.333           |
|  | RUNOFF VOLUME (mm)=                | 23.00                      | 6.70         | 8.411           |
|  | TOTAL RAINFALL (mm)=               |                            | 25.01        | 25.005          |
|  | RUNOFF COEFFICIENT =               | .92                        | .27          | .336            |
|  |                                    |                            |              |                 |

<sup>(</sup>i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN\* = 84.0 Ia = Dep. Storage (Above)

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<sup>\*</sup> TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

<sup>\*</sup> SITE (POST2 - Uncontrolled Area)

<sup>(</sup>ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

<sup>(</sup>iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\24-hour_SCS\2-CYRSCS.out
    R0001:C00008-----
     ** END OF RUN : 0
    *****************************
           | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    START
       ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
       TZERO = .00 hrs on
       METOUT= 2 (output = METRIC)
       NRUN = 0002
       NSTORM= 1
          # 1=2SCS24.stm
    *#**********************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
    *# Date
               : 07-31-2017
    *# Modeller
               : [J. Lightheart]
    *# Company
               : WMI & Associates Ltd.
    *# License # : 2880720
    *#*****************************
    * Post-Development Condition - Mansfield Ski Club
    R0002:C00002-----
     READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
     Ptotal= 54.70 mm Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
        TIME RAIN TIME
                        RAIN! TIME
                                     RAIN TIME RAIN
                                                      TIME RAIN
                                                                  TIME
       hh:mm mm/hr | hh:mm
             .547
                   4:12 1.094
                               8:12 1.641 12:12 10.940 16:12
        0:24
             .547
                   4:24 1.094
                               8:24 1.641 12:24 6.838 16:24
                                                           1.367 20:24
        0:36
             .547
                   4:36 1.094
                               8:36 1.641 12:36 4.923 16:36 1.367 20:36
        0:48
                               8:48 1.641 12:48 4.650 16:48 1.367
              .547
                   4:48
                        1 094
                                                                  20:48
        1:00
              .547
                   5:00
                         1.094
                               9:00 1.641
                                          13:00 3.282
                                                      17:00
                                                             .820
                                                                   21:00
        1:12
              .547
                    5:12
                         1.094
                                9:12 1.641
                                           13:12
                                                2.735
                                                      17:12
                                                             . 821
                                                                   21:12
        1:24
              .547
                    5:24
                         1.094
                                9:24 1.641
                                           13:24 2.735
                                                      17:24
                                                            1.094
                                                                  21:24
        1:36
              .547
                   5:36
                         1.094
                               9:36 1.641 13:36 2.735 17:36
                                                             .821
                                                                  21:36
        1:48
             .547
                   5:48 1.094
                               9:48 1.641 13:48 2.735 17:48 1.094
                                                                  21:48
        2:00
                   6:00 1.094 10:00 1.641 14:00 2.735 18:00
                                                            .821 | 22:00
             .547
        2:12
                   6:12 1.094 10:12 3.008 14:12 1.641 18:12
        2:24
             .547
                   6:24 1.094 10:24 3.009 14:24 1.641 18:24
                                                             .820 | 22:24
                   6:36 1.094 10:36 3.008 14:36 1.641 18:36
        2:36
              .547
                                                           1.094 | 22:36
        2:48
              .547 6:48 1.094 10:48 3.009 14:48 1.641 18:48
                                                             821 22:48
```

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 $\verb|\wmi-server| Data| Projects \| 2015\| 15-319 \\| Design \\| Storm \\| Issue\_No1 \\| SWMHYMO \\| PR \\| 24-hour\_SCS \\| 2-CYRSCS.out \\| Output \\| Outp$ 

| 3:00 | .547 | 7:00 | 1.094 | 11:00 | 3.008  | 15:00 | 1.641 | 19:00 | .821  | 23:00 |
|------|------|------|-------|-------|--------|-------|-------|-------|-------|-------|
| 3:12 | .547 | 7:12 | 1.094 | 11:12 | 4.102  | 15:12 | 1.367 | 19:12 | 1.094 | 23:12 |
| 3:24 | .547 | 7:24 | 1.094 | 11:24 | 6.017  | 15:24 | 1.367 | 19:24 | .821  | 23:24 |
| 3:36 | .547 | 7:36 | 1.094 | 11:36 | 14.495 | 15:36 | 1.367 | 19:36 | 1.094 | 23:36 |
| 3:48 | .547 | 7:48 | 1.094 | 11:48 | 30.085 | 15:48 | 1.367 | 19:48 | .821  | 23:48 |
| 4:00 | .547 | 8:00 | 1.094 | 12:00 | 61.538 | 16:00 | 1.367 | 20:00 | 1.094 | 24:00 |

R0002:C00003-----

\* SITE (POST1 - Controlled Area)

|   | CALIB STANDHYD   |          | Area (ha)=    | 2.94     |      |           |       |  |
|---|------------------|----------|---------------|----------|------|-----------|-------|--|
| ĺ | 01:POST1 DT= 1   | 1.00     | Total Imp(%)= | 69.00    | Dir. | Conn.(%)= | 59.00 |  |
| _ |                  |          |               |          |      |           |       |  |
|   |                  |          | IMPERVIOUS    | PERVIOUS | (i)  |           |       |  |
|   | Surface Area     | (ha) =   | 2.03          | .91      |      |           |       |  |
|   | Dep. Storage     | ( mm ) = | 2.00          | 5.00     |      |           |       |  |
|   | Average Slope    | (%)=     | 3.50          | 33.30    |      |           |       |  |
|   | Length           | (m) =    | 300.00        | 6.00     |      |           |       |  |
|   | Mannings n       | =        | .013          | .250     |      |           |       |  |
|   |                  |          |               |          |      |           |       |  |
|   | Max.eff.Inten.(m | nm/hr)=  | 61.54         | 56.60    |      |           |       |  |
|   | over             | (min)    | 4.00          | 5.00     |      |           |       |  |
|   | Storage Coeff.   | (min) =  | 4.12 (ii)     | 5.34     | (ii) |           |       |  |
|   | Unit Hyd. Tpeak  | (min) =  | 4.00          | 5.00     |      |           |       |  |
|   | Unit Hyd. peak   | (cms)=   | .28           | .22      |      |           |       |  |
|   |                  |          |               |          |      | *TOTALS*  |       |  |
|   | PEAK FLOW        | (cms)=   | .28           | .12      |      | .406      | (iii) |  |
|   | TIME TO PEAK     | (hrs)=   | 12.00         | 12.02    |      | 12.000    |       |  |
|   | RUNOFF VOLUME    | ( mm ) = | 52.70         | 29.63    |      | 43.242    |       |  |
|   | TOTAL RAINFALL   | ( mm ) = | 54.70         | 54.70    |      | 54.700    |       |  |
|   | RUNOFF COEFFICIE | ENT =    | .96           | .54      |      | .791      |       |  |
|   |                  |          |               |          |      |           |       |  |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

P0002:C00004-----

\* EXTERNAL (Routed through SWM Facility)

RUNOFF VOLUME (mm) = 22.962

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| ( | CALIB NAS | HYD      |           | Area    | (ha) =   | 11.940   | Curve Number  | (CN) =  | 83.00 |  |
|---|-----------|----------|-----------|---------|----------|----------|---------------|---------|-------|--|
| ( | )2:EXT    | DT=      | 1.00      | Ia      | ( mm ) = | 6.800    | # of Linear R | es.(N)= | 3.00  |  |
|   |           |          |           | U.H. Tr | (hrs)=   | .240     |               |         |       |  |
|   | Unit H    | yd Qpeak | ( cms ) = | 1.900   | ı        |          |               |         |       |  |
|   | PEAK F    | LOW      | (cms)=    | .604    | (i)      |          |               |         |       |  |
|   | TIME T    | O PEAK   | (hrs)=    | 12.150  |          |          |               |         |       |  |
|   | DURATI    | ON       | (hrs)=    | 25.667  | , (dddd  | hh:mm:)= | 1   01:40     |         |       |  |
|   | AVERAG    | E FLOW   | (cms)=    | .030    |          |          |               |         |       |  |

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TOTAL RAINFALL (mm) = 54.700 RUNOFF COEFFICIENT = .420

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

| : TOTAL FLOW FROM T     |       |              |        |       |        |        |       |
|-------------------------|-------|--------------|--------|-------|--------|--------|-------|
| ADD HYD<br>03:POST1+EXT |       | ID:NHYD      | AREA   | OPEAK | TPEAK  | R.V.   | DWF   |
|                         |       |              | (ha)   | (cms) | (hrs)  | (mm)   | (cms) |
|                         | ID 1  | 01:POST1     | 2.940  | .406  | 12.000 | 43.242 | .000  |
|                         | +ID 2 | 02:EXT       | 11.940 | .604  | 12.150 | 22.962 | .000  |
|                         | ===== |              |        |       |        |        |       |
|                         | SUM   | 03:POST1+EXT | 14.880 | .887  | 12.033 | 26.969 | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0002:C00006-----

\* SWM Facility

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----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms) .000 .0000E+00| .010 .1885E-01| .082 .5634E-01| 1.421 . .003 .1960E-02 | .010 .2327E-01 | .208 .6357E-01 | 1.732 . .004 .3050E-02 | .011 .2566E-01 | .285 .6738E-01 | 1.906 . .005 .4220E-02 .011 .2818E-01 .370 .7134E-01 2.095 . .006 .5470E-02 | .011 .3083E-01| .462 .7545E-01| 2.299 . .006 .6810E-02 .012 .3361E-01 .562 .7970E-01 .007 .8230E-02| .012 .3653E-01 .668 .8411E-01 2.758 . .012 .3958E-01 .007 .9750E-02| .780 .8867E-01| 3 015 .008 .1136E-01 .013 .4279E-01 .897 .9339E-01 3 291 .009 .1489E-01 | .013 .4964E-01 | 1.148 .1033E+00 | 3.904 . .009 .1682E-01 .038 .5293E-01 | 1.282 .1085E+00 | 4.242 .

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK  | R.V.   |
|-------------------------|--------|-------|--------|--------|
|                         | (ha)   | (cms) | (hrs)  | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | .887  | 12.033 | 26.969 |
| OUTFLOW < 04:SWM Facili | 14.880 | .722  | 12.183 | 26.969 |

PEAK FLOW REDUCTION [Qout/Qin](%)= 81.397
TIME SHIFT OF PEAK FLOW (min)= 9.00
MAXIMUM STORAGE USED (ha.m.)=.8632E-01

R0002:C00007-----

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

- \* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
- \* SITE (POST2 Uncontrolled Area)

-----

|   | CALIB STANDHYD         | Area (ha)=    | .85          |                |     |
|---|------------------------|---------------|--------------|----------------|-----|
|   | 05:POST2 DT= 1.00      | Total Imp(%)= | 21.00 Dir.   | . Conn.(%)= 10 | .50 |
| - |                        |               |              |                |     |
|   |                        | IMPERVIOUS    | PERVIOUS (i) |                |     |
|   | Surface Area (ha)=     | .18           | .67          |                |     |
|   | Dep. Storage (mm)=     | 2.00          | 5.00         |                |     |
|   | Average Slope (%)=     | 6.00          | 11.10        |                |     |
|   | Length (m)=            | 120.00        | 50.00        |                |     |
|   | Mannings n =           | .013          | .250         |                |     |
|   |                        |               |              |                |     |
|   | Max.eff.Inten.(mm/hr)= | 61.54         | 43.49        |                |     |
|   | over (min)             | 2.00          | 9.00         |                |     |
|   | Storage Coeff. (min)=  | 2.02 (ii)     | 8.75 (ii)    |                |     |
|   | Unit Hyd. Tpeak (min)= | 2.00          | 9.00         |                |     |
|   | Unit Hyd. peak (cms)=  | .56           | .13          |                |     |
|   |                        |               |              | *TOTALS*       |     |
|   | PEAK FLOW (cms)=       | .02           | .06          | .070 (iii)     | )   |
|   | TIME TO PEAK (hrs)=    | 12.00         | 12.07        | 12.017         |     |
|   | RUNOFF VOLUME (mm)=    | 52.70         | 27.19        | 29.872         |     |
|   | TOTAL RAINFALL (mm)=   | 54.70         | 54.70        | 54.700         |     |
|   | RUNOFF COEFFICIENT =   | .96           | .50          | .546           |     |
|   |                        |               |              |                |     |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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|       |       | -     |       |       |        |       |        |       |       |       |
|-------|-------|-------|-------|-------|--------|-------|--------|-------|-------|-------|
| TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN   | TIME  | RAIN   | TIME  | RAIN  | TIME  |
| hh:mm | mm/hr | hh:mm | mm/hr | hh:mm | mm/hr  | hh:mm | mm/hr  | hh:mm | mm/hr | hh:mm |
| 0:12  | .721  | 4:12  | 1.442 | 8:12  | 2.163  | 12:12 | 14.420 | 16:12 | 1.803 | 20:12 |
| 0:24  | .721  | 4:24  | 1.442 | 8:24  | 2.163  | 12:24 | 9.013  | 16:24 | 1.802 | 20:24 |
| 0:36  | .721  | 4:36  | 1.442 | 8:36  | 2.163  | 12:36 | 6.489  | 16:36 | 1.802 | 20:36 |
| 0:48  | .721  | 4:48  | 1.442 | 8:48  | 2.163  | 12:48 | 6.129  | 16:48 | 1.802 | 20:48 |
| 1:00  | .721  | 5:00  | 1.442 | 9:00  | 2.163  | 13:00 | 4.326  | 17:00 | 1.081 | 21:00 |
| 1:12  | .721  | 5:12  | 1.442 | 9:12  | 2.163  | 13:12 | 3.605  | 17:12 | 1.082 | 21:12 |
| 1:24  | .721  | 5:24  | 1.442 | 9:24  | 2.163  | 13:24 | 3.605  | 17:24 | 1.442 | 21:24 |
| 1:36  | .721  | 5:36  | 1.442 | 9:36  | 2.163  | 13:36 | 3.605  | 17:36 | 1.082 | 21:36 |
| 1:48  | .721  | 5:48  | 1.442 | 9:48  | 2.163  | 13:48 | 3.605  | 17:48 | 1.442 | 21:48 |
| 2:00  | .721  | 6:00  | 1.442 | 10:00 | 2.163  | 14:00 | 3.605  | 18:00 | 1.082 | 22:00 |
| 2:12  | .721  | 6:12  | 1.442 | 10:12 | 3.965  | 14:12 | 2.163  | 18:12 | 1.082 | 22:12 |
| 2:24  | .721  | 6:24  | 1.442 | 10:24 | 3.966  | 14:24 | 2.163  | 18:24 | 1.081 | 22:24 |
| 2:36  | .721  | 6:36  | 1.442 | 10:36 | 3.965  | 14:36 | 2.163  | 18:36 | 1.442 | 22:36 |
| 2:48  | .721  | 6:48  | 1.442 | 10:48 | 3.966  | 14:48 | 2.163  | 18:48 | 1.082 | 22:48 |
| 3:00  | .721  | 7:00  | 1.442 | 11:00 | 3.965  | 15:00 | 2.163  | 19:00 | 1.082 | 23:00 |
| 3:12  | .721  | 7:12  | 1.442 | 11:12 | 5.408  | 15:12 | 1.802  | 19:12 | 1.442 | 23:12 |
| 3:24  | .721  | 7:24  | 1.442 | 11:24 | 7.931  | 15:24 | 1.802  | 19:24 | 1.082 | 23:24 |
| 3:36  | .721  | 7:36  | 1.442 | 11:36 | 19.106 | 15:36 | 1.802  | 19:36 | 1.442 | 23:36 |
| 3:48  | .721  | 7:48  | 1.442 | 11:48 | 39.655 | 15:48 | 1.802  | 19:48 | 1.082 | 23:48 |
| 4:00  | .721  | 8:00  | 1.442 | 12:00 | 81.113 | 16:00 | 1.802  | 20:00 | 1.442 | 24:00 |
|       |       |       |       |       |        |       |        |       |       |       |

R0003:C00003-----

\* SITE (POST1 - Controlled Area)

| CALIB STANDHYD |             | Area (ha)=    | 2.94     |                |       |
|----------------|-------------|---------------|----------|----------------|-------|
| 01:POST1       | DT= 1.00    | Total Imp(%)= | 69.00    | Dir. Conn.(%)= | 59.00 |
|                |             |               |          |                |       |
|                |             | IMPERVIOUS    | PERVIOUS | (i)            |       |
| Surface Are    | a (ha)=     | 2.03          | .91      |                |       |
| Dep. Storag    | re (mm)=    | 2.00          | 5.00     |                |       |
| Average Slo    | pe (%)=     | 3.50          | 33.30    |                |       |
| Length         | ( m ) =     | 300.00        | 6.00     |                |       |
| Mannings n     | =           | .013          | .250     |                |       |
|                |             |               |          |                |       |
| Max.eff.Int    | en.(mm/hr)= | 81.11         | 83.02    |                |       |
|                |             |               |          |                |       |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

```
over (min)
                     4.00
                                5.00
Storage Coeff. (min)=
                     3.69 (ii) 4.74 (ii)
Unit Hyd. Tpeak (min)=
                     4.00
                                5.00
                    .30
                               .23
Unit Hyd. peak (cms)=
                                         *TOTALS*
                      .38
                               .19
PEAK FLOW
            (cms)=
                                          .564 (iii)
TIME TO PEAK (hrs)=
                     12.00 12.00
                                        12.000
                     70.10 44.49
RUNOFF VOLUME (mm)=
                                        59.602
TOTAL RAINFALL (mm)=
                     72.10 72.10
                                        72.101
RUNOFF COEFFICIENT =
                                          .827
```

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

R0003:C00004-----

\* EXTERNAL (Routed through SWM Facility)

|                    | Ia (mm)=   | 6.800 | Curve Number (CN)= 83.00 # of Linear Res.(N)= 3.00 |
|--------------------|------------|-------|--|
| Unit Hyd Qpeak (cm | 1.900      |       |  |
| DEAK FLOW          | -) 066 (;) |       |  |

PEAK FLOW (cms) = .966 (i)

TIME TO PEAK (hrs) = 12.133

DURATION (hrs) = 25.667, (dddd|hh:mm:) = 1|01:40

AVERAGE FLOW (cms) = .047

RUNOFF VOLUME (mm) = 36.345

TOTAL RAINFALL (mm) = 72.101

RUNOFF COEFFICIENT = .504

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

R0003:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

ADD HYD 03:POST1+EXT ID:NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) ID 1 01:POST1 2.940 .564 12.000 59.602 .000 +ID 2 02:EXT 11.940 .966 12.133 36.345 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 1.350 12.033 40.940 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0003:C00006-----

\* SWM Facility

8/17/2020 12:40:17 PM 10/23

| ROUTE RESERVOIR ->   | Requ   | ested rout:   | ing time s                               | tep = 1.                                  | 0 min.                       |           |         |
|--|--|---|--|---|------------------------------|-----------|---------|
| IN>03:POST1+EXT<br>OUT<04:SWM Facili   |  |   |  | OTITI.FOW S                               | TOPAGE TAI                   | BLE ===== |         |
|  | ,  |   |  |   |                              |           | OUTFLOW |
|  |  |   |  |   |                              | (ha.m.)   |         |
|  |  | .0000E+00   |  | .1885E-01                                 |                              | .5634E-01 |         |
|  |  | .9500E-03   |  | .2100E-01                                 |                              | .5989E-01 |         |
|  | .003   | .1960E-02   | .010                                     | .2327E-01                                 | 1 .208                       | .6357E-01 | 1.732   |
|  | .004   | .3050E-02   | .011                                     | .2566E-01                                 | . 285                        | .6738E-01 | 1.906   |
|  | 005  | 4220E-02  | 011                                      | 2818E-01                                  | 370                          | 7134E-01  | 2 095   |
|  | 006  | 5470E-02  | 011                                      | 3083E-01                                  | 462                          | .7134E-01 | 2 299   |
|  | .006   | .6810E-02   | .012                                     | .3361E-01                                 | .562                         | .7970E-01 | 2.520   |
|  |  | .8230E-02   |  | .3653E-01                                 |                              | .8411E-01 |         |
|  | 007  | 9750E-02  | 012                                      | 3958E-01                                  | 780                          | .8867E-01 | 3 015   |
|  |  | .1136E-01   |  | .4279E-01                                 |                              | .9339E-01 |         |
|  |  | .1308E-01   |  |   |                              | .9827E-01 |         |
|  |  |   |  |   |                              | .1033E+00 |         |
|  |  | .1682E-01   |  |   |                              | .1085E+00 |         |
| ROUTING RESULTS  |  | AREA  | QPEAK                                    | TPEAK                                     | R.V.                         |           |         |
|  |  |   |  | (hrs)                                     | (mm)                         |           |         |
| INFLOW > 03:POST   | 1+EXT  |   | 1.350                                    |   | 40.940                       |           |         |
| OUTFLOW < 04:SWM H   |  | 14.880  |  |   | 40.940                       |           |         |
| TIN MAX  |  | F PEAK FLOI<br>RAGE USEI  | W (h                                     | (min) = a.m.) = .10                       | 937E+00                      |           |         |
| TIN MAX  | ME SHIFT OF XIMUM STORM  | F PEAK FLOURAGE USEI  | N (h                                     | (min) = a.m.) = .10                       | 7.00<br>37E+00               |           |         |
| TIN MAX  0003:C00007  TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1   | ME SHIFT OF XIMUM STORM STORM SIDEROAD 1: trolled Are   Are   Are  | F PEAK FLOURAGE USEI  | W (h                                     | (min) = a.m.) = .10                       | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  | ME SHIFT OF ME SHIPT OF ME SHIFT OF ME SHIPT OF ME SHI | F PEAK FLOM RAGE USEN 5 CROSS CUM ea) hea (ha): tal Imp(%):   | W (h                                     | (min) = a.m.) = .10                       | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area  | ME SHIFT OF XIMUM STON   | F PEAK FLOI RAGE USEI  5 CROSS CUI ea  (ha): tal Imp(%):  | W (h                                     | (min) = a.m.) = .10                       | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007  TOTAL FLOW FROM TO SITE (POST2 - Uncont  CALIB STANDHYD  05:POST2 DT= 1  Surface Area Dep. Storage   | ME SHIFT ON XIMUM STON SIDEROAD 1: trolled Arc   Arc   Arc   On   Too   Too   (ha) = (mm) =  | F PEAK FLOM RAGE USEN 5 CROSS CUI ea (ha): tal Imp(%): MPERVIOUS .18 2.00   | W (h (h) (h) (h) (h) (h) (h) (h) (h) (h) | (min) = a.m.) = .10                       | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007  TOTAL FLOW FROM TO SITE (POST2 - Uncont  CALIB STANDHYD  05:POST2 DT= 1  Surface Area Dep. Storage   | ME SHIFT OF ME SHI | F PEAK FLOM RAGE USEN  5 CROSS CUM ea)  ea (ha): tal Imp(%): MPERVIOUS .18 2.00 6.00                                  | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc        | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007  TOTAL FLOW FROM TO SITE (POST2 - Uncont  CALIB STANDHYD  05:POST2 DT= 1  Surface Area Dep. Storage   | ME SHIFT OF XIMUM STON STON STORE AND STON STONE AND STONE STONE AND STONE STONE STONE AND STONE | F PEAK FLOM RAGE USEN  5 CROSS CUM ea)  ea (ha): tal Imp(%): MPERVIOUS .18 2.00 6.00                                  | W O (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc        | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope   | ME SHIFT OF ME SHIP OF ME SHIFT OF ME SHIF | F PEAK FLOM RAGE USEN  5 CROSS CUM ea)  ea (ha): tal Imp(%): MPERVIOUS .18 2.00 6.00                                  | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc        | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont   | ME SHIFT OF MINING ME SHIFT OF MINING ME SHIFT OF MINING ME STORE ME SHIFT OF MINING ME SHIP OF ME SHIP  | F PEAK FLOMARAGE USEN  5 CROSS CUMBEA  15 Lal Imp(%):  MPERVIOUS  2.00 6.00 120.00 .013                               | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc S (i)  | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAN  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm  | ME SHIFT OF MINING ME SHIFT OF MINING ME SHORE OF MINING ME SHIFT OF MINING ME SHIP OF MINING ME SHIFT OF MINING ME SHIP OF ME SHIP O | F PEAK FLOMARAGE USEN   | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc        | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm over Storage Coeff.                    | ME SHIFT OF ME SHIP OF ME SHIFT OF ME SHIF | F PEAK FLOMARAGE USEN   | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT) Dir. Cc        | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm over Storage Coeff. Unit Hyd. Tpeak    | ME SHIFT OF MINING ME SHIFT OF MINING ME SHORE OF MINING ME SHIFT OF MINING ME SHIP OF MINING ME SHIFT OF MINING ME SHIP OF ME | F PEAK FLOMARAGE USEN  5 CROSS CUI ea (ha): tal Imp(%):  MPERVIOUS .18 2.00 6.00 120.00 .013 81.11 2.00 1.81 (i: 2.00 | W D (h                                   | (min) = a.m.) = .10                       | 7.00<br>037E+00<br>          | ED)       |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm over Storage Coeff.                    | ME SHIFT OF MINING ME SHIFT OF MINING ME SHORE OF MINING ME SHIFT OF MINING ME SHIP OF MINING ME SHIFT OF MINING ME SHIP OF ME | F PEAK FLOMARAGE USEN   | W D (h                                   | (min) = a.m.) = .10                       | 7.00<br>337E+00<br>CONTROLLE | ED)       |         |
| O003:C00007 TOTAL FLOW FROM TO SITE (POST2 - Uncont CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak | ME SHIFT OF XIMUM STON STORMAN STON STON STON STON STON STON STON STO   | F PEAK FLOW RAGE USEN USEN USEN USEN USEN USEN USEN USE   | W D (h                                   | (min) = a.m.) = .10                       | 7.00<br>37E+00<br>           | 10.50     |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm  | ME SHIFT OF MINING ME SHIFT OF MINING ME SHORE OF MINING ME SHIFT OF MINING ME SHIP OF ME SHIFT OF MINING ME SHIP OF ME SHIP | F PEAK FLOMARAGE USEN   | W D (h                                   | (min) = a.m.) = .10                       | 7.00<br>137E+00<br>          | 10.50     |         |
| TIN MAX  0003:C00007 TOTAL FLOW FROM TO S SITE (POST2 - Uncont  CALIB STANDHYD 05:POST2 DT= 1  Surface Area Dep. Storage Average Slope Length Mannings n  Max.eff.Inten.(mm  | ME SHIFT ON  XIMUM STON  SIDEROAD 1:  trolled Are    Are  (ha) = (mm) = (%) = (mm) = (min) = (min) = (min) = (cms) = (         | F PEAK FLOW RAGE USEN USEN USEN USEN USEN USEN USEN USE   | W D (h                                   | (min)= a.m.)=.10 ST1+ EXT)  Dir. Cc S (i) | 7.00<br>37E+00<br>           | 10.50     |         |

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out TOTAL RAINFALL (mm)= 72.10 72.10 72.101 .58 RUNOFF COEFFICIENT = .97 .617 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 84.0$  Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. R0003:C00002-----\*\* END OF RUN : 2 START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 0004 NSTORM= 1 # 1=25SCS24.stm R0004:C00002----\*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \* Post-Development Condition - Mansfield Ski Club R0004:C00002-----| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ Ptotal= 98.40 mm Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield, TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 0:12 .984 | 4:12 1.968 | 8:12 2.952 | 12:12 19.680 | 16:12 2.460 20:12 0:24 .984 | 4:24 1.968 | 8:24 2.952 | 12:24 12.300 | 16:24 2.460 | 20:24 0:36 .984 4:36 1.968 8:36 2.952 12:36 8.856 16:36 2.460 20:36

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| 0:48 | .984 | 4:48 | 1.968 | 8:48  | 2.952   | 12:48 | 8.364 | 16:48 | 2.460 | 20:48 |
|------|------|------|-------|-------|---------|-------|-------|-------|-------|-------|
| 1:00 | .984 | 5:00 | 1.968 | 9:00  | 2.952   | 13:00 | 5.904 | 17:00 | 1.476 | 21:00 |
| 1:12 | .984 | 5:12 | 1.968 | 9:12  | 2.952   | 13:12 | 4.920 | 17:12 | 1.476 | 21:12 |
| 1:24 | .984 | 5:24 | 1.968 | 9:24  | 2.952   | 13:24 | 4.920 | 17:24 | 1.968 | 21:24 |
| 1:36 | .984 | 5:36 | 1.968 | 9:36  | 2.952   | 13:36 | 4.920 | 17:36 | 1.476 | 21:36 |
| 1:48 | .984 | 5:48 | 1.968 | 9:48  | 2.952   | 13:48 | 4.920 | 17:48 | 1.968 | 21:48 |
| 2:00 | .984 | 6:00 | 1.968 | 10:00 | 2.952   | 14:00 | 4.920 | 18:00 | 1.476 | 22:00 |
| 2:12 | .984 | 6:12 | 1.968 | 10:12 | 5.412   | 14:12 | 2.952 | 18:12 | 1.476 | 22:12 |
| 2:24 | .984 | 6:24 | 1.968 | 10:24 | 5.412   | 14:24 | 2.952 | 18:24 | 1.476 | 22:24 |
| 2:36 | .984 | 6:36 | 1.968 | 10:36 | 5.412   | 14:36 | 2.952 | 18:36 | 1.968 | 22:36 |
| 2:48 | .984 | 6:48 | 1.968 | 10:48 | 5.412   | 14:48 | 2.952 | 18:48 | 1.476 | 22:48 |
| 3:00 | .984 | 7:00 | 1.968 | 11:00 | 5.412   | 15:00 | 2.952 | 19:00 | 1.476 | 23:00 |
| 3:12 | .984 | 7:12 | 1.968 | 11:12 | 7.380   | 15:12 | 2.460 | 19:12 | 1.968 | 23:12 |
| 3:24 | .984 | 7:24 | 1.968 | 11:24 | 10.824  | 15:24 | 2.460 | 19:24 | 1.476 | 23:24 |
| 3:36 | .984 | 7:36 | 1.968 | 11:36 | 26.076  | 15:36 | 2.460 | 19:36 | 1.968 | 23:36 |
| 3:48 | .984 | 7:48 | 1.968 | 11:48 | 54.120  | 15:48 | 2.460 | 19:48 | 1.476 | 23:48 |
| 4:00 | .984 | 8:00 | 1.968 | 12:00 | 110.700 | 16:00 | 2.460 | 20:00 | 1.968 | 24:00 |

R0004:C00003-----

\* SITE (POST1 - Controlled Area)

| <br>             |          |              |          |                |       |
|------------------|----------|--------------|----------|----------------|-------|
| CALIB STANDHYD   |          | Area (ha)    | = 2.94   |                |       |
| 01:POST1 DT= 1   | .00      | Total Imp(%) | = 69.00  | Dir. Conn.(%)= | 59.00 |
| <br>             |          |              |          |                |       |
|                  |          | IMPERVIOUS   | PERVIOUS | (i)            |       |
| Surface Area     | (ha) =   | 2.03         | .91      |                |       |
| Dep. Storage     | ( mm ) = | 2.00         | 5.00     |                |       |
| Average Slope    | (%)=     | 3.50         | 33.30    |                |       |
| Length           | (m)=     | 300.00       | 6.00     |                |       |
| Mannings n       | =        | .013         | .250     |                |       |
|                  |          |              |          |                |       |
| Max.eff.Inten.(m | m/hr)=   | 110.70       | 124.23   |                |       |
| over             | (min)    | 3.00         | 4.00     |                |       |
| Storage Coeff.   | (min)=   | 3.26 (i      | i) 4.15  | (ii)           |       |
| Unit Hyd. Tpeak  | (min)=   | 3.00         | 4.00     |                |       |
| Unit Hyd. peak   | (cms)=   | .36          | .28      |                |       |
| 1 1              |          |              |          | *TOTALS*       |       |
| PEAK FLOW        | (cms)=   | .52          | .29      | .815           | (iii) |
| TIME TO PEAK     | (hrs)=   | 12.00        | 12.00    | 12.000         |       |
| RUNOFF VOLUME    | ( mm ) = | 96.40        | 68.24    | 84.853         |       |
| TOTAL RAINFALL   | ( mm ) = | 98.40        | 98.40    | 98.399         |       |
| RUNOFF COEFFICIE | NT =     | .98          | .69      | .862           |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0004:C00004-----

K0004.C00004-----

\* EXTERNAL (Routed through SWM Facility)

8/17/2020 12:40:17 PM 13/23

R0004:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD      | Ţ     |              |        |       |        |        |       |
|--------------|-------|--------------|--------|-------|--------|--------|-------|
| 03:POST1+EXT |       | ID:NHYD      | AREA   | QPEAK | TPEAK  | R.V.   | DWF   |
|              |       |              | (ha)   | (cms) | (hrs)  | ( mm ) | (cms) |
|              | ID 1  | 01:POST1     | 2.940  | .815  | 12.000 | 84.853 | .000  |
|              | +ID 2 | 02:EXT       | 11.940 | 1.559 | 12.133 | 58.420 | .000  |
|              | ===== |              |        |       |        |        |       |
|              | SUM   | 03:POST1+EXT | 14.880 | 2.068 | 12.017 | 63.642 | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0004:C00006-----

\* SWM Facility

| ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. | IN>03:POST1+EXT |

| IN>03:POST1+EXT   |         |           |         |            |           |           |         |
|-------------------|---------|-----------|---------|------------|-----------|-----------|---------|
| OUT<04:SWM Facili | ======  |           |         | OUTLFOW ST | ORAGE TAR | BLE ===== |         |
|                   | OUTFLOW | STORAGE   | OUTFLOW | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW |
|                   | (cms)   | (ha.m.)   | (cms)   | (ha.m.)    | (cms)     | (ha.m.)   | (cms)   |
|                   | .000    | .0000E+00 | .010    | .1885E-01  | .082      | .5634E-01 | 1.421 . |
|                   | .002    | .9500E-03 | .010    | .2100E-01  | .140      | .5989E-01 | 1.571 . |
|                   | .003    | .1960E-02 | .010    | .2327E-01  | .208      | .6357E-01 | 1.732 . |
|                   | .004    | .3050E-02 | .011    | .2566E-01  | .285      | .6738E-01 | 1.906 . |
|                   | .005    | .4220E-02 | .011    | .2818E-01  | .370      | .7134E-01 | 2.095 . |
|                   | .006    | .5470E-02 | .011    | .3083E-01  | .462      | .7545E-01 | 2.299 . |
|                   | .006    | .6810E-02 | .012    | .3361E-01  | .562      | .7970E-01 | 2.520 . |
|                   | .007    | .8230E-02 | .012    | .3653E-01  | .668      | .8411E-01 | 2.758 . |
|                   | .007    | .9750E-02 | .012    | .3958E-01  | .780      | .8867E-01 | 3.015 . |
|                   | .008    | .1136E-01 | .013    | .4279E-01  | .897      | .9339E-01 | 3.291 . |
|                   | .008    | .1308E-01 | .013    | .4614E-01  | 1.020     | .9827E-01 | 3.588 . |
|                   | .009    | .1489E-01 | .013    | .4964E-01  | 1.148     | .1033E+00 | 3.904 . |
|                   | .009    | .1682E-01 | .038    | .5293E-01  | 1.282     | .1085E+00 | 4.242 . |

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| ROUTING RESULTS         | AREA   | QPEAK | TPEAK  | R.V.   |
|-------------------------|--------|-------|--------|--------|
|                         | (ha)   | (cms) | (hrs)  | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | 2.068 | 12.017 | 63.642 |
| OUTFLOW < 04:SWM Facili | 14.880 | 1.807 | 12.133 | 63.642 |

PEAK FLOW REDUCTION [Qout/Qin](%) = 87.362
TIME SHIFT OF PEAK FLOW (min) = 7.00
MAXIMUM STORAGE USED (ha.m.) = .1279E+00

R0004:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

|  | CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha) = Total Imp(%) = |          | Dir.  | Conn.(%)= | 10.50 |
|--|------------------------------------|----------------------------|----------|-------|-----------|-------|
|  |                                    | IMPERVIOUS                 | PERVIOUS | S (i) |           |       |
|  | Surface Area (ha)=                 | .18                        | .67      |       |           |       |
|  | Dep. Storage (mm)=                 | 2.00                       | 5.00     |       |           |       |
|  | Average Slope (%)=                 | 6.00                       | 11.10    |       |           |       |
|  | Length (m)=                        | 120.00                     | 50.00    |       |           |       |
|  | Mannings n =                       | .013                       | .250     |       |           |       |
|  | Max.eff.Inten.(mm/hr)=             | 110.70                     | 101.37   |       |           |       |
|  | over (min)                         | 2.00                       | 6.00     |       |           |       |
|  | Storage Coeff. (min)=              | 1.60 (ii)                  | 6.40     | (ii)  |           |       |
|  | Unit Hyd. Tpeak (min)=             | 2.00                       | 6.00     |       |           |       |
|  | Unit Hyd. peak (cms)=              | .64                        | .18      |       |           |       |
|  |                                    |                            |          |       | *TOTALS*  |       |
|  | PEAK FLOW (cms)=                   | .03                        | .16      |       | .183      | (iii) |
|  | TIME TO PEAK (hrs)=                | 12.00                      | 12.02    |       | 12.000    |       |
|  | RUNOFF VOLUME (mm)=                | 96.40                      | 64.62    |       | 67.959    |       |
|  | TOTAL RAINFALL (mm) =              | 98.40                      | 98.40    |       | 98.399    |       |
|  | RUNOFF COEFFICIENT =               | .98                        | .66      |       | .691      |       |

- (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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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

```
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = .00 hrs on 0
  METOUT= 2 (output = METRIC)
  NRUN = 0005
  NSTORM= 1
    # 1=100SCS24.stm
R0005:C00002-----
*#************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#****************************
* Post-Development Condition - Mansfield Ski Club
R0005:C00002-----
READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\
| Ptotal= 120.00 mm | Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
   TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME
                                                                 TIME
                                                           RAIN
   hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm
                                                          mm/hr|
                                                                hh:mm
    0:12 1.200
                4:12 2.400
                            8:12 3.600 12:12 24.000 16:12
                                                          3.0001
                                                                20:12
    0:24 1.200
                4:24 2.400
                            8:24 3.600 12:24 15.000 16:24
                                                          3.0001
                                                                20:24
    0:36
                4:36
                     2.400
                            8:36
                                  3.600
                                        12:36 10.800
                                                    16:36
         1.200
                                                                 20:36
    0:48
         1.200
                4:48
                     2.400
                            8:48
                                  3.600|
                                        12:48 10.200
                                                    16:48
                                                           3.000|
                                                                 20:48
    1:00 1.200
                5:00
                     2.400
                            9:00
                                  3.600
                                       13:00 7.200
                                                    17:00
                                                          1.800|
                                                                21:00
    1:12 1 200
                5:12 2 400
                            9:12 3 600 13:12 6 000 17:12 1 800
                                                                21:12
    1:24 1.200
                5:24 2.400
                           9:24 3.600 13:24
                                              6.000 | 17:24 2.400 |
                                                                21:24
    1:36 1.200|
                5:36 2.400 9:36 3.600 13:36
                                              6.000| 17:36
                                                         1.800|
    1:48 1.200|
                5:48 2.400
                           9:48 3.600 13:48
                                              6.000 | 17:48 2.400 |
                                                                21:48
                                              6.000| 18:00 1.800|
    2:00 1.200
                6:00 2.400| 10:00 3.600|
                                       14:00
                                                                22:00
    2:12 1 2001
                6:12 2 400 | 10:12 6 600 |
                                        14:12
                                              3 600 | 18:12 | 1 800 |
                                                                22:12
    2:24 1.200
                6:24 2.400
                           10:24 6.600
                                        14:24
                                              3.600
                                                    18:24
                                                          1.800
                                                                22:24
    2:36
         1.200
                6:36 2.400
                           10:36
                                  6.600
                                        14:36
                                              3.600|
                                                    18:36
                                                           2.400
                                                                 22:36
    2:48
         1.200|
                6:48 2.400
                           10:48
                                  6.600
                                        14:48
                                              3.600|
                                                    18:48
                                                          1.800|
                                                                22:48
    3:00 1.200
                7:00 2.400 11:00 6.600
                                        15:00
                                              3.600 19:00 1.800
                                                                23:00
    3:12 1.200
                7:12 2.400 11:12 9.000 15:12
                                              3.000 19:12 2.400
                                                                23:12
    3:24 1.200
                7:24 2.400 11:24 13.200 15:24 3.000 19:24 1.800
                                                                23:24
    3:36 1.200
                7:36 2.400 11:36 31.800 15:36 3.000 19:36 2.400
    3:48 1.200
                7:48 2.400 11:48 66.000 15:48 3.000 19:48 1.800
    4:00 1.200 8:00 2.400 12:00 135.000 16:00 3.000 20:00 2.400 24:00
```

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```
R0005:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD | Area (ha)= 2.94
 01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                     IMPERVIOUS PERVIOUS (i)
              (ha)=
                     2.03
   Surface Area
                                 . 91
   Dep. Storage (mm)=
                      2.00
                                  5.00
   Average Slope (%)=
                      3.50
                               33.30
                               6.00
   Length
               (m) = 300.00
                                .250
                = .013
   Mannings n
   Max.eff.Inten.(mm/hr)=
                      135.00
                                157.84
          over (min)
                       3.00
                                  4.00
   Storage Coeff. (min)=
                       3.01 (ii) 3.82 (ii)
                       3.00
   Unit Hyd. Tpeak (min) =
                                  4.00
   Unit Hyd. peak (cms)=
                        .37
                                  .29
                                           *TOTALS*
   PEAK FLOW
               (cms)=
                        .64
                                 .38
                                           1.018 (iii)
                              12.00
   TIME TO PEAK (hrs)=
                       12.00
                                           12.000
   RUNOFF VOLUME (mm)=
                       118.00
                                88.39
                                          105.863
   TOTAL RAINFALL (mm)=
                       120.00
                                120.00
                                          120.000
   RUNOFF COEFFICIENT =
                       .98
                                            .882
    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0005:C00004-----
* EXTERNAL (Routed through SWM Facility)
 CALIB NASHYD
                    Area (ha)= 11.940 Curve Number (CN)= 83.00
 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                                240
   Unit Hyd Qpeak (cms)= 1.900
   PEAK FLOW
               (cms) = 2.065 (i)
   TIME TO PEAK
              (hrs) = 12.133
   DURATION
               (hrs) = 25.667, (dddd|hh:mm:) = 1 | 01:40
   AVERAGE FLOW
               (cms)=
                      .100
   RUNOFF VOLUME
               (mm) = 77.557
   TOTAL RAINFALL (mm) = 120.000
   RUNOFF COEFFICIENT = .646
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
______
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD 03:POST1+EXT |       | ID:NHYD      | AREA     | QPEAK | TPEAK  | R.V.    | DWF   |
|----------------------|-------|--------------|----------|-------|--------|---------|-------|
| ·<br>                |       |              | (ha)     | (cms) | (hrs)  | (mm)    | (cms) |
|                      | ID 1  | 01:POST1     | 2.940    | 1.018 | 12.000 | 105.863 | .000  |
|                      | +ID 2 | 02:EXT       | 11.940   | 2.065 | 12.133 | 77.557  | .000  |
|                      | ===== |              | ======== |       |        |         |       |
|                      | SUM   | 03:POST1+EXT | 14.880   | 2.695 | 12.017 | 83.150  | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0005:C00006-----

\* SWM Facility

ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | ============ OUTLFOW STORAGE TABLE ========== ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms) .010 .1885E-01 .082 .5634E-01 | 1.421 . .000 .0000E+00| .010 .2100E-01 .140 .5989E-01 1.571 . .002 .9500E-03| .010 .2327E-01 .003 .1960E-02| .208 .6357E-01 1.732 . .004 .3050E-02 .011 .2566E-01 .285 .6738E-01| 1.906 . .005 .4220E-02| .011 .2818E-01| .370 .7134E-01 2.095 . .006 .5470E-02 .011 .3083E-01| .462 .7545E-01 2.299 . .012 .3361E-01 .562 .7970E-01 .006 .6810E-02| 2.520 . 2.758 . .007 .8230E-02| .012 .3653E-01| .668 .8411E-01| .007 .9750E-02 .012 .3958E-01 .780 .8867E-01 .008 .1136E-01 .013 .4279E-01| .897 .9339E-01 3.291 . .008 .1308E-01 .013 .4614E-01| 1.020 .9827E-01| 3.588 . .013 .4964E-01 | 1.148 .1033E+00| .009 .1489E-01| 3.904 . .009 .1682E-01| .038 .5293E-01| 1.282 .1085E+00| 4.242 .

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK  | R.V.   |
|-------------------------|--------|-------|--------|--------|
|                         | (ha)   | (cms) | (hrs)  | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | 2.695 | 12.017 | 83.150 |
| OUTFLOW < 04:SWM Facili | 14 880 | 2.389 | 12 133 | 83 150 |

PEAK FLOW REDUCTION [Qout/Qin](%) = 88.660
TIME SHIFT OF PEAK FLOW (min) = 7.00
MAXIMUM STORAGE USED (ha.m.) = .1463E+00

R0005:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

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```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\24-hour_SCS\2-CYRSCS.out
        Surface Area
                       (ha) =
                                 .18
                                            .67
        Dep. Storage
                                2 00
                                           5 00
                       ( mm ) =
                                6.00
                                          11.10
        Average Slope
                       (%)=
         Length
                       (m) =
                               120.00
                                          50.00
         Mannings n
                                .013
                                           .250
                               135.00
                                          130 11
         Max.eff.Inten.(mm/hr)=
                 over (min)
                               1 00
                                           6 00
        Storage Coeff. (min)=
                                1.48 (ii)
                                           5.82 (ii)
        Unit Hyd. Tpeak (min)=
                                1.00
                                           6.00
        Unit Hyd. peak (cms)=
                                 .84
                                            .19
                                                     *TOTALS*
                                 .03
                                           .21
                                                        .240 (iii)
         PEAK FLOW
                     (cms)=
                                                      12.000
         TIME TO PEAK
                     (hrs)=
                               12.00
                                          12.02
         RUNOFF VOLUME
                      ( mm ) =
                               117.97
                                          84.40
                                                      87.927
         TOTAL RAINFALL
                      (mm) =
                               120.00
                                          120.00
                                                     120.000
        RUNOFF COEFFICIENT =
                                           .70
                                                       .733
                                 .98
          (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN^* = 84.0 Ia = Dep. Storage (Above)
         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
         (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
    R0005:C00002-----
    R0005:C00002-----
      ** END OF RUN : 4
                  | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      START
      ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
        TZERO = .00 hrs on
        METOUT= 2 (output = METRIC)
       NRIIN = 0.006
       NSTORM= 1
             # 1=12regtim.o89
    *#*********************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
```

\*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] \*# Company : WMI & Associates Ltd. \*# License # : 2880720 \* Post-Development Condition - Mansfield Ski Club | READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ Ptotal= 193.00 mm | Comments: TIMMINS REGIONAL STORM (12-hour) TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 3:00 10.000| 7:00 43.000| 9:00 23.000| 11:00 1:00 15.000 5:00 5.000 2:00 20.000| 4:00 3.000 6:00 20.000 8:00 20.000 10:00 13.000 12:00 R0006:C00003-----\* SITE (POST1 - Controlled Area) \_\_\_\_\_ CALIB STANDHYD 2.94 Area (ha)= 01:POST1 DT= 1.00 Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00 IMPERVIOUS PERVIOUS (i) (ha)= 2.03 Surface Area . 91 Dep. Storage ( mm ) = 2 00 5.00 Average Slope ( % ) = 3.50 33.30 Length (m) =300.00 6.00 Mannings n .013 250 Max.eff.Inten.(mm/hr)= 43.00 53.33 over (min) 5.00 6.00 Storage Coeff. (min)= 4.75 (ii) 6.00 (ii) Unit Hyd. Tpeak (min) = 5.00 6.00 Unit Hyd. peak (cms)= 19 23 \*TOTALS\* PEAK FLOW (cms)= .13 .342 (iii) TIME TO PEAK (hrs)= 7.00 7.00 7 000 158.56 RUNOFF VOLUME (mm) =191.00 177 702 193.00 193.00 193.000 TOTAL RAINFALL (mm) = RUNOFF COEFFICIENT = 921 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. R0006:C00004-----\* EXTERNAL (Routed through SWM Facility)

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\24-hour\_SCS\2-CYRSCS.out

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```
CALIB NASHYD | Area (ha)= 11.940 Curve Number (CN)= 83.00
02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                                   .240
   Unit Hyd Qpeak (cms)= 1.900
   DEAK FLOW
               (cms)= 1.239 (i)
   TIME TO PEAK (hrs)= 7.017
   DURATION
               (hrs) = 13.667, (dddd|hh:mm:) = 0 | 13:40
   AVERAGE FLOW (cms)=
                      .353
   RUNOFF VOLUME (mm) = 145.537
   TOTAL RAINFALL (mm) = 193.000
   RUNOFF COEFFICIENT = .754
```

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

```
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ADD HYD
               ID:NHYD
                               AREA QPEAK TPEAK
 03:POST1+EXT
                                                       R V
                                                               DWF
                                  (ha)
                                        (cms) (hrs)
                                                        (mm) (cms)
                                2.940
                                                               .000
```

ID 1 01:POST1 .342 7.000 177.702 11.940 1.239 7.017 145.537 +ID 2 02:EXT .000 \_\_\_\_\_\_ SUM 03:POST1+EXT 14.880 1.579 7.000 151.893 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0006:C00006-----

\* SWM Facility

ROUTE RESERVOIR -> | Requested routing time step = 1.0 min.

| IN>03  | :POST1+EXT | _       |           | _       | _          |           |           |          |   |
|--------|------------|---------|-----------|---------|------------|-----------|-----------|----------|---|
| OUT<04 | SWM Facili |         |           |         | OUTLFOW ST | ORAGE TAR | BLE ===== | ======== | = |
|        |            | OUTFLOW | STORAGE   | OUTFLOW | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW  |   |
|        |            | (cms)   | (ha.m.)   | (cms)   | (ha.m.)    | (cms)     | (ha.m.)   | (cms)    |   |
|        |            | .000    | .0000E+00 | .010    | .1885E-01  | .082      | .5634E-01 | 1.421 .  |   |
|        |            | .002    | .9500E-03 | .010    | .2100E-01  | .140      | .5989E-01 | 1.571 .  |   |
|        |            | .003    | .1960E-02 | .010    | .2327E-01  | .208      | .6357E-01 | 1.732 .  |   |
|        |            | .004    | .3050E-02 | .011    | .2566E-01  | .285      | .6738E-01 | 1.906 .  |   |
|        |            | .005    | .4220E-02 | .011    | .2818E-01  | .370      | .7134E-01 | 2.095 .  |   |
|        |            | .006    | .5470E-02 | .011    | .3083E-01  | .462      | .7545E-01 | 2.299 .  |   |
|        |            | .006    | .6810E-02 | .012    | .3361E-01  | .562      | .7970E-01 | 2.520 .  |   |
|        |            | .007    | .8230E-02 | .012    | .3653E-01  | .668      | .8411E-01 | 2.758 .  |   |
|        |            | .007    | .9750E-02 | .012    | .3958E-01  | .780      | .8867E-01 | 3.015 .  |   |
|        |            | .008    | .1136E-01 | .013    | .4279E-01  | .897      | .9339E-01 | 3.291 .  |   |
|        |            | .008    | .1308E-01 | .013    | .4614E-01  | 1.020     | .9827E-01 | 3.588 .  |   |
|        |            | .009    | .1489E-01 | .013    | .4964E-01  | 1.148     | .1033E+00 | 3.904 .  |   |
|        |            | .009    | .1682E-01 | .038    | .5293E-01  | 1.282     | .1085E+00 | 4.242 .  |   |
|        |            |         |           |         |            |           |           |          |   |

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| ROUTING RESULTS         | AREA   | QPEAK | TPEAK | R.V.    |
|-------------------------|--------|-------|-------|---------|
|                         | (ha)   | (cms) | (hrs) | ( mm )  |
| INFLOW > 03:POST1+EXT   | 14.880 | 1.579 | 7.000 | 151.893 |
| OUTFLOW < 04:SWM Facili | 14.880 | 1.561 | 7.033 | 151.892 |

PEAK FLOW REDUCTION [Qout/Qin](%)= 98.865 TIME SHIFT OF PEAK FLOW (min) = 2.00 MAXIMUM STORAGE USED (ha.m.) = .1192E + 00

- R0006:C00007-----\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
- \* SITE (POST2 Uncontrolled Area)

| CALIB STANDHYD 05:POST2 DT= 1 |          |           | na)= .85<br>(%)= 21.00 | Dir. | Conn.(%)= | : 10.50 |
|-------------------------------|----------|-----------|------------------------|------|-----------|---------|
|                               |          | IMPERVIOU | JS PERVIOUS            | (i)  |           |         |
| Surface Area                  | (ha) =   | .18       | .67                    |      |           |         |
| Dep. Storage                  | ( mm ) = | 2.00      | 5.00                   |      |           |         |
| Average Slope                 | (%)=     | 6.00      | 11.10                  |      |           |         |
| Length                        | ( m ) =  | 120.00    | 50.00                  |      |           |         |
| Mannings n                    | =        | .013      | .250                   |      |           |         |
|                               |          |           |                        |      |           |         |
| Max.eff.Inten.(               |          |           |                        |      |           |         |
| over                          | (min)    | 2.00      | 9.00                   |      |           |         |
| Storage Coeff.                | (min)=   | 2.33      | (ii) 8.99              | (ii) |           |         |
| Unit Hyd. Tpeak               | (min) =  | 2.00      | 9.00                   |      |           |         |
| Unit Hyd. peak                | (cms)=   | .50       | .13                    |      |           |         |
|                               |          |           |                        |      | *TOTALS*  |         |
| PEAK FLOW                     | (cms)=   | .01       | .08                    |      | .094      | (iii)   |
| TIME TO PEAK                  | (hrs)=   | 6.92      | 7.00                   |      | 7.000     |         |
| RUNOFF VOLUME                 | ( mm ) = | 191.00    | 153.77                 |      | 157.677   |         |
| TOTAL RAINFALL                | ( mm ) = | 193.00    | 193.00                 |      | 193.000   |         |
| RUNOFF COEFFICIA              | ENT =    | .99       | .80                    |      | .817      |         |
|                               |          |           |                        |      |           |         |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0006:C00008-----R0006:C00002-----R0006:C00002-----R0006:C00002-----

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| erver\Data\Projects\2015\15-319\De | sign\Storm\Issue_No1\SWMHYMO\PR\24-hour_SCS\2-CYRSC |
|------------------------------------|---|
| R0006:C00002                       |   |
| FINISH                             |   |
| *****                              | ***************************************             |
| WARNINGS / ERRORS / NOTES          |   |
| Simulation ended on 2020-04-28     | at 12:03:03   |

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| Post-Development Condition 12-hour SCS Type-II Storm Distribution |
|---|
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |

```
Metric units
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#*****************
* Post-Development Condition - Mansfield Ski Club
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
            TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
* %
               ["25mm4hr.stm"] <--storm filename
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8------
* SITE (POST1 - Controlled Area)
            ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.94](ha),
CALIB STANDHYD
              XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[84],
              Pervious surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                              LGP=[6](m), MNP=[0.25], SCP=[0](min),
              Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[300](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*&-----
* EXTERNAL (Routed through SWM Facility)
              ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*%------
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
ADD HYD
*%------
* SWM Facility
ROUTE RESERVOIR
              IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                  TABLE of ( OUTFLOW-STORAGE ) values
                         (cms) - (ha-m)
                        [ 0.000 , 0.00000 ]
                        [0.0015 , 0.00095]
                        [0.0031 , 0.00196]
                        [0.0041 , 0.00305]
                        [0.0050 , 0.00422]
                        [0.0057 , 0.00547]
                        [0.0063 , 0.00681]
                        [0.0069 , 0.00823]
                        [0.0074 . 0.00975]
                        [0.0079 , 0.01136]
                        [0.0084 , 0.01308]
                        [0.0088 , 0.01489]
                        [0.0092 , 0.01682]
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\12-hour\_SCS\2-CYRSCS.dat

```
[0.0096 , 0.01885]
                              [0.0100 , 0.02100]
                              [0.0104 , 0.02327]
                              [0.0108 , 0.02566]
                              [0.0111 , 0.02818]
                              [0.0114 , 0.03083]
                              [0.0118 , 0.03361]
                              [0.0121 , 0.03653]
                              [0.0124 , 0.03958]
                              [0.0127 , 0.04279]
                              [0.0130 , 0.04614]
                              [0.0133 , 0.04964]
                              [0.0377 , 0.05293]
                              [0.0822 , 0.05634]
                              [0.1396 , 0.05989]
                              [0.2076 , 0.06357]
                              [0.2847 , 0.06738]
                              [0.3698 , 0.07134]
                              [0.4624 , 0.07545]
                              [0.5619 , 0.07970]
                              [0.6677 , 0.08411]
                              [0.7796 , 0.08867]
                              [0.8972 , 0.09339]
                              [1.0202 , 0.09827]
                              [1.1485 , 0.10332]
                              [1.2819 , 0.10854]
                              [1.4214 , 0.11394]
                              [1.5706 , 0.11951]
                              [1.7315 , 0.12526]
                              [1.9058 , 0.13120]
                              [2.0945 , 0.13732]
                              [2.2989 , 0.14363]
                              [2.5199 , 0.15014]
                              [2.7584 . 0.15655]
                              [3.0154 , 0.16308]
                              [3.2914 , 0.16974]
                              [3.5875 , 0.17653]
                              [3.9042 , 0.18344]
                              [4.2422 , 0.19049]
                              [ -1 , -1 ] (maximum one hundred pairs of points)
                              IDovf=[ ], NHYDovf=[" "],
*&_____|____
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
* SITE (POST2 - Uncontrolled Area)
                  ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.85](ha),
                  XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[84].
                  Pervious surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                     LGP=[50](m), MNP=[0.25], SCP=[0](min),
                  Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                     LGI=[120](m), MNI=[0.013], SCI=[0](min),
                  RAINFALL=[ , , , , ](mm/hr) , END=-1
```

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\*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2] ["2SCS12.stm"] <--storm filename \*8------\*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3] START ["5SCS12.stm"] <--storm filename \*% \*8-----\*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] ["25SCS12.stm"] <--storm filename \*8------\*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr) START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5] ["100SCS12.stm"] <--storm filename \*\*-----\*% Timmins Regional Storm (12-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[6] START ["12reqtim.o89"] <--storm filename

FINISH

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\12-hour\_SCS\2-CYRSCS.dat

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\12-hour\_SCS\2-CYRSCS.dat

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out \_\_\_\_\_\_ SSSSS W W M M H H Y Y M M 000 222 000 11 77777 == S WWW MM MM H H YY MM MM 0 0 2. 0 0 11 7 7 ннннн Y M M M 2 0 0 11 SSSSS W W W M M M 0 0 7 ww M M н н Y M M O O 222 0 0 11 S 7 == SSSSS м н н 000 0 11 Y M M 2 Λ 0 0 11 7 # 2 StormWater Management HYdrologic Model 222 000 11 7 == \* \*\*\*\*\*\*\* A single event and continuous hydrologic simulation model \*\*\*\*\*\*\*\* \*\*\*\*\*\*\* based on the principles of HYMO and its successors OTTHYMO-83 and OTTHYMO-89. \* \*\*\*\*\*\*\*\*\*\*\*\* Distributed by: J.F. Sabourin and Associates Inc. Ottawa, Ontario: (613) 836-3884 Gatineau, Quebec: (819) 243-6858 \*\*\*\*\*\* +++++++++ E-Mail: swmhvmo@ifsa.com \* Barrie SERIAL#:2880720 \*\*\*\*\* ++++++ PROGRAM ARRAY DIMENSIONS ++++++ \*\*\*\*\*\*\*\*\*\*\* Maximum value for ID numbers : 11 +++++++++++++++ Max. number of rainfall points: 105408 +++++++++ Max. number of flow points : 105408 \* \* DETAILED OUTPUT \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* \*\*\*\*\* \* \* Input file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\6-hour\_SCS\2-CYRSCS.dat \* Output file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\6-hour SCS\2-CYRSCS out \* Summary file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\6-hour\_SCS\2-CYRSCS.sum \* User comments: \* 1:\_\_ \* 2:\_ \* 3:\_ \*

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\*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \*#\* \* Post-Development Condition - Mansfield Ski Club | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\ TZERO = .00 hrs on METOUT= 2 (output = METRIC) NRUN = 0001 NSTORM= 1 # 1=25mm4hr.stm READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON. TIME RAIN TIME RATN TIME RATN TIME RATN TIME RATN TIME hh:mm mm/hr hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 1:30 13.830 0:10 1.970 0:50 3.820 2:10 4.080 2:50 2.650 3:30 1:00 5.380 1:40 8.070 3:00 2.450 3:40 0:20 2.220 2:20 3.570 0:30 2.550 1:10 10.940 1:50 5.950 2:30 3.190 3:10 2.290 3:50 0:40 3.030 1:20 56.670 2:00 4.810 2:40 2.890 3:20 2.150 R0001:C00003-----\* SITE (POST1 - Controlled Area) CALIB STANDHYD (ha)= 2.94 Area | 01:POST1 | DT= 1.00 | Total Imp(%) = 69.00 Dir. Conn.(%) = 59.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 2.03 .91 Dep. Storage (mm) =2 00 5 00 3 50 33 30 Average Slope (%)= 300.00 6.00 Length (m) =Mannings n 013 250 Max.eff.Inten.(mm/hr)= 56.67 23 86 over (min) 4 00 6 00 Storage Coeff. (min)= 4.26 (ii) 5.98 (ii) Unit Hvd. Tpeak (min)= 6.00 4.00 Unit Hyd. peak (cms)= \*TOTALS\* PEAK FLOW (cms)= 2.4 0.4 .274 (iii) TIME TO PEAK (hrs)= 1.33 1.40 1.350

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```
RUNOFF VOLUME (mm) = 23.01 7.79 16.768
TOTAL RAINFALL (mm) = 25.01 25.01 25.005
RUNOFF COEFFICIENT = .92 .31 .671
```

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0001:C00004-----

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD |          | Area   | (ha)=    | 11.940 | Curve Number (CN) = 83 | 3.00 |
|--------------|----------|--------|----------|--------|------------------------|------|
| 02:EXT       | DT= 1.00 | Ia     | ( mm ) = | 6.800  | # of Linear Res.(N)=   | 3.00 |
|              |          | U.H. T | 'p(hrs)= | .240   |                        |      |

Unit Hyd Qpeak (cms)= 1.900

PEAK FLOW (cms) = .115 (i)

TIME TO PEAK (hrs)= 1.650

DURATION (hrs) = 5.667, (dddd|hh:mm:) = 0|05:40 AVERAGE FLOW (cms) = .028

RUNOFF VOLUME (mm) = 4.719
TOTAL RAINFALL (mm) = 25.005

RUNOFF COEFFICIENT = .189

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

R0001:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD<br>  03:POST1+EXT |       | ID:NHYD      | AREA   | QPEAK | TPEAK | R.V.   | DWF   |  |
|---------------------------|-------|--------------|--------|-------|-------|--------|-------|--|
| ·<br>                     |       |              | (ha)   | (cms) | (hrs) | ( mm ) | (cms) |  |
|                           | ID 1  | 01:POST1     | 2.940  | .274  | 1.350 | 16.768 | .000  |  |
|                           | +ID 2 | 02:EXT       | 11.940 | .115  | 1.650 | 4.719  | .000  |  |
|                           | ===== |              |        |       |       |        |       |  |
|                           | SUM   | 03:POST1+EXT | 14.880 | .300  | 1.367 | 7.100  | .000  |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0001:C00006-----

\* SWM Facility

| ROUTE RESERVOIR -> | Reque   | sted routi | ng time s | step = 1.0 | min.      |           |         |    |
|--------------------|---------|------------|-----------|------------|-----------|-----------|---------|----|
| IN>03:POST1+EXT    |         |            |           |            |           |           |         |    |
| OUT<04:SWM Facili  |         |            | ======    | OUTLFOW ST | ORAGE TAR | BLE ===== |         | == |
|                    | OUTFLOW | STORAGE    | OUTFLOW   | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW |    |
|                    | (cms)   | (ha.m.)    | (cms)     | (ha.m.)    | (cms)     | (ha.m.)   | (cms)   |    |
|                    | .000    | .0000E+00  | .010      | .1885E-01  | .082      | .5634E-01 | 1.421   |    |

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| .002 | .9500E-03 | .010 | .2100E-01 | .140  | .5989E-01 | 1.571 |  |
|------|-----------|------|-----------|-------|-----------|-------|--|
| .003 | .1960E-02 | .010 | .2327E-01 | .208  | .6357E-01 | 1.732 |  |
| .004 | .3050E-02 | .011 | .2566E-01 | .285  | .6738E-01 | 1.906 |  |
| .005 | .4220E-02 | .011 | .2818E-01 | .370  | .7134E-01 | 2.095 |  |
| .006 | .5470E-02 | .011 | .3083E-01 | .462  | .7545E-01 | 2.299 |  |
| .006 | .6810E-02 | .012 | .3361E-01 | .562  | .7970E-01 | 2.520 |  |
| .007 | .8230E-02 | .012 | .3653E-01 | .668  | .8411E-01 | 2.758 |  |
| .007 | .9750E-02 | .012 | .3958E-01 | .780  | .8867E-01 | 3.015 |  |
| .008 | .1136E-01 | .013 | .4279E-01 | .897  | .9339E-01 | 3.291 |  |
| .008 | .1308E-01 | .013 | .4614E-01 | 1.020 | .9827E-01 | 3.588 |  |
| .009 | .1489E-01 | .013 | .4964E-01 | 1.148 | .1033E+00 | 3.904 |  |
| .009 | .1682E-01 | .038 | .5293E-01 | 1.282 | .1085E+00 | 4.242 |  |
|      |           |      |           |       |           |       |  |

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK | R.V.   |
|-------------------------|--------|-------|-------|--------|
|                         | (ha)   | (cms) | (hrs) | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | .300  | 1.367 | 7.100  |
| OUTFLOW < 04:SWM Facili | 14.880 | .083  | 2.300 | 7.100  |

PEAK FLOW REDUCTION [Qout/Qin](%) = 27.688

TIME SHIFT OF PEAK FLOW (min) = 56.00

MAXIMUM STORAGE USED (ha.m.) = .5640E-01

01:C00007----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

\_\_\_\_\_

|  | CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha)=<br>Total Imp(%)= |              | Conn.(%)= 10.50 |  |
|--|------------------------------------|-----------------------------|--------------|-----------------|--|
|  |                                    | IMPERVIOUS                  | PERVIOUS (i) |                 |  |
|  | Surface Area (ha)=                 |                             | ,            |                 |  |
|  | Dep. Storage (mm)=                 | 2.00                        | 5.00         |                 |  |
|  | Average Slope (%)=                 |                             |              |                 |  |
|  | Length (m)=                        | 120.00                      | 50.00        |                 |  |
|  | Mannings n =                       | .013                        | .250         |                 |  |
|  | Max.eff.Inten.(mm/hr)=             | 56.67                       | 11.01        |                 |  |
|  | over (min)                         | 2.00                        | 14.00        |                 |  |
|  | Storage Coeff. (min)=              | 2.09 (ii)                   | 13.75 (ii)   |                 |  |
|  | Unit Hyd. Tpeak (min)=             | 2.00                        | 14.00        |                 |  |
|  | Unit Hyd. peak (cms)=              | .54                         | .08          |                 |  |
|  |                                    |                             |              | *TOTALS*        |  |
|  | PEAK FLOW (cms)=                   | .01                         | .01          | .017 (iii)      |  |
|  | TIME TO PEAK (hrs)=                | 1.33                        | 1.55         | 1.333           |  |
|  | RUNOFF VOLUME (mm)=                | 23.00                       | 6.70         | 8.411           |  |
|  | TOTAL RAINFALL (mm)=               | 25.01                       | 25.01        | 25.005          |  |
|  | RUNOFF COEFFICIENT =               | .92                         | .27          | .336            |  |
|  |                                    |                             |              |                 |  |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out
    R0001:C00008-----
     ** END OF RUN : 0
    *****************************
    START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      TZERO = .00 hrs on
      METOUT= 2 (output = METRIC)
      NRUN = 0002
      NSTORM= 1
         # 1=2SCS6.stm
    *#***************************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
    *# Date
              : 07-31-2017
    *# Modeller : [J. Lightheart]
    *# Company
              : WMI & Associates Ltd.
    *# License # : 2880720
    *#****************************
    * Post-Development Condition - Mansfield Ski Club
    R0002:C00002-----
     READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
     Ptotal= 36.00 mm | Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
        TIME RAIN TIME
                       RAIN TIME
                                   RAIN! TIME
                                              RATN
                                                   TIME
                                                        RATN
                                                              TIME
       hh:mm mm/hr | hh:mm
        0:30 1.440 1:30 2.880
                             2:30 5.040
                                        3:30
                                             9.360
        1:00 1.440 2:00 2.880 3:00 36.720
                                        4:00 4.320 5:00 2.160 6:00
    R0002:C00003-----
    * SITE (POST1 - Controlled Area)
     CALIB STANDHYD | Area (ha)= 2.94
     01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                        IMPERVIOUS PERVIOUS (i)
       Surface Area
                 (ha)=
                        2.03
                                   .91
                                    5 00
       Dep. Storage (mm)=
                           2 00
       Average Slope
                  (%)=
                           3 50
                                   33.30
```

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| Length           | (m)=     | 300.00 | 6.00      |          |       |
|------------------|----------|--------|-----------|----------|-------|
| Mannings n       | =        | .013   | .250      |          |       |
|                  |          |        |           |          |       |
| Max.eff.Inten.(  | mm/hr)=  | 36.72  | 27.71     |          |       |
| over             | (min)    | 5.00   | 7.00      |          |       |
| Storage Coeff.   | (min) =  | 5.06   | (ii) 6.69 | (ii)     |       |
| Unit Hyd. Tpeak  | (min) =  | 5.00   | 7.00      |          |       |
| Unit Hyd. peak   | (cms)=   | .22    | .17       |          |       |
|                  |          |        |           | *TOTALS* |       |
| PEAK FLOW        | (cms)=   | .18    | .06       | .237     | (iii) |
| TIME TO PEAK     | (hrs)=   | 3.00   | 3.02      | 3.000    |       |
| RUNOFF VOLUME    | ( mm ) = | 34.00  | 15.09     | 26.246   |       |
| TOTAL RAINFALL   | (mm) =   | 36.00  | 36.00     | 36.000   |       |
| RUNOFF COEFFICIA | ENT =    | .94    | .42       | .729     |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 84.0$  Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0002:C00004-----

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASH | YD       | Area | (ha)=    | 11.940 | Curve Number (CN)=   | 83.00 |
|------------|----------|------|----------|--------|----------------------|-------|
| 02:EXT     | DT= 1.00 | Ia   | ( mm ) = | 6.800  | # of Linear Res.(N)= | 3.00  |
|            |          | U.H. | Tp(hrs)= | .240   |                      |       |
|            |          |      |          |        |                      |       |

Unit Hyd Qpeak (cms)= 1.900

PEAK FLOW (cms)= .310 (i) TIME TO PEAK (hrs)= 3.150 DURATION (hrs) = 7.667, (dddd|hh:mm:) = 0 | 07:40 AVERAGE FLOW (cms)= .045

RUNOFF VOLUME (mm) = 10.497TOTAL RAINFALL (mm) = 36.000 RUNOFF COEFFICIENT = .292

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

R0002:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

ADD HYD ID:NHYD 03:POST1+EXT AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) .237 3.000 ID 1 01:POST1 2.940 26.246 .000 +ID 2 02:EXT 11.940 .310 3.150 10.497 .000 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 .497 3.050 13.609 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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R0002:C00006-----\* SWM Facility ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | ============= OUTLFOW STORAGE TABLE ========== ------OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | .000 .0000E+00| .010 .1885E-01 .082 .5634E-01 1.421 . .010 .2100E-01 .002 .9500E-03| .140 .5989E-01 1.571 . .010 .2327E-01 .003 .1960E-02 .208 .6357E-01 1.732 . .011 .2566E-01 .004 .3050E-02| .285 .6738E-01| 1.906 . .005 .4220E-02| .011 .2818E-01| .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01| .462 .7545E-01 2.299 . .006 .6810E-02| .012 .3361E-01| .562 .7970E-01 2.520 . .007 .8230E-02 .012 .3653E-01 .668 .8411E-01| 2.758 . .007 .9750E-02 .012 .3958E-01 .780 .8867E-01| 3.015 . .008 .1136E-01| .013 .4279E-01 .897 .9339E-01| 3.291 . 3.588 . .008 .1308E-01| .013 .4614E-01 | 1.020 .9827E-01| .013 .4964E-01 1.148 .1033E+00 3.904 . .009 .1489E-01| .009 .1682E-01| .038 .5293E-01 | 1.282 .1085E+00 | 4.242 . ROUTING RESULTS AREA OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW > 03:POST1+EXT 14.880 .497 3.050 13.609 OUTFLOW < 04:SWM Facili 14.880 . 344 3.300 13.609 PEAK FLOW REDUCTION [Qout/Qin](%)= 69.259 TIME SHIFT OF PEAK FLOW (min) = 15.00 MAXIMUM STORAGE USED (ha.m.) = .7016E-01\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED) \* SITE (POST2 - Uncontrolled Area) CALIB STANDHYD Area (ha)= .85 05:POST2 DT= 1.00 | Total Imp(%)= 21.00 Dir. Conn.(%)= 10.50 IMPERVIOUS PERVIOUS (i) .18 Surface Area (ha)= 67 Dep. Storage ( mm ) = 2 00 5 00 Average Slope (%)= 6.00 11.10 Length (m) =120.00 50.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 36.72 20 32 over (min) 2.00 12.00 Storage Coeff. (min)= 2.49 (ii) 11.61 (ii) Unit Hvd. Tpeak (min) = 2.00 12 00 Unit Hyd. peak (cms)= 48 1.0

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\6-hour\_SCS\2-CYRSCS.out

```
*TOTALS*
   PEAK FLOW
                         0.1
                                   .03
                                             .035 (iii)
               (cms)=
                         2.77
   TIME TO PEAK
               (hrs)=
                                  3.08
                                             3.000
   RUNOFF VOLUME
               ( mm ) =
                        34.00
                                  13.43
                                            15.590
                        36.00
                                  36.00
                                            36.000
   TOTAL RAINFALL (mm) =
   RUNOFF COEFFICIENT =
                        .94
                                  .37
                                             .433
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN^* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
 ** END OF RUN : 1
*****************************
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = 00 hrs on
                      0
  METOUT= 2 (output = METRIC)
  NRUN = 0003
  NSTORM= 1
      # 1=5SCS6.stm
R0003:C00002----
*#**************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
          : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#************************
* Post-Development Condition - Mansfield Ski Club
R0003:C00002-----
| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
| Ptotal= 47.50 mm | Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
    TIME RAIN TIME
                     RAIN
                           TIME
                                 RAIN
                                       TIME
                                             RAIN
                                                   TIME
                                                         RAIN
                                                               TIME
   hh:mm mm/hr| hh:mm mm/hr|
                          hh:mm mm/hr| hh:mm mm/hr| hh:mm
                                                         mm/hr|
                                                               hh:mm
                    3.800
        1.900
               1:30
                           2:30
                                 6.650
                                       3:30 12.350
                                                   4:30
                                                         3.800
                                                                5:30
```

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1:00 1.900| 2:00 3.800| 3:00 48.450| 4:00 5.700| 5:00 2.850| 6:00

R0003:C00003-----

\* SITE (POST1 - Controlled Area)

| CALIB STANDHYD    |          | Area (ha)=    | 2.94     |      |           |       |
|-------------------|----------|---------------|----------|------|-----------|-------|
| 01:POST1 DT= 1.   | 00       | Total Imp(%)= | 69.00    | Dir. | Conn.(%)= | 59.00 |
|                   |          |               |          |      |           |       |
|                   |          | IMPERVIOUS    | PERVIOUS | (i)  |           |       |
| Surface Area      | (ha)=    | 2.03          | .91      |      |           |       |
| Dep. Storage      | ( mm ) = | 2.00          | 5.00     |      |           |       |
| Average Slope     | (%)=     | 3.50          | 33.30    |      |           |       |
| Length            | (m)=     | 300.00        | 6.00     |      |           |       |
| Mannings n        | =        | .013          | .250     |      |           |       |
|                   |          |               |          |      |           |       |
| Max.eff.Inten.(mm | n/hr)=   | 48.45         | 42.87    |      |           |       |
| over (            | min)     | 5.00          | 6.00     |      |           |       |
| Storage Coeff. (  | min)=    | 4.53 (ii)     | 5.90     | (ii) |           |       |
| Unit Hyd. Tpeak ( | min)=    | 5.00          | 6.00     |      |           |       |
| Unit Hyd. peak (  | cms)=    | .24           | .19      |      |           |       |
|                   |          |               |          |      | *TOTALS*  |       |
| PEAK FLOW (       | cms)=    | .23           | .10      |      | .331      | (iii) |
| TIME TO PEAK (    | hrs)=    | 3.00          | 3.02     |      | 3.000     |       |
| RUNOFF VOLUME     | ( mm ) = | 45.50         | 23.80    |      | 36.604    |       |
| TOTAL RAINFALL    | ( mm ) = | 47.50         | 47.50    |      | 47.500    |       |
| RUNOFF COEFFICIEN | TT =     | .96           | .50      |      | .771      |       |
|                   |          |               |          |      |           |       |

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

20002-200004

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD 02:EXT DT=   | 1.00             |                | (ha)=<br>(mm)=<br>nrs)= | 11.940<br>6.800<br>.240 | Curve Number (CN) = 83.00<br># of Linear Res.(N) = 3.00 |
|---------------------------|------------------|----------------|-------------------------|-------------------------|---|
| Unit Hyd Qpeak            | (cms)=           | 1.900          |                         |                         |   |
| PEAK FLOW<br>TIME TO PEAK | (cms)=<br>(hrs)= | .547<br>3.133  | (i)                     |                         |   |
| DURATION<br>AVERAGE FLOW  | (hrs)=<br>(cms)= | 7.667,<br>.077 | (dddd                   | hh:mm:)=                | 0   07:40   |
| RUNOFF VOLUME             | ( mm ) =         | 17.865         |                         |                         |   |
| TOTAL RAINFALL            | ( mm ) =         | 47.500         |                         |                         |   |
| RUNOFF COEFFICI           | ENT =            | .376           |                         |                         |   |

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

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out

R0003:C00005-----\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT) ID:NHYD 03:POST1+EXT AREA OPEAK TPEAK R.V. DWF \_\_\_\_\_ (ha) (cms) (hrs) (mm) (cms) .331 3.000 TD 1 01:POST1 000 2 940 36 604 +ID 2 02:EXT 11.940 .547 3.133 17.865 .000 \_\_\_\_\_\_ SUM 03:POST1+EXT 14.880 .811 3.033 21.567 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. \* SWM Facility -----| ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. IN>03:POST1+EXT OUT<04:SWM Facili | ============= OUTLFOW STORAGE TABLE =========== ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | (cms) .000 .0000E+00| .010 .1885E-01| .082 .5634E-01 1.421 . .002 .9500E-03 .010 .2100E-01| .140 .5989E-01| 1.571 . .003 .1960E-02| .010 .2327E-01 .208 .6357E-01 1.732 . .004 .3050E-02| .011 .2566E-01| .285 .6738E-01 1.906 . .011 .2818E-01 .005 .4220E-02| .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01| .462 .7545E-01| 2.299 . .006 .6810E-02 .012 .3361E-01 .562 .7970E-01 2.520 . .007 .8230E-02 .012 .3653E-01| .668 .8411E-01| 2.758 . .780 .8867E-01 3.015 . .007 .9750E-02| .012 .3958E-01| .013 .4279E-01| .008 .1136E-01| .897 .9339E-01 3.291 . .008 .1308E-01| .013 .4614E-01| 1.020 .9827E-01| 3.588 . .009 .1489E-01 .013 .4964E-01 1.148 .1033E+00 3.904 . .009 .1682E-01 .038 .5293E-01| 1.282 .1085E+00| 4.242 . ROUTING RESULTS AREA OPEAK TPEAK R.V. -----(ha) (cms) (hrs) ( mm ) INFLOW > 03:POST1+EXT 14.880 3.033 21.567 OUTFLOW < 04:SWM Facili 14.880 .665 3.183 21.567 PEAK FLOW REDUCTION [Qout/Qin](%)= 82.021 TIME SHIFT OF PEAK FLOW (min) = 9.00MAXIMUM STORAGE USED (ha.m.) = .8400E-01\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED) \* SITE (POST2 - Uncontrolled Area) | CALIB STANDHYD | Area (ha)= .85

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| 05:POST2 | DT= 1.00 | Total Imp(%)= 21.00 Dir. Conn.(%)= 10.50

| <br>             |          |            |             |            |
|------------------|----------|------------|-------------|------------|
|                  |          | IMPERVIOUS | PERVIOUS (i | .)         |
| Surface Area     | (ha)=    | .18        | .67         |            |
| Dep. Storage     | ( mm ) = | 2.00       | 5.00        |            |
| Average Slope    | (%)=     | 6.00       | 11.10       |            |
| Length           | (m)=     | 120.00     | 50.00       |            |
| Mannings n       | =        | .013       | .250        |            |
| Max.eff.Inten.(m | nm/hr)=  | 48.45      | 32.84       |            |
| over             | (min)    | 2.00       | 10.00       |            |
| Storage Coeff.   | (min)=   | 2.22 (ii)  | 9.76 (ii    | .)         |
| Unit Hyd. Tpeak  | (min)=   | 2.00       | 10.00       |            |
| Unit Hyd. peak   | (cms)=   | .52        | .12         |            |
|                  |          |            |             | *TOTALS*   |
| PEAK FLOW        | (cms)=   | .01        | .05         | .060 (iii) |
| TIME TO PEAK     | (hrs)=   | 2.90       | 3.05        | 3.000      |
| RUNOFF VOLUME    | ( mm ) = | 45.50      | 21.64       | 24.145     |
| TOTAL RAINFALL   | ( mm ) = | 47.50      | 47.50       | 47.500     |
| RUNOFF COEFFICIE | ENT =    | .96        | .46         | .508       |
|                  |          |            |             |            |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- $CN^* = 84.0$  Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| R0003:C00008   |     |
|--|-----|
| R0003:C00002   |     |
| R0003:C00002** END OF RUN : 2  |     |
| ***************************************                                  | *** |
| START   Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-31 |     |

\*#\*

\*# Project Name: [Mansfield Ski Club] Project Number: [15-319]

\*# Date : 07-31-2017

\*# Modeller : [J. Lightheart]

8/17/2020 12:41:27 PM 11/21 R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out

\*# Company : WMI & Associates Ltd.

\*# License # : 2880720 \*#\*

\* Post-Development Condition - Mansfield Ski Club

| CALIB STANDHYD | Area (ha)= 2.94

R0004:C00002-----

READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ Ptotal= 64.80 mm | Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,

TIME RAIN TIME RAIN TIME RAIN TIME RATN TIME hh:mm mm/hr | hh:mm 0:30 2.592 1:30 5.184 2:30 9.072 3:30 16.848 4:30 5.184 1:00 2.592 2:00 5.184 3:00 66.096 4:00 7.776 5:00 3.888 6:00

R0004:C00003-----

\_\_\_\_\_

\* SITE (POST1 - Controlled Area)

Unit Hyd. peak (cms)=

\_\_\_\_\_

01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha) =2 03 .91 Dep. Storage ( mm ) = 2.00 5.00 (%)= 33.30 Average Slope 3.50 Length (m) = 300.00 6.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 66.10 66 82 over (min) 4.00 5.00 Storage Coeff. (min)= 4.00 (ii) 5.15 (ii) Unit Hyd. Tpeak (min)= 4.00 5.00

\*TOTALS\* PEAK FLOW (cms)= .32 16 .477 (iii) TIME TO PEAK (hrs)= 3.00 3.00 3.000 RUNOFF VOLUME (mm)= 62.80 38.15 52.693 TOTAL RAINFALL (mm) = 64.80 64.80 64.800 RUNOFF COEFFICIENT = .97 .59 .813

.28

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

.22

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

R0004:C00004-----

\* EXTERNAL (Routed through SWM Facility)

\_\_\_\_\_ CALTE NASHYD Area (ha)= 11.940 Curve Number (CN)= 83.00

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```
R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\6-hour_SCS\2-CYRSCS.out
```

R0004:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

|              |       |              |        |        | ,     |        |      |  |
|--------------|-------|--------------|--------|--------|-------|--------|------|--|
| ADD HYD      |       |              |        |        |       |        |      |  |
| 03:POST1+EXT |       | ID:NHYD      | AREA   | QPEAK  | TPEAK | R.V.   | DWF  |  |
|              | (ha)  | (cms)        | (hrs)  | ( mm ) | (cms) |        |      |  |
|              | ID 1  | 01:POST1     | 2.940  | .477   | 3.000 | 52.693 | .000 |  |
|              | +ID 2 | 02:EXT       | 11.940 | .960   | 3.117 | 30.575 | .000 |  |
|              | ===== |              |        |        |       |        |      |  |
|              | SUM   | 03:POST1+EXT | 14.880 | 1.334  | 3.033 | 34.945 | .000 |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| R0004:C00006       |       |             |            |            |       |           |       |  |
|--------------------|-------|-------------|------------|------------|-------|-----------|-------|--|
| * SWM Facility     |       |             |            |            |       |           |       |  |
|                    |       |             |            |            |       |           |       |  |
| ROUTE RESERVOIR -> | Reque | ested routi | ing time : | step = 1.0 | min.  |           |       |  |
| IN>03:POST1+EXT    |       |             |            |            |       |           |       |  |
| OUT<04:SWM Facili  |       |             |            | OUTLFOW ST |       |           |       |  |
|                    |       |             |            |            |       |           |       |  |
|                    |       |             |            | (ha.m.)    |       |           |       |  |
|                    | .000  | .0000E+00   | .010       | .1885E-01  | .082  | .5634E-01 | 1.421 |  |
|                    |       |             |            | .2100E-01  |       |           |       |  |
|                    | .003  | .1960E-02   | .010       | .2327E-01  | .208  | .6357E-01 | 1.732 |  |
|                    | .004  | .3050E-02   | .011       | .2566E-01  | .285  | .6738E-01 | 1.906 |  |
|                    | .005  | .4220E-02   | .011       | .2818E-01  | .370  | .7134E-01 | 2.095 |  |
|                    | .006  | .5470E-02   | .011       | .3083E-01  | .462  | .7545E-01 | 2.299 |  |
|                    | .006  | .6810E-02   | .012       | .3361E-01  | .562  | .7970E-01 | 2.520 |  |
|                    | .007  | .8230E-02   | .012       | .3653E-01  | .668  | .8411E-01 | 2.758 |  |
|                    | .007  | .9750E-02   | .012       | .3958E-01  | .780  | .8867E-01 | 3.015 |  |
|                    | .008  | .1136E-01   | .013       | .4279E-01  | .897  | .9339E-01 | 3.291 |  |
|                    | .008  | .1308E-01   | .013       | .4614E-01  | 1.020 | .9827E-01 | 3.588 |  |
|                    | .009  | .1489E-01   | .013       | .4964E-01  | 1.148 | .1033E+00 | 3.904 |  |
|                    | .009  | .1682E-01   | .038       | .5293E-01  | 1.282 | .1085E+00 | 4.242 |  |
| ROUTING RESULTS    |       | AREA        | QPEAK      | TPEAK      | R.V.  |           |       |  |

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|                         | (ha)         | (cms) (hrs    | ) ( mm )   |  |
|-------------------------|--------------|---------------|------------|--|
| INFLOW > 03:POST1+EXT   | 14.880       | 1.334 3.03    | 3 34.945   |  |
| OUTFLOW < 04:SWM Facili | 14.880       | 1.171 3.13    | 3 34.945   |  |
|                         |              |               |            |  |
| PEAK FLOW               | REDUCTION    | [Qout/Qin](%) | = 87.768   |  |
| TIME SHIFT              | OF PEAK FLOW | (min)         | = 6.00     |  |
| MAXIMUM ST              | ORAGE USED   | (ha.m.)       | =.1042E+00 |  |
|                         |              |               |            |  |
|                         |              |               |            |  |

R0004:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

| CALIB STANDHYD 05:POST2 DT= 1.00 | Area (ha)= Total Imp(%)= |              | Conn.(%)= 10.50 |
|----------------------------------|--------------------------|--------------|-----------------|
|                                  |                          |              |                 |
|                                  | IMPERVIOUS               | PERVIOUS (i) |                 |
| Surface Area (ha)=               | .18                      | .67          |                 |
| Dep. Storage (mm)=               | 2.00                     | 5.00         |                 |
| Average Slope (%)=               | 6.00                     | 11.10        |                 |
| Length (m)=                      | 120.00                   | 50.00        |                 |
| Mannings n =                     | .013                     | .250         |                 |
|                                  |                          |              |                 |
| Max.eff.Inten.(mm/hr)=           | 66.10                    | 53.07        |                 |
| over (min)                       | 2.00                     | 8.00         |                 |
| Storage Coeff. (min)=            | 1.96 (ii)                | 8.18 (ii)    |                 |
| Unit Hyd. Tpeak (min)=           | 2.00                     | 8.00         |                 |
| Unit Hyd. peak (cms)=            | .57                      | .14          |                 |
|                                  |                          |              | *TOTALS*        |
| PEAK FLOW (cms)=                 | .02                      | .09          | .101 (iii)      |
| TIME TO PEAK (hrs)=              | 2.87                     | 3.03         | 3.000           |
| RUNOFF VOLUME (mm)=              | 62.80                    | 35.37        | 38.252          |
| TOTAL RAINFALL (mm)=             | 64.80                    | 64.80        | 64.800          |
| RUNOFF COEFFICIENT =             | .97                      | .55          | .590            |
|                                  |                          |              |                 |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = .00 hrs on
                     0
  METOUT= 2 (output = METRIC)
  NRUN = 0005
  NSTORM= 1
      # 1=100SCS6.stm
R0005:C00002-----
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
      : 07-31-2017
*# Modeller : [J. Lightheart]
          : WMI & Associates Ltd.
*# Company
*# License # : 2880720
*#***********************
* Post-Development Condition - Mansfield Ski Club
 READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
 Ptotal= 79.10 mm | Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
    TIME RAIN TIME
                     RAIN
                          TIME
                                 RAIN TIME
                                            RAIN TIME
                                                        RATN
                    mm/hr|
                                mm/hr| hh:mm mm/hr| hh:mm
   hh:mm mm/hr| hh:mm
                          hh:mm
                                                       mm/hr| hh:mm
    0:30 3.164 1:30 6.328
                          2:30 11.074
                                       3:30 20.566
                                                  4:30 6.328
                                                              5:30
    1:00 3.164 2:00 6.328 3:00 80.682 4:00 9.492 5:00 4.746 6:00
R0005:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD
                    Area (ha)= 2.94
 01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                      IMPERVIOUS
                                PERVIOUS (i)
   Surface Area
               (ha)=
                        2 03
                                 91
   Dep. Storage
               ( mm ) =
                         2 00
                                  5 00
   Average Slope
                (%)=
                         3.50
                                  33.30
   Length
                       300.00
                                  6.00
                (m) =
   Mannings n
                       .013
                                  .250
   Max.eff.Inten.(mm/hr)=
                      80.68
                                  86.82
           over (min)
                        4.00
                                  5.00
   Storage Coeff. (min)=
                        3.70 (ii) 4.72 (ii)
   Unit Hyd. Tpeak (min) =
                        4.00
                                  5.00
   Unit Hyd. peak (cms)=
                         3.0
                                   23
```

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```
R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out
                                                *TOTALS*
                             39
                                       .21
                                                 .599 (iii)
       PEAK FLOW
                   (cms)=
       TIME TO PEAK
                   (hrs)=
                             3.00
                                       3.00
                                                 3.000
       RUNOFF VOLUME
                   ( mm ) =
                            77.10
                                      50.70
                                                 66.275
                            79.10
                                      79.10
                                                 79.100
       TOTAL RAINFALL (mm) =
       RUNOFF COEFFICIENT =
                             .97
                                      .64
                                                  .838
         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN^* = 84.0 Ia = Dep. Storage (Above)
         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
    R0005:C00004-----
    * EXTERNAL (Routed through SWM Facility)
                         Area (ha)= 11.940 Curve Number (CN)= 83.00
    CALIB NASHYD
    02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
    ----- U.H. Tp(hrs)=
                                      .240
       Unit Hyd Qpeak (cms)= 1.900
       PEAK FLOW
                   (cms) = 1 333 (i)
       TIME TO PEAK
                   (hrs)=
                          3.117
        DURATION
                   (hrs)=
                           7.667, (dddd|hh:mm:)= 0|07:40
       AVERAGE FLOW
                   (cms)=
                           .182
       RUNOFF VOLUME
                   (mm) = 42.046
       TOTAL RAINFALL (mm) = 79.100
       RUNOFF COEFFICIENT =
                          .532
       (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
    ______
    R0005:C00005-----
    * TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
    ADD HYD
    03:POST1+EXT
                    ID:NHYD
                                     AREA OPEAK TPEAK
                                                            R V
                                                                   DWF
                                     (ha)
                                            (cms)
                                                   (hrs)
                                                           ( mm )
                                                                 (cms)
                   ID 1 01:POST1
                                     2.940
                                             .599 3.000
                                                          66.275
                   +ID 2 02:EXT
                                     11.940
                                            1.333 3.117 42.046
                                                                  .000
                   ______
                   SIIM 03:POST1+EXT
                                     14 880
                                            1 806 3 033
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\* SWM Facility

ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT 

R0005:C00006-----

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| OUTFLOW                             | STORAGE   | OUTFLOW | STORAGE   | OUTFLOW | STORAGE   | OUTFLOW |  |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|--|
| (cms)                               | (ha.m.)   | (cms)   | (ha.m.)   | (cms)   | (ha.m.)   | (cms)   |  |
| .000                                | .0000E+00 | .010    | .1885E-01 | .082    | .5634E-01 | 1.421 . |  |
| .002                                | .9500E-03 | .010    | .2100E-01 | .140    | .5989E-01 | 1.571 . |  |
| .003                                | .1960E-02 | .010    | .2327E-01 | .208    | .6357E-01 | 1.732 . |  |
| .004                                | .3050E-02 | .011    | .2566E-01 | .285    | .6738E-01 | 1.906 . |  |
| .005                                | .4220E-02 | .011    | .2818E-01 | .370    | .7134E-01 | 2.095 . |  |
| .006                                | .5470E-02 | .011    | .3083E-01 | .462    | .7545E-01 | 2.299 . |  |
| .006                                | .6810E-02 | .012    | .3361E-01 | .562    | .7970E-01 | 2.520 . |  |
| .007                                | .8230E-02 | .012    | .3653E-01 | .668    | .8411E-01 | 2.758 . |  |
| .007                                | .9750E-02 | .012    | .3958E-01 | .780    | .8867E-01 | 3.015 . |  |
| .008                                | .1136E-01 | .013    | .4279E-01 | .897    | .9339E-01 | 3.291 . |  |
| .008                                | .1308E-01 | .013    | .4614E-01 | 1.020   | .9827E-01 | 3.588 . |  |
| .009                                | .1489E-01 | .013    | .4964E-01 | 1.148   | .1033E+00 | 3.904 . |  |
| .009                                | .1682E-01 | .038    | .5293E-01 | 1.282   | .1085E+00 | 4.242 . |  |
|                                     |           |         |           |         |           |         |  |
| ROUTING RESULTS                     | AREA      | QPEAK   | TPEAK     | R.V.    |           |         |  |
|                                     | (ha)      | (cms)   | (hrs)     | ( mm )  |           |         |  |
| <pre>INFLOW &gt; 03:POST1+EXT</pre> | 14.880    | 1.806   | 3.033     | 46.833  |           |         |  |
| OUTFLOW < 04:SWM Facili             | 14.880    | 1.618   | 3.117     | 46.833  |           |         |  |

PEAK FLOW REDUCTION [Qout/Qin](%) = 89.567

TIME SHIFT OF PEAK FLOW (min) = 5.00

MAXIMUM STORAGE USED (ha.m.) = .1212E+00

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## R0005:C00007

- \* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
- \* SITE (POST2 Uncontrolled Area)

| <br>             |          |               |          |      |           |         |
|------------------|----------|---------------|----------|------|-----------|---------|
| CALIB STANDHYD   |          | Area (ha)=    | .85      |      |           |         |
| 05:POST2 DT= 3   | 1.00     | Total Imp(%)= | 21.00    | Dir. | Conn.(%)= | = 10.50 |
| <br>             |          |               |          |      |           |         |
|                  |          | IMPERVIOUS    | PERVIOUS | (i)  |           |         |
| Surface Area     | (ha) =   | .18           | .67      |      |           |         |
| Dep. Storage     | ( mm ) = | 2.00          | 5.00     |      |           |         |
| Average Slope    | (%)=     | 6.00          | 11.10    |      |           |         |
| Length           | (m) =    | 120.00        | 50.00    |      |           |         |
| Mannings n       | =        | .013          | .250     |      |           |         |
|                  |          |               |          |      |           |         |
| Max.eff.Inten.(r | mm/hr)=  | 80.68         | 70.28    |      |           |         |
| over             | (min)    | 2.00          | 7.00     |      |           |         |
| Storage Coeff.   | (min) =  | 1.81 (ii)     | 7.37     | (ii) |           |         |
| Unit Hyd. Tpeak  | (min) =  | 2.00          | 7.00     |      |           |         |
| Unit Hyd. peak   | (cms)=   | .59           | .16      |      |           |         |
|                  |          |               |          |      | *TOTALS*  | +       |
| PEAK FLOW        | (cms)=   | .02           | .12      |      | .137      | (iii)   |
| TIME TO PEAK     | (hrs)=   | 2.73          | 3.02     |      | 3.000     |         |
| RUNOFF VOLUME    | ( mm ) = | 77.10         | 47.52    |      | 50.623    |         |
| TOTAL RAINFALL   | ( mm ) = | 79.10         | 79.10    |      | 79.100    |         |
| RUNOFF COEFFICIA | ENT =    | .97           | .60      |      | .640      |         |
|                  |          |               |          |      |           |         |

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

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```
CN* = 84.0 Ia = Dep. Storage (Above)
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0005:C00002-----
R0005:C00002-----
R0005:C00002----
 ** END OF RUN : 4
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
TZERO = .00 hrs on
                0
  METOUT= 2 (output = METRIC)
 NRUN = 0006
 NSTORM= 1
      # 1=12regtim.o89
R0006:C00002----
*#************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
        : 07-31-2017
*# Modeller : [J. Lightheart]
        : WMI & Associates Ltd.
*# Company
*# License # : 2880720
* Post-Development Condition - Mansfield Ski Club
R0006:C00002-----
| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
TIME RAIN TIME RAIN TIME
                              TIME
                                  RAIN| TIME
                                            RAIN
                        RAIN
  hh:mm mm/hr |    1:00 15.000 3:00 10.000 5:00 5.000
                              7:00 43.000| 9:00 23.000|
   2:00 20.000 | 4:00 3.000 | 6:00 20.000 | 8:00 20.000 | 10:00 13.000 | 12:00
```

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```
R0006:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD
                     Area (ha)= 2.94
 01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                      IMPERVIOUS PERVIOUS (i)
                (ha)=
                      2.03
   Surface Area
                                  . 91
   Dep. Storage
                ( mm ) =
                         2.00
                                   5.00
   Average Slope
              (%)=
                       3.50
                                33.30
   Length
               ( m ) =
                       300.00
                                6.00
                                  .250
   Mannings n
                 =
                       . 013
   Max.eff.Inten.(mm/hr)=
                        43.00
                                  53.33
           over (min)
                         5.00
                                   6.00
   Storage Coeff. (min)=
                        4.75 (ii) 6.00 (ii)
   Unit Hyd. Tpeak (min)=
                         5.00
                                   6.00
   Unit Hyd. peak (cms)=
                         .23
                                   .19
                                            *TOTALS*
   PEAK FLOW
               (cms)=
                          .21
                                  .13
                                              .342 (iii)
                        7.00
                                 7.00
                                             7.000
   TIME TO PEAK (hrs)=
   RUNOFF VOLUME (mm) =
                       191.00
                                 158 56
                                            177.702
   TOTAL RAINFALL (mm) =
                        193.00
                                 193.00
                                            193.000
   RUNOFF COEFFICIENT =
                        . 99
                                              .921
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0006:C00004-----
* EXTERNAL (Routed through SWM Facility)
 CALIB NASHYD
                     Area (ha)= 11.940 Curve Number (CN)= 83.00
 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                                  240
   Unit Hyd Qpeak (cms)= 1.900
   PEAK FLOW
               (cms) = 1.239 (i)
   TIME TO PEAK
               (hrs) = 7.017
   DURATION
               (hrs) = 13.667, (dddd|hh:mm:) = 0|13:40
   AVERAGE FLOW
               (cms)=
                       .353
   RUNOFF VOLUME
               (mm) = 145.537
   TOTAL RAINFALL (mm) = 193.000
   RUNOFF COEFFICIENT = .754
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
______
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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\6-hour\_SCS\2-CYRSCS.out

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

ADD HYD 03:POST1+EXT ID:NHYD AREA OPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) ID 1 01:POST1 2.940 .342 7.000 177.702 .000 1.239 7.017 145.537 +TD 2 02:EXT 11.940 .000 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 1.579 7.000 151.893 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0006:C00006-----

\* SWM Facility

ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | =========== OUTLFOW STORAGE TABLE ========== ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms) .010 .1885E-01 .000 .0000E+00| .082 .5634E-01 1.421 . .002 .9500E-03| .010 .2100E-01| .140 .5989E-01| 1 571 .003 .1960E-02 .010 .2327E-01 .208 .6357E-01| 1.732 . .004 .3050E-02 .011 .2566E-01| .285 .6738E-01 1.906 . .005 .4220E-02 .011 .2818E-01 .370 .7134E-01 2.095 . .462 .7545E-01| .006 .5470E-02 .011 .3083E-01| 2.299 . .012 .3361E-01| .562 .7970E-01 .006 .6810E-02| 2.520 . .007 .8230E-02 .012 .3653E-01| .668 .8411E-01| 2 758 .007 .9750E-02 .012 .3958E-01 .780 .8867E-01 .008 .1136E-01 .013 .4279E-01| .897 .9339E-01| 3.291 . .008 .1308E-01| .013 .4614E-01| 1.020 .9827E-01| 3.588 . .013 .4964E-01 | 1.148 .1033E+00| .009 .1489E-01| 3.904 . .009 .1682E-01| .038 .5293E-01| 1.282 .1085E+00| 4.242 .

ROUTING RESULTS AREA OPEAK TPEAK R.V. \_\_\_\_\_\_ (ha) (cms) (hrs) (mm) INFLOW > 03:POST1+EXT 14 880 1 579 7 000 151 893 OUTFLOW < 04:SWM Facili 14.880 1.561 7.033 151.892

PEAK FLOW REDUCTION [Qout/Qin](%) = 98.865

TIME SHIFT OF PEAK FLOW (min) = 2.00

MAXIMUM STORAGE USED (ha.m.) = .1192E+00

R0006:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

19/21

8/17/2020 12:41:27 PM 20/21

| ٧, | tırm i | -gerver | (Data) | Droi | ecte\ | 2015 | 15- | 319 | Degia | n\Storm | Teene | No1' | \SWMHYMO\ | DP\ | 6-hour | 9091 | 2-CVRSCS | 011+ |
|----|--------|---------|--------|------|-------|------|-----|-----|-------|---------|-------|------|-----------|-----|--------|------|----------|------|
|    |        |         |        |      |       |      |     |     |       |         |       |      |           |     |        |      |          |      |

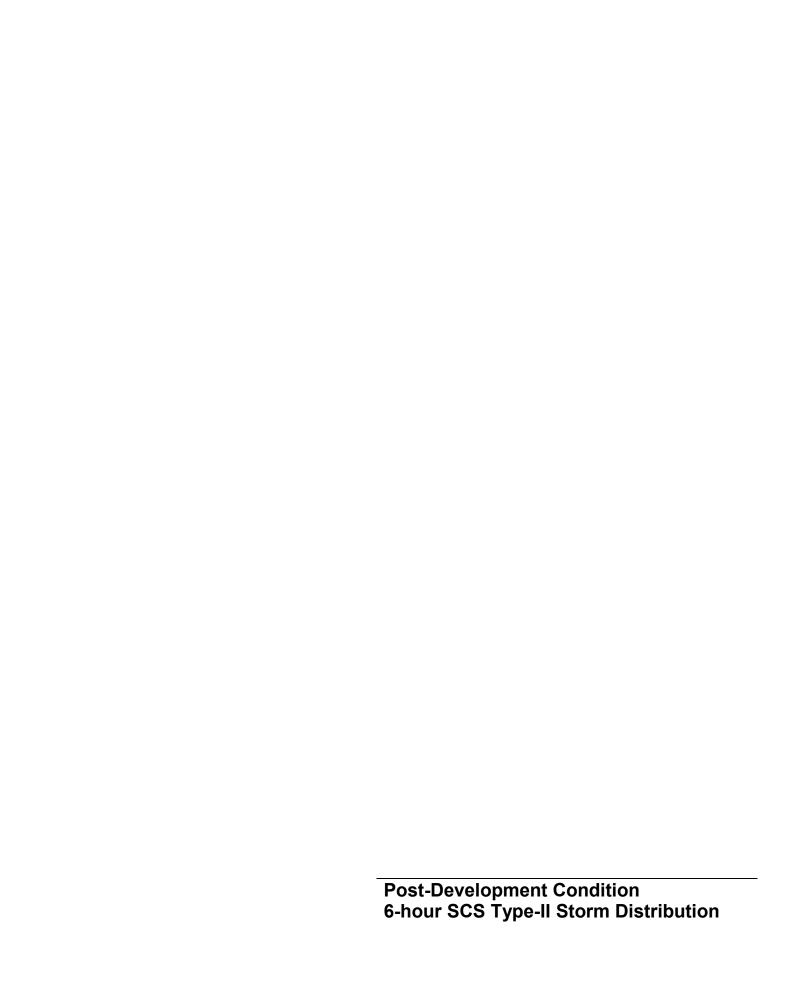
| Surface Area     | (ha)=    | .18    | .67       |         |       |
|------------------|----------|--------|-----------|---------|-------|
| Dep. Storage     | (mm) =   | 2.00   | 5.00      |         |       |
| Average Slope    | (%)=     | 6.00   | 11.10     |         |       |
| Length           | ( m ) =  | 120.00 | 50.00     |         |       |
| Mannings n       | =        | .013   | .250      |         |       |
|                  |          |        |           |         |       |
| Max.eff.Inten.(n | nm/hr)=  | 43.00  | 44.82     |         |       |
| over             | (min)    | 2.00   | 9.00      |         |       |
| Storage Coeff.   | (min) =  | 2.33   | (ii) 8.99 | (ii)    |       |
| Unit Hyd. Tpeak  | (min) =  | 2.00   | 9.00      |         |       |
| Unit Hyd. peak   | (cms)=   | .50    | .13       |         |       |
|                  |          |        |           | *TOTALS | *     |
| PEAK FLOW        | (cms)=   | .01    | .08       | .094    | (iii) |
| TIME TO PEAK     | (hrs)=   | 6.92   | 7.00      | 7.000   |       |
| RUNOFF VOLUME    | ( mm ) = | 191.00 | 153.77    | 157.677 |       |
| TOTAL RAINFALL   | ( mm ) = | 193.00 | 193.00    | 193.000 |       |
| RUNOFF COEFFICIE | ENT =    | .99    | .80       | .817    |       |
|                  |          |        |           |         |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| R0006:C00008                               |
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| R0006:C00002                               |
|  |
| FINISH                                     |
| <u>'</u>                                   |
|  |
| *************************                  |
| WARNINGS / ERRORS / NOTES                  |
| MARKETOD / BRICOG / NOTED                  |
| Simulation ended on 2020-04-28 at 12:05:03 |
| Simulation ended on 2020-04-28 at 12:05:03 |

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| S.out    |
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```
Metric units
*#*********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#*****************
* Post-Development Condition - Mansfield Ski Club
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
           TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
* %
              ["25mm4hr.stm"] <--storm filename
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8------
* SITE (POST1 - Controlled Area)
CALIB STANDHYD
            ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.94](ha),
              XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[84],
              Pervious surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                              LGP=[6](m), MNP=[0.25], SCP=[0](min),
              Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[300](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*&-----
* EXTERNAL (Routed through SWM Facility)
              ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*%------
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
ADD HYD
*%------
* SWM Facility
ROUTE RESERVOIR
              IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                  TABLE of ( OUTFLOW-STORAGE ) values
                         (cms) - (ha-m)
                        [ 0.000 , 0.00000 ]
                        [0.0015 , 0.00095]
                        [0.0031 , 0.00196]
                        [0.0041 , 0.00305]
                        [0.0050 , 0.00422]
                        [0.0057 , 0.00547]
                        [0.0063 , 0.00681]
                        [0.0069 , 0.00823]
                        [0.0074 . 0.00975]
                        [0.0079 , 0.01136]
                        [0.0084 , 0.01308]
                        [0.0088 , 0.01489]
                        [0.0092 , 0.01682]
```

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\6-hour\_SCS\2-CYRSCS.dat

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[0.0096 , 0.01885]
                              [0.0100 , 0.02100]
                              [0.0104 , 0.02327]
                              [0.0108 , 0.02566]
                              [0.0111 , 0.02818]
                              [0.0114 , 0.03083]
                              [0.0118 , 0.03361]
                              [0.0121 , 0.03653]
                              [0.0124 , 0.03958]
                              [0.0127 , 0.04279]
                              [0.0130 , 0.04614]
                              [0.0133 , 0.04964]
                              [0.0377 , 0.05293]
                              [0.0822 , 0.05634]
                              [0.1396 , 0.05989]
                              [0.2076 , 0.06357]
                              [0.2847 , 0.06738]
                              [0.3698 , 0.07134]
                              [0.4624 , 0.07545]
                              [0.5619 , 0.07970]
                              [0.6677 , 0.08411]
                              [0.7796 , 0.08867]
                              [0.8972 , 0.09339]
                              [1.0202 , 0.09827]
                              [1.1485 , 0.10332]
                              [1.2819 , 0.10854]
                              [1.4214 , 0.11394]
                              [1.5706 , 0.11951]
                              [1.7315 , 0.12526]
                              [1.9058 , 0.13120]
                              [2.0945 , 0.13732]
                              [2.2989 , 0.14363]
                              [2.5199 , 0.15014]
                              [2.7584 . 0.15655]
                              [3.0154 , 0.16308]
                              [3.2914 , 0.16974]
                              [3.5875 , 0.17653]
                              [3.9042 , 0.18344]
                              [4.2422 , 0.19049]
                              [ -1 , -1 ] (maximum one hundred pairs of points)
                              IDovf=[ ], NHYDovf=[" "],
*&_____|____
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
* SITE (POST2 - Uncontrolled Area)
                  ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.85](ha),
                  XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[84],
                  Pervious surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                     LGP=[50](m), MNP=[0.25], SCP=[0](min),
                  Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                     LGI=[120](m), MNI=[0.013], SCI=[0](min),
                  RAINFALL=[ , , , , ](mm/hr) , END=-1
```

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```
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
     TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
             ["2SCS6.stm"] <--storm filename
*8------
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
       TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3]
START
*%
             ["5SCS6.stm"] <--storm filename
*8-----
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
            TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4]
             ["25SCS6.stm"] <--storm filename
*8------
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START
           TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5]
             ["100SCS6.stm"] <--storm filename
**-----
*% Timmins Regional Storm (12-hr)
           TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[6]
START
             ["12reqtim.o89"] <--storm filename
FINISH
```

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\6-hour\_SCS\2-CYRSCS.dat

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 $\label{lem:reconstruction} $$R\mathrm{\nol}\sum_Nol\sum_No$ 8/17/2020 12:51:27 PM 5/5

1/21

8/17/2020 12:52:09 PM

8/17/2020 12:52:09 PM 2/21

```
*#***********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
            : 07-31-2017
*# Modeller
            : [J. Lightheart]
            : WMI & Associates Ltd.
*# Company
*# License # : 2880720
*#***************************
* Post-Development Condition - Mansfield Ski Club
             | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\
  TZERO = .00 hrs on
   METOUT= 2 (output = METRIC)
   NRUN = 0001
   NSTORM= 1
        # 1=25mm4hr.stm
READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
| Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
    TIME RAIN
                 TIME
                       RATN
                              TIME
                                    RATN
                                            TIME
                                                  RATN
                                                         TIME
                                                               RATN
                                                                      TIME
   hh:mm mm/hr
                 hh:mm
                       mm/hr|
                              hh:mm mm/hr|
                                           hh:mm
                                                  mm/hr|
                                                        hh:mm
                                                               mm/hr|
                                                                     hh:mm
                              1:30 13.830
    0:10 1.970
                 0:50
                      3.820
                                           2:10
                                                  4.080
                                                         2:50
                                                               2.650
                                                                      3:30
                 1:00 5.380
                              1:40 8.070
                                                         3:00
                                                               2.450
                                                                      3:40
    0:20 2.220
                                            2:20
                                                 3.570
    0:30 2.550 1:10 10.940 1:50 5.950
                                            2:30 3.190
                                                         3:10 2.290
                                                                      3:50
     0:40 3.030 1:20 56.670 2:00 4.810 2:40 2.890 3:20 2.150
R0001:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD
                             (ha)=
                                     2.94
                       Area
| 01:POST1 | DT= 1.00 |
                       Total Imp(%) = 69.00 Dir. Conn.(%) = 59.00
                        IMPERVIOUS
                                    PERVIOUS (i)
   Surface Area
                 (ha)=
                           2.03
                                      .91
   Dep. Storage
                  (mm) =
                           2 00
                                      5 00
                           3 50
                                     33 30
   Average Slope
                  (%)=
                          300.00
                                      6.00
   Length
                  (m) =
   Mannings n
                           013
                                      250
   Max.eff.Inten.(mm/hr)=
                           56.67
                                     23 86
             over (min)
                           4 00
                                      6 00
   Storage Coeff. (min)=
                           4.26 (ii)
                                      5.98 (ii)
    Unit Hvd. Tpeak (min)=
                                      6.00
                           4.00
   Unit Hyd. peak (cms)=
                                                *TOTALS*
   PEAK FLOW
                 (cms)=
                            2.4
                                       0.4
                                                  .274 (iii)
   TIME TO PEAK
                 (hrs)=
                           1.33
                                      1.40
                                                  1.350
```

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out

```
RUNOFF VOLUME (mm) = 23.01 7.79 16.768
TOTAL RAINFALL (mm) = 25.01 25.01 25.005
RUNOFF COEFFICIENT = .92 .31 .671
```

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0001:C00004-----

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD | 1        | Area | (ha)=    | 11.940 | Curve Number (CN)= 83.  | .00 |
|--------------|----------|------|----------|--------|-------------------------|-----|
| 02:EXT       | DT= 1.00 | Ia   | ( mm ) = | 6.800  | # of Linear Res.(N)= 3. | .00 |
|              |          | U.H. | Tp(hrs)= | .240   |                         |     |

Unit Hyd Qpeak (cms)= 1.900

PEAK FLOW (cms)= .115 (i)

TIME TO PEAK (hrs)= 1.650

DURATION (hrs) = 5.667, (dddd|hh:mm:) = 0 | 05:40

AVERAGE FLOW (cms)= .028 RUNOFF VOLUME (mm)= 4.719

TOTAL RAINFALL (mm) = 25.005

RUNOFF COEFFICIENT = .189

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

R0001:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD 03:POST1+EXT |      | ID:NHYD      | AREA   | OPEAK | TPEAK | R.V.   | DWF   |  |
|----------------------|------|--------------|--------|-------|-------|--------|-------|--|
| USTIODIITEMI         | - 1  | ID-MIIID     |        | ~     |       |        |       |  |
|                      |      |              | (ha)   | (cms) | (hrs) | ( mm ) | (cms) |  |
|                      | ID   | 1 01:POST1   | 2.940  | .274  | 1.350 | 16.768 | .000  |  |
|                      | +ID  | 2 02:EXT     | 11.940 | .115  | 1.650 | 4.719  | .000  |  |
|                      | ==== |              |        |       |       |        |       |  |
|                      | SUM  | 03:POST1+EXT | 14.880 | .300  | 1.367 | 7.100  | .000  |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0001:C00006-----

\* SWM Facility

| ROUTE RESERVOIR -> | Reque   | sted routi | ng time s | step = 1.0 | min.      |           |         |    |
|--------------------|---------|------------|-----------|------------|-----------|-----------|---------|----|
| IN>03:POST1+EXT    |         |            |           |            |           |           |         |    |
| OUT<04:SWM Facili  | ======  |            | ======    | OUTLFOW ST | ORAGE TAI | BLE ===== |         | == |
|                    | OUTFLOW | STORAGE    | OUTFLOW   | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW |    |
|                    | (cms)   | (ha.m.)    | (cms)     | (ha.m.)    | (cms)     | (ha.m.)   | (cms)   |    |
|                    | .000    | .0000E+00  | .010      | .1885E-01  | .082      | .5634E-01 | 1.421   |    |
|                    |         |            |           |            |           |           |         |    |

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|                 | .002 | .9500E-03 | .010  | .2100E-01 | .140  | .5989E-01 | 1.571 |  |
|-----------------|------|-----------|-------|-----------|-------|-----------|-------|--|
|                 | .003 | .1960E-02 | .010  | .2327E-01 | .208  | .6357E-01 | 1.732 |  |
|                 | .004 | .3050E-02 | .011  | .2566E-01 | .285  | .6738E-01 | 1.906 |  |
|                 | .005 | .4220E-02 | .011  | .2818E-01 | .370  | .7134E-01 | 2.095 |  |
|                 | .006 | .5470E-02 | .011  | .3083E-01 | .462  | .7545E-01 | 2.299 |  |
|                 | .006 | .6810E-02 | .012  | .3361E-01 | .562  | .7970E-01 | 2.520 |  |
|                 | .007 | .8230E-02 | .012  | .3653E-01 | .668  | .8411E-01 | 2.758 |  |
|                 | .007 | .9750E-02 | .012  | .3958E-01 | .780  | .8867E-01 | 3.015 |  |
|                 | .008 | .1136E-01 | .013  | .4279E-01 | .897  | .9339E-01 | 3.291 |  |
|                 | .008 | .1308E-01 | .013  | .4614E-01 | 1.020 | .9827E-01 | 3.588 |  |
|                 | .009 | .1489E-01 | .013  | .4964E-01 | 1.148 | .1033E+00 | 3.904 |  |
|                 | .009 | .1682E-01 | .038  | .5293E-01 | 1.282 | .1085E+00 | 4.242 |  |
| ROUTING RESULTS |      | AREA      | QPEAK | TPEAK     | R.V.  |           |       |  |

| 10001111 | HOUTING HEDUELD |               |        | 21 2111 |       | 1      |
|----------|-----------------|---------------|--------|---------|-------|--------|
|          |                 |               | (ha)   | (cms)   | (hrs) | ( mm ) |
| INFLOW   | >               | 03:POST1+EXT  | 14.880 | .300    | 1.367 | 7.100  |
| OUTFLOW  | <               | 04:SWM Facili | 14.880 | .083    | 2.300 | 7.100  |
|          |                 |               |        |         |       |        |

PEAK FLOW REDUCTION [Qout/Qin](%) = 27.688
TIME SHIFT OF PEAK FLOW (min) = 56.00
MAXIMUM STORAGE USED (ha.m.) = .5640E-01

001:C00007-

\_\_\_\_\_

| CALIB STANDHYD         | Area (ha)=    | .85        |                    |  |
|------------------------|---------------|------------|--------------------|--|
| 05:POST2 DT= 1.00      | Total Imp(%)= | 21.00 Dir  | c. Conn.(%)= 10.50 |  |
| <br>                   |               |            |                    |  |
|                        | IMPERVIOUS    | ,          |                    |  |
| Surface Area (ha)=     | .18           | .67        |                    |  |
| Dep. Storage (mm)=     | 2.00          | 5.00       |                    |  |
| Average Slope (%)=     | 6.00          | 11.10      |                    |  |
| Length (m)=            | 120.00        | 50.00      |                    |  |
| Mannings n =           | .013          | .250       |                    |  |
|                        |               |            |                    |  |
| Max.eff.Inten.(mm/hr)= | 56.67         | 11.01      |                    |  |
| over (min)             | 2.00          | 14.00      |                    |  |
| Storage Coeff. (min)=  | 2.09 (ii)     | 13.75 (ii) |                    |  |
| Unit Hyd. Tpeak (min)= | 2.00          | 14.00      |                    |  |
| Unit Hyd. peak (cms)=  | .54           | .08        |                    |  |
|                        |               |            | *TOTALS*           |  |
| PEAK FLOW (cms)=       | .01           | .01        | .017 (iii)         |  |
| TIME TO PEAK (hrs)=    | 1.33          | 1.55       | 1.333              |  |
| RUNOFF VOLUME (mm)=    | 23.00         | 6.70       | 8.411              |  |
| TOTAL RAINFALL (mm)=   | 25.01         | 25.01      | 25.005             |  |
| RUNOFF COEFFICIENT =   |               | .27        | .336               |  |
|                        | .,,           | ,          |                    |  |

<sup>(</sup>i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

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<sup>\*</sup> TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

<sup>\*</sup> SITE (POST2 - Uncontrolled Area)

CN\* = 84.0 Ia = Dep. Storage (Above)

<sup>(</sup>ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

<sup>(</sup>iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\6-hour_SCS\2-CYRSCS.out
   R0001:C00008-----
     ** END OF RUN : 0
   *****************************
          | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      TZERO = .00 hrs on
      METOUT= 2 (output = METRIC)
      NRUN = 0002
      NSTORM= 1
         # 1=2SCS6.stm
   *#***************************
   *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
   *# Date
             : 07-31-2017
   *# Modeller : [J. Lightheart]
    *# Company
             : WMI & Associates Ltd.
   *# License # : 2880720
    *#*****************************
   * Post-Development Condition - Mansfield Ski Club
   R0002:C00002-----
     READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
     Ptotal= 36.00 mm | Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
       TIME RAIN TIME
                      RAIN TIME
                                 RATN
                                      TIME
                                            RATN
                                                 TIME
                                                     RATN
                                                           TIME
      hh:mm mm/hr | hh:mm
       0:30 1.440 1:30 2.880
                           2:30 5.040
                                      3:30
                                           9.360
       1:00 1.440 2:00 2.880 3:00 36.720
                                      4:00 4.320 5:00 2.160 6:00
   R0002:C00003-----
   * SITE (POST1 - Controlled Area)
    CALIB STANDHYD | Area (ha)= 2.94
    IMPERVIOUS PERVIOUS (i)
       Surface Area
                 (ha)=
                       2.03
                                 .91
                                  5 00
      Dep. Storage (mm)=
                          2.00
      Average Slope
                 (%)=
                         3 50
                                  33.30
```

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| Length         | (m)=      | 300.00 | 6.00      |          |       |
|----------------|-----------|--------|-----------|----------|-------|
| Mannings n     | =         | .013   | .250      |          |       |
|                |           |        |           |          |       |
| Max.eff.Inten. | (mm/hr)=  | 36.72  | 27.71     |          |       |
| ove            | er (min)  | 5.00   | 7.00      |          |       |
| Storage Coeff. | (min)=    | 5.06   | (ii) 6.69 | (ii)     |       |
| Unit Hyd. Tpea | ak (min)= | 5.00   | 7.00      |          |       |
| Unit Hyd. peak | (cms)=    | .22    | .17       |          |       |
|                |           |        |           | *TOTALS* |       |
| PEAK FLOW      | (cms)=    | .18    | .06       | .237     | (iii) |
| TIME TO PEAK   | (hrs)=    | 3.00   | 3.02      | 3.000    |       |
| RUNOFF VOLUME  | ( mm ) =  | 34.00  | 15.09     | 26.246   |       |
| TOTAL RAINFALI | ( mm ) =  | 36.00  | 36.00     | 36.000   |       |
| RUNOFF COEFFIC | CIENT =   | .94    | .42       | .729     |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0002:C00004----

\* EXTERNAL (Routed through SWM Facility)

|          |         | 1.00   | Ia  |     | 6.800 | Curve Number (CN)=<br># of Linear Res.(N)= |  |
|----------|---------|--------|-----|-----|-------|--|--|
| Unit Hyd | l Qpeak | (cms)= | 1.9 | 900 |       |  |  |

PEAK FLOW (cms) = .310 (i)

TIME TO PEAK (hrs) = 3.150

DURATION (hrs) = 7.667, (dddd|hh:mm:) = 0|07:40

AVERAGE FLOW (cms) = .045

RUNOFF VOLUME (mm) = 10.497

TOTAL RAINFALL (mm) = 36.000

RUNOFF COEFFICIENT = .292

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

R0002:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

ADD HYD ID:NHYD 03:POST1+EXT AREA QPEAK TPEAK R.V. DWF \_\_\_\_\_ (ha) (cms) (hrs) (mm) (cms) .237 3.000 ID 1 01:POST1 2.940 26.246 .000 +ID 2 02:EXT 11.940 .310 3.150 10.497 .000 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 .497 3.050 13.609 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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R0002:C00006-----\* SWM Facility ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | ============= OUTLFOW STORAGE TABLE ========== ------OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | .000 .0000E+00| .010 .1885E-01 .082 .5634E-01 1.421 . .010 .2100E-01 .002 .9500E-03| .140 .5989E-01 1.571 . .010 .2327E-01 .003 .1960E-02 .208 .6357E-01 1.732 . .011 .2566E-01 .004 .3050E-02| .285 .6738E-01| 1.906 . .005 .4220E-02| .011 .2818E-01| .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01| .462 .7545E-01 2.299 . .006 .6810E-02| .012 .3361E-01| .562 .7970E-01 2.520 . .007 .8230E-02 .012 .3653E-01 .668 .8411E-01| 2.758 . .007 .9750E-02| .012 .3958E-01 .780 .8867E-01| 3.015 . .008 .1136E-01| .013 .4279E-01| .897 .9339E-01| 3.291 . 3.588 . .008 .1308E-01| .013 .4614E-01 | 1.020 .9827E-01| .013 .4964E-01 1.148 .1033E+00 3.904 . .009 .1489E-01| .009 .1682E-01| .038 .5293E-01 | 1.282 .1085E+00 | 4.242 . ROUTING RESULTS AREA OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW > 03:POST1+EXT 14.880 .497 3.050 13.609 OUTFLOW < 04:SWM Facili 14.880 . 344 3.300 13.609 PEAK FLOW REDUCTION [Qout/Qin](%)= 69.259 TIME SHIFT OF PEAK FLOW (min) = 15.00 MAXIMUM STORAGE USED (ha.m.) = .7016E-01\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED) \* SITE (POST2 - Uncontrolled Area) CALIB STANDHYD Area (ha)= .85 05:POST2 DT= 1.00 | Total Imp(%)= 21.00 Dir. Conn.(%)= 10.50 IMPERVIOUS PERVIOUS (i) .18 Surface Area (ha)= 67 Dep. Storage ( mm ) = 2 00 5 00 Average Slope (%)= 6.00 11.10 Length (m) =120.00 50.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 36.72 20 32 over (min) 2.00 12.00 Storage Coeff. (min)= 2.49 (ii) 11.61 (ii) Unit Hvd. Tpeak (min) = 2.00 12 00 Unit Hyd. peak (cms)= 48 1.0

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```
*TOTALS*
   PEAK FLOW
                         0.1
                                   .03
                                             .035 (iii)
               (cms)=
                         2.77
   TIME TO PEAK
               (hrs)=
                                   3.08
                                             3.000
   RUNOFF VOLUME
               ( mm ) =
                        34.00
                                  13.43
                                             15.590
                        36.00
                                  36.00
                                             36.000
   TOTAL RAINFALL (mm) =
   RUNOFF COEFFICIENT =
                         .94
                                  .37
                                             .433
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN^* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
 ** END OF RUN : 1
*****************************
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = 00 hrs on
                      0
  METOUT= 2 (output = METRIC)
  NRUN = 0003
  NSTORM= 1
      # 1=5SCS6.stm
R0003:C00002----
*#**************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
          : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#************************
* Post-Development Condition - Mansfield Ski Club
R0003:C00002-----
| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
| Ptotal= 47.50 mm | Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
    TIME RAIN TIME
                     RAIN
                           TIME
                                 RAIN
                                       TIME
                                             RAIN
                                                   TIME
                                                          RAIN
                                                                TIME
   hh:mm mm/hr| hh:mm mm/hr|
                           hh:mm mm/hr| hh:mm mm/hr| hh:mm
                                                         mm/hr|
                                                               hh:mm
               1:30 3.800
        1.900
                           2:30
                                 6.650
                                       3:30 12.350
                                                   4:30
                                                         3.800
                                                                5:30
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```

1:00 1.900| 2:00 3.800| 3:00 48.450| 4:00 5.700| 5:00 2.850| 6:00

R0003:C00003-----

\* SITE (POST1 - Controlled Area)

| CALIB STANDHYD  |          | Area (ha)=    | 2.94     |      |           |       |
|-----------------|----------|---------------|----------|------|-----------|-------|
| 01:POST1 DT=    | 1.00     | Total Imp(%)= | 69.00    | Dir. | Conn.(%)= | 59.00 |
|                 |          |               |          |      |           |       |
|                 |          | IMPERVIOUS    | PERVIOUS | (i)  |           |       |
| Surface Area    | (ha) =   | 2.03          | .91      |      |           |       |
| Dep. Storage    | ( mm ) = | 2.00          | 5.00     |      |           |       |
| Average Slope   | (%)=     | 3.50          | 33.30    |      |           |       |
| Length          | ( m ) =  | 300.00        | 6.00     |      |           |       |
| Mannings n      | =        | .013          | .250     |      |           |       |
|                 |          |               |          |      |           |       |
| Max.eff.Inten.( | mm/hr)=  | 48.45         | 42.87    |      |           |       |
| over            | (min)    | 5.00          | 6.00     |      |           |       |
| Storage Coeff.  | (min) =  | 4.53 (ii)     | 5.90     | (ii) |           |       |
| Unit Hyd. Tpeak | (min)=   | 5.00          | 6.00     |      |           |       |
| Unit Hyd. peak  | (cms)=   | .24           | .19      |      |           |       |
|                 |          |               |          |      | *TOTALS*  |       |
| PEAK FLOW       | (cms)=   | .23           | .10      |      | .331      | (iii) |
| TIME TO PEAK    | (hrs)=   | 3.00          | 3.02     |      | 3.000     |       |
| RUNOFF VOLUME   | ( mm ) = | 45.50         | 23.80    |      | 36.604    |       |
| TOTAL RAINFALL  | ( mm ) = | 47.50         | 47.50    |      | 47.500    |       |
| RUNOFF COEFFICI | ENT =    | .96           | .50      |      | .771      |       |
|                 |          |               |          |      |           |       |

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

70002.000004

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD    |          | Area    | (ha)=   | 11.940   | Curve Number (CN) = 83.00 |
|-----------------|----------|---------|---------|----------|---------------------------|
| 02:EXT DT=      | 1.00     | Ia      | (mm) =  | 6.800    | # of Linear Res.(N)= 3.00 |
|                 |          | U.H. Tp | (hrs)=  | .240     |                           |
| Unit Hyd Qpeak  | (cms)=   | 1.900   |         |          |                           |
| PEAK FLOW       | (cms)=   | .547    | (i)     |          |                           |
| TIME TO PEAK    | (hrs)=   | 3.133   |         |          |                           |
| DURATION        | (hrs)=   | 7.667   | , (dddd | hh:mm:)= | 0   07:40                 |
| AVERAGE FLOW    | (cms)=   | .077    |         |          |                           |
| RUNOFF VOLUME   | ( mm ) = | 17.865  |         |          |                           |
| TOTAL RAINFALL  | ( mm ) = | 47.500  |         |          |                           |
| RUNOFF COEFFICI | ENT =    | .376    |         |          |                           |

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

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R0003:C00005-----\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT) ID:NHYD 03:POST1+EXT AREA OPEAK TPEAK R.V. DWF \_\_\_\_\_ (ha) (cms) (hrs) (mm) (cms) .331 3.000 TD 1 01:POST1 000 2 940 36 604 +ID 2 02:EXT 11.940 .547 3.133 17.865 .000 \_\_\_\_\_\_ SUM 03:POST1+EXT 14.880 .811 3.033 21.567 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. \* SWM Facility -----| ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. IN>03:POST1+EXT OUT<04:SWM Facili | ============= OUTLFOW STORAGE TABLE =========== ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | (cms) .000 .0000E+00| .010 .1885E-01| .082 .5634E-01 1.421 . .002 .9500E-03 .010 .2100E-01| .140 .5989E-01| 1.571 . .003 .1960E-02| .010 .2327E-01 .208 .6357E-01 1.732 . .004 .3050E-02| .011 .2566E-01| .285 .6738E-01 1.906 . .011 .2818E-01 .005 .4220E-02| .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01| .462 .7545E-01| 2.299 . .006 .6810E-02 .012 .3361E-01 .562 .7970E-01 2.520 . .007 .8230E-02 .012 .3653E-01| .668 .8411E-01| 2.758 . .780 .8867E-01 3.015 . .007 .9750E-02| .012 .3958E-01| .013 .4279E-01| .008 .1136E-01| .897 .9339E-01 3.291 . .008 .1308E-01| .013 .4614E-01| 1.020 .9827E-01| 3.588 . .009 .1489E-01 .013 .4964E-01 1.148 .1033E+00 3.904 . .009 .1682E-01 .038 .5293E-01| 1.282 .1085E+00| 4.242 . ROUTING RESULTS AREA OPEAK TPEAK R.V. -----(ha) (cms) (hrs) ( mm ) INFLOW > 03:POST1+EXT 14.880 3.033 21.567 OUTFLOW < 04:SWM Facili 14.880 .665 3.183 21.567 PEAK FLOW REDUCTION [Qout/Qin](%)= 82.021 TIME SHIFT OF PEAK FLOW (min) = 9.00MAXIMUM STORAGE USED (ha.m.) = .8400E-01\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED) \* SITE (POST2 - Uncontrolled Area) | CALIB STANDHYD | Area (ha)= .85 | 05:POST2 | DT= 1.00 | Total Imp(%)= 21.00 Dir. Conn.(%)= 10.50

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|                 |          | IMPERVIOUS | PERVIOUS (i) |            |
|-----------------|----------|------------|--------------|------------|
| Surface Area    | (ha) =   | .18        | .67          |            |
| Dep. Storage    | ( mm ) = | 2.00       | 5.00         |            |
| Average Slope   | (%)=     | 6.00       | 11.10        |            |
| Length          | (m)=     | 120.00     | 50.00        |            |
| Mannings n      | =        | .013       | .250         |            |
| Max.eff.Inten.( | nm/hr)=  | 48.45      | 32.84        |            |
|                 | (min)    | 2.00       | 10.00        |            |
| Storage Coeff.  | (min)=   | 2.22 (ii)  | 9.76 (ii)    |            |
| Unit Hyd. Tpeak | (min)=   | 2.00       | 10.00        |            |
| Unit Hyd. peak  | (cms)=   | .52        | .12          |            |
|                 |          |            |              | *TOTALS*   |
| PEAK FLOW       | (cms)=   | .01        | .05          | .060 (iii) |
| TIME TO PEAK    | (hrs)=   | 2.90       | 3.05         | 3.000      |
| RUNOFF VOLUME   | ( mm ) = | 45.50      | 21.64        | 24.145     |
| TOTAL RAINFALL  | ( mm ) = | 47.50      | 47.50        | 47.500     |
| RUNOFF COEFFICI | ENT =    | .96        | .46          | .508       |
|                 |          |            |              |            |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  $CN^* = 84.0$  Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| R0003:C00008 |  |
|--------------|--|
| R0003:C00002 |  |
|              |  |
| ******       | ***************************************  |
|              |  |
|              |  |
| START        | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\ Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\ 00 brs on 0 |

NRUN = 0004 NSTORM= 1 # 1=25SCS6.stm

\*#\*

\*# Project Name: [Mansfield Ski Club] Project Number: [15-319]

\*# Date : 07-31-2017

\*# Modeller : [J. Lightheart]

METOUT= 2 (output = METRIC)

8/17/2020 12:52:09 PM 11/21 R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out

\*# Company : WMI & Associates Ltd.

\*# License # : 2880720 \*#\*

\* Post-Development Condition - Mansfield Ski Club

R0004:C00002-----

READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ Ptotal= 64.80 mm | Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,

TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 0:30 2.592 1:30 5.184 2:30 9.072 3:30 16.848 4:30 5.184 1:00 2.592 2:00 5.184 3:00 66.096 4:00 7.776 5:00 3.888 6:00

R0004:C00003-----

\_\_\_\_\_

\* SITE (POST1 - Controlled Area) \_\_\_\_\_

| CALIB STANDHYD         | Area (ha)=    | 2.94         |                 |
|------------------------|---------------|--------------|-----------------|
| 01:POST1   DT= 1.00    | Total Imp(%)= | 69.00 Dir.   | Conn.(%)= 59.00 |
|                        |               |              |                 |
|                        | IMPERVIOUS    | PERVIOUS (i) |                 |
| Surface Area (ha)=     | 2.03          | .91          |                 |
| Dep. Storage (mm)=     | 2.00          | 5.00         |                 |
| Average Slope (%)=     | 3.50          | 33.30        |                 |
| Length (m)=            | 300.00        | 6.00         |                 |
| Mannings n =           | .013          | .250         |                 |
|                        |               |              |                 |
| Max.eff.Inten.(mm/hr)= | 66.10         | 66.82        |                 |
| over (min)             | 4.00          | 5.00         |                 |
| Storage Coeff. (min)=  | 4.00 (ii)     | 5.15 (ii)    |                 |
| Unit Hyd. Tpeak (min)= | 4.00          | 5.00         |                 |
| Unit Hyd. peak (cms)=  | .28           | .22          |                 |
|                        |               |              | *TOTALS*        |
| PEAK FLOW (cms)=       | .32           | .16          | .477 (iii)      |
| TIME TO PEAK (hrs)=    | 3.00          | 3.00         | 3.000           |
| RUNOFF VOLUME (mm)=    | 62.80         | 38.15        | 52.693          |

64.80

.97

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0004:C00004-----

64.80

.59

64.800

.813

\* EXTERNAL (Routed through SWM Facility)

\_\_\_\_\_

TOTAL RAINFALL (mm)=

RUNOFF COEFFICIENT =

CALIB NASHYD Area (ha)= 11.940 Curve Number (CN)= 83.00

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R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\6-hour_SCS\2-CYRSCS.out
```

R0004:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

|   |       |              |        |       | ,     |        |        |  |
|---|-------|--------------|--------|-------|-------|--------|--------|--|
| ADD HYD                                 |       |              |        |       |       |        |        |  |
| 03:POST1+EXT                            |       | ID:NHYD      | AREA   | QPEAK | TPEAK | R.V.   | DWF    |  |
|   |       |              | (ha)   | (cms) | (hrs) | ( mm ) | (cms)  |  |
|   | ID 1  | 01:POST1     | 2.940  | .477  | 3.000 | 52.693 | .000   |  |
|   | +ID 2 | 02:EXT       | 11.940 | .960  | 3.117 | 30.575 | .000   |  |
| ======================================= |       |              |        |       |       |        | :===== |  |
|   | SUM   | 03:POST1+EXT | 14.880 | 1.334 | 3.033 | 34.945 | .000   |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0004:C00006-----

| R0004:C00006                              |         |             |            |            |           |           |         |    |
|---|---------|-------------|------------|------------|-----------|-----------|---------|----|
| * SWM Facility                            |         |             |            |            |           |           |         |    |
| ROUTE RESERVOIR ->  <br>  IN>03:POST1+EXT | Reque   | ested rout: | ing time s | step = 1.0 | min.      |           |         |    |
| OUT<04:SWM Facili                         | ======  |             |            | OUTLFOW ST | ORAGE TAI | BLE ===== |         | == |
|   | OUTFLOW | STORAGE     | OUTFLOW    | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW |    |
|   | (cms)   | (ha.m.)     | (cms)      | (ha.m.)    | (cms)     | (ha.m.)   | (cms)   |    |
|   | .000    | .0000E+00   | .010       | .1885E-01  | .082      | .5634E-01 | 1.421   |    |
|   | .002    | .9500E-03   | .010       | .2100E-01  | .140      | .5989E-01 | 1.571   |    |
|   | .003    | .1960E-02   | .010       | .2327E-01  | .208      | .6357E-01 | 1.732   |    |
|   | .004    | .3050E-02   | .011       | .2566E-01  | .285      | .6738E-01 | 1.906   |    |
|   | .005    | .4220E-02   | .011       | .2818E-01  | .370      | .7134E-01 | 2.095   |    |
|   | .006    | .5470E-02   | .011       | .3083E-01  | .462      | .7545E-01 | 2.299   |    |
|   | .006    | .6810E-02   | .012       | .3361E-01  | .562      | .7970E-01 | 2.520   |    |
|   | .007    | .8230E-02   | .012       | .3653E-01  | .668      | .8411E-01 | 2.758   |    |
|   | .007    | .9750E-02   | .012       | .3958E-01  | .780      | .8867E-01 | 3.015   |    |
|   | .008    | .1136E-01   | .013       | .4279E-01  | .897      | .9339E-01 | 3.291   |    |
|   | .008    | .1308E-01   | .013       | .4614E-01  | 1.020     | .9827E-01 | 3.588   |    |
|   | .009    | .1489E-01   | .013       | .4964E-01  | 1.148     | .1033E+00 | 3.904   |    |
|   | .009    | .1682E-01   | .038       | .5293E-01  | 1.282     | .1085E+00 | 4.242   |    |
| ROUTING RESULTS                           |         | AREA        | QPEAK      | TPEAK      | R.V.      |           |         |    |

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|                         | (ha)         | (cms)        | (hrs)    | ( mm ) |
|-------------------------|--------------|--------------|----------|--------|
| INFLOW > 03:POST1+EXT   | 14.880       | 1.334        | 3.033    | 34.945 |
| OUTFLOW < 04:SWM Facili | 14.880       | 1.171        | 3.133    | 34.945 |
| DEAK ELOI               | ו ספרווכידיו | ION [Oout // | 7in1(2)- | 97 769 |

PEAK FLOW REDUCTION [Qout/Qin](%)= 87.768
TIME SHIFT OF PEAK FLOW (min)= 6.00
MAXIMUM STORAGE USED (ha.m.)=.1042E+00

P0004:00007

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

| CALIB STANDHYD         | Area (ha)=    | .85          |                 |
|------------------------|---------------|--------------|-----------------|
| 05:POST2 DT= 1.00      | Total Imp(%)= | 21.00 Dir.   | Conn.(%)= 10.50 |
|                        |               |              |                 |
|                        | IMPERVIOUS    | PERVIOUS (i) |                 |
| Surface Area (ha)=     | .18           | .67          |                 |
| Dep. Storage (mm)=     | 2.00          | 5.00         |                 |
| Average Slope (%)=     | 6.00          | 11.10        |                 |
| Length (m)=            | 120.00        | 50.00        |                 |
| Mannings n =           | .013          | .250         |                 |
|                        |               |              |                 |
| Max.eff.Inten.(mm/hr)= | 66.10         | 53.07        |                 |
| over (min)             | 2.00          | 8.00         |                 |
| Storage Coeff. (min)=  | 1.96 (ii)     | 8.18 (ii)    |                 |
| Unit Hyd. Tpeak (min)= | 2.00          | 8.00         |                 |
| Unit Hyd. peak (cms)=  | .57           | .14          |                 |
|                        |               |              | *TOTALS*        |
| PEAK FLOW (cms)=       | .02           | .09          | .101 (iii)      |
| TIME TO PEAK (hrs)=    | 2.87          | 3.03         | 3.000           |
| RUNOFF VOLUME (mm)=    | 62.80         | 35.37        | 38.252          |
| TOTAL RAINFALL (mm)=   | 64.80         | 64.80        | 64.800          |
| RUNOFF COEFFICIENT =   | .97           | .55          | .590            |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
  TZERO = .00 hrs on
                     0
  METOUT= 2 (output = METRIC)
  NRUN = 0005
  NSTORM= 1
      # 1=100SCS6.stm
R0005:C00002-----
*#***********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
      : 07-31-2017
*# Modeller : [J. Lightheart]
          : WMI & Associates Ltd.
*# Company
*# License # : 2880720
*#***********************
* Post-Development Condition - Mansfield Ski Club
 READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
 Ptotal= 79.10 mm | Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
    TIME RAIN TIME
                     RAIN
                          TIME
                                 RAIN TIME
                                            RAIN TIME
                                                        RATN
                    mm/hr|
                               mm/hr| hh:mm mm/hr| hh:mm
   hh:mm mm/hr| hh:mm
                          hh:mm
                                                       mm/hr| hh:mm
    0:30 3.164 1:30 6.328
                          2:30 11.074
                                       3:30 20.566
                                                  4:30 6.328
                                                              5:30
    1:00 3.164 2:00 6.328 3:00 80.682 4:00 9.492 5:00 4.746 6:00
R0005:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD
                    Area (ha)= 2.94
 01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                     IMPERVIOUS
                                PERVIOUS (i)
                      2.03
   Surface Area
              (ha)=
                                 91
   Dep. Storage
               ( mm ) =
                         2.00
                                  5 00
   Average Slope
                (%)=
                        3.50
                                 33.30
   Length
                       300.00
                                  6.00
                (m) =
   Mannings n
                       .013
                                  .250
   Max.eff.Inten.(mm/hr)=
                      80.68
                                 86.82
           over (min)
                        4.00
                                  5.00
   Storage Coeff. (min)=
                        3.70 (ii) 4.72 (ii)
   Unit Hyd. Tpeak (min)=
                        4.00
                                  5.00
   Unit Hyd. peak (cms)=
                         3.0
                                   23
```

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```
*TOTALS*
                        39
                                 .21
                                           .599 (iii)
   PEAK FLOW
               (cms)=
   TIME TO PEAK (hrs)=
                        3.00
                                 3.00
                                           3.000
   RUNOFF VOLUME
               ( mm ) =
                       77.10
                                50.70
                                           66.275
                       79.10
                                 79.10
                                           79.100
   TOTAL RAINFALL (mm) =
   RUNOFF COEFFICIENT =
                        .97
                                 .64
                                            .838
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN^* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0005:C00004-----
* EXTERNAL (Routed through SWM Facility)
                    Area (ha)= 11.940 Curve Number (CN)= 83.00
CALIB NASHYD
02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                                .240
   Unit Hyd Qpeak (cms)= 1.900
   PEAK FLOW
               (cms) = 1 333 (i)
   TIME TO PEAK
               (hrs)=
                     3.117
   DURATION
               (hrs)=
                      7.667, (dddd|hh:mm:)= 0|07:40
   AVERAGE FLOW
               (cms)=
                      .182
   RUNOFF VOLUME
               (mm) = 42.046
   TOTAL RAINFALL (mm) = 79.100
   RUNOFF COEFFICIENT =
                     .532
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
______
R0005:C00005-----
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
_____
ADD HYD
03:POST1+EXT
               ID:NHYD
                               AREA OPEAK TPEAK
                                                     R V
                                                            DWF
                                (ha)
                                      (cms) (hrs)
                                                     (mm)
                                                          (cms)
               ID 1 01:POST1
                               2.940
                                       .599 3.000
                                                   66.275
               +ID 2 02:EXT
                               11.940
                                      1.333 3.117 42.046
                                                            .000
               ______
```

SIIM 03:POST1+EXT 14 880 1 806 3 033 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

R0005:C00006-----\* SWM Facility

| ROUTE RESERVOIR -> | Requested routing time | step = 1.0 min.       |              |
|--------------------|------------------------|-----------------------|--------------|
| IN>03:POST1+EXT    |                        |                       |              |
| OUT<04:SWM Facili  |                        | OUTLFOW STORAGE TABLE | ============ |

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|                      | OUTFLOW | STORAGE   | OUTFLOW | STORAGE   | OUTFLOW | STORAGE   | OUTFLOW |  |
|----------------------|---------|-----------|---------|-----------|---------|-----------|---------|--|
|                      | (cms)   | (ha.m.)   | (cms)   | (ha.m.)   | (cms)   | (ha.m.)   | (cms)   |  |
|                      | .000    | .0000E+00 | .010    | .1885E-01 | .082    | .5634E-01 | 1.421   |  |
|                      | .002    | .9500E-03 | .010    | .2100E-01 | .140    | .5989E-01 | 1.571   |  |
|                      | .003    | .1960E-02 | .010    | .2327E-01 | .208    | .6357E-01 | 1.732   |  |
|                      | .004    | .3050E-02 | .011    | .2566E-01 | .285    | .6738E-01 | 1.906   |  |
|                      | .005    | .4220E-02 | .011    | .2818E-01 | .370    | .7134E-01 | 2.095   |  |
|                      | .006    | .5470E-02 | .011    | .3083E-01 | .462    | .7545E-01 | 2.299   |  |
|                      | .006    | .6810E-02 | .012    | .3361E-01 | .562    | .7970E-01 | 2.520   |  |
|                      | .007    | .8230E-02 | .012    | .3653E-01 | .668    | .8411E-01 | 2.758   |  |
|                      | .007    | .9750E-02 | .012    | .3958E-01 | .780    | .8867E-01 | 3.015   |  |
|                      | .008    | .1136E-01 | .013    | .4279E-01 | .897    | .9339E-01 | 3.291   |  |
|                      | .008    | .1308E-01 | .013    | .4614E-01 | 1.020   | .9827E-01 | 3.588   |  |
|                      | .009    | .1489E-01 | .013    | .4964E-01 | 1.148   | .1033E+00 | 3.904   |  |
|                      | .009    | .1682E-01 | .038    | .5293E-01 | 1.282   | .1085E+00 | 4.242   |  |
|                      |         |           |         |           |         |           |         |  |
| ROUTING RESULTS      |         | AREA      | QPEAK   | TPEAK     | R.V.    |           |         |  |
|                      |         | (ha)      | (cms)   | (hrs)     | ( mm )  |           |         |  |
| INFLOW > 03:POST1+1  | EXT 1   | L4.880    | 1.806   | 3.033     | 46.833  |           |         |  |
| OUTFLOW < 04:SWM Fac | cili 1  | L4.880    | 1.618   | 3.117     | 46.833  |           |         |  |

PEAK FLOW REDUCTION [Qout/Qin](%)= 89.567
TIME SHIFT OF PEAK FLOW (min)= 5.00
MAXIMUM STORAGE USED (ha.m.)=.1212E+00

## R0005:C00007

- \* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
- \* SITE (POST2 Uncontrolled Area)

| IMPERVIOUS   PERVIOUS (i)  | CALIB STANDHYD D5:POST2 DT= 1 |          |            |          | Dir. | Conn.(%)= | = 10.50 |  |
|--|-------------------------------|----------|------------|----------|------|-----------|---------|--|
| Dep. Storage (mm) = 2.00 5.00 Average Slope (%) = 6.00 11.10 Length (m) = 120.00 50.00 Mannings n = .013 .250  Max.eff.Inten.(mm/hr) = 80.68 70.28   |                               |          | IMPERVIOUS | PERVIOUS | (i)  |           |         |  |
| Average Slope (%) = 6.00 11.10 Length (m) = 120.00 50.00 Mannings n = .013 .250  Max.eff.Inten.(mm/hr) = 80.68 70.28   | Surface Area                  | (ha) =   | .18        | .67      |      |           |         |  |
| Length (m)= 120.00 50.00  Mannings n = .013 .250   Max.eff.Inten.(mm/hr)= 80.68 70.28  | Dep. Storage                  | ( mm ) = | 2.00       | 5.00     |      |           |         |  |
| Mannings n = .013 .250  Max.eff.Inten.(mm/hr) = 80.68 70.28  | Average Slope                 | (%)=     | 6.00       | 11.10    |      |           |         |  |
| Max.eff.Inten.(mm/hr) = 80.68 70.28  | Length                        | (m)=     | 120.00     | 50.00    |      |           |         |  |
| over (min)         2.00         7.00           Storage Coeff. (min)=         1.81 (ii)         7.37 (ii)           Unit Hyd. Tpeak (min)=         2.00         7.00           Unit Hyd. peak (cms)=         .59         .16           *TOTALS*           PEAK FLOW (cms)=         .02         .12         .137 (iii)           TIME TO PEAK (hrs)=         2.73         3.02         3.000 | Mannings n                    | =        | .013       | .250     |      |           |         |  |
| Storage Coeff. (min) = 1.81 (ii) 7.37 (ii) Unit Hyd. Tpeak (min) = 2.00 7.00 Unit Hyd. peak (cms) = .59 .16  PEAK FLOW (cms) = .02 .12 .137 (iii) TIME TO PEAK (hrs) = 2.73 3.02 3.000   | Max.eff.Inten.(r              | mm/hr)=  | 80.68      | 70.28    |      |           |         |  |
| Unit Hyd. Tpeak (min) = 2.00 7.00 Unit Hyd. peak (cms) = .59 .16  PEAK FLOW (cms) = .02 .12 .137 (iii) TIME TO PEAK (hrs) = 2.73 3.02 3.000  | over                          | (min)    | 2.00       | 7.00     |      |           |         |  |
| Unit Hyd. peak (cms) = .59 .16  *TOTALS*  PEAK FLOW (cms) = .02 .12 .137 (iii)  TIME TO PEAK (hrs) = 2.73 3.02 3.000   | Storage Coeff.                | (min) =  | 1.81 (ii   | ) 7.37   | (ii) |           |         |  |
| *TOTALS*  PEAK FLOW (cms)= .02 .12 .137 (iii)  TIME TO PEAK (hrs)= 2.73 3.02 3.000   | Unit Hyd. Tpeak               | (min)=   | 2.00       | 7.00     |      |           |         |  |
| PEAK FLOW (cms)= .02 .12 .137 (iii) TIME TO PEAK (hrs)= 2.73 3.02 3.000  | Unit Hyd. peak                | (cms)=   | .59        | .16      |      |           |         |  |
| TIME TO PEAK (hrs)= 2.73 3.02 3.000  |                               |          |            |          |      | *TOTALS*  | *       |  |
|  | PEAK FLOW                     | (cms)=   | .02        | .12      |      | .137      | (iii)   |  |
| PIINOFF VOLUME (mm)= 77 10 47 52 50 623  | TIME TO PEAK                  | (hrs)=   | 2.73       | 3.02     |      | 3.000     |         |  |
| 101011 VOLOTE (mm.)- 11.10 41.32 30.023  | RUNOFF VOLUME                 | ( mm ) = | 77.10      | 47.52    |      | 50.623    |         |  |
| TOTAL RAINFALL (mm)= 79.10 79.10 79.10   | TOTAL RAINFALL                | ( mm ) = | 79.10      | 79.10    |      | 79.100    |         |  |
| RUNOFF COEFFICIENT = .97 .60 .640  | RUNOFF COEFFICIA              | ENT =    | .97        | .60      |      | .640      |         |  |

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

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```
CN* = 84.0 Ia = Dep. Storage (Above)
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0005:C00002-----
R0005:C00002-----
R0005:C00002-----
 ** END OF RUN : 4
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
TZERO = .00 hrs on
                0
  METOUT= 2 (output = METRIC)
 NRUN = 0006
 NSTORM= 1
     # 1=12regtim.o89
R0006:C00002----
*#************************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
        : 07-31-2017
*# Modeller : [J. Lightheart]
        : WMI & Associates Ltd.
*# Company
*# License # : 2880720
* Post-Development Condition - Mansfield Ski Club
R0006:C00002-----
| READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
TIME RAIN TIME RAIN TIME
                                  RAIN| TIME
                                            RAIN
                        RAIN
                              TIME
  hh:mm mm/hr |   1:00 15.000 3:00 10.000 5:00 5.000 7:00 43.000 9:00 23.000 11:00
   2:00 20.000 | 4:00 3.000 | 6:00 20.000 | 8:00 20.000 | 10:00 13.000 | 12:00
```

8/17/2020 12:52:09 PM 18/21

```
R0006:C00003-----
* SITE (POST1 - Controlled Area)
 CALIB STANDHYD
                    Area (ha)= 2.94
 01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                     IMPERVIOUS PERVIOUS (i)
              (ha)=
                      2.03
   Surface Area
                                 . 91
   Dep. Storage
               ( mm ) =
                      2.00
                                  5.00
   Average Slope (%)=
                      3.50
                               33.30
                               6.00
   Length
               (m) = 300.00
                                 .250
   Mannings n
                =
                      . 013
   Max.eff.Inten.(mm/hr)=
                       43.00
                                 53.33
          over (min)
                        5.00
                                  6.00
   Storage Coeff. (min)=
                        4.75 (ii) 6.00 (ii)
   Unit Hyd. Tpeak (min)=
                        5.00
                                  6.00
   Unit Hyd. peak (cms)=
                         .23
                                  .19
                                           *TOTALS*
   PEAK FLOW
               (cms)=
                         .21
                                  .13
                                            .342 (iii)
   TIME TO PEAK (hrs)=
                        7.00
                                 7.00
                                            7.000
   RUNOFF VOLUME (mm)=
                       191.00
                                158 56
                                           177.702
   TOTAL RAINFALL (mm)=
                       193.00
                                193.00
                                           193.000
   RUNOFF COEFFICIENT =
                       . 99
                                             .921
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0006:C00004-----
* EXTERNAL (Routed through SWM Facility)
 CALIB NASHYD
                    Area (ha)= 11.940 Curve Number (CN)= 83.00
 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                                 240
   Unit Hyd Qpeak (cms)= 1.900
   PEAK FLOW
               (cms) = 1.239 (i)
   TIME TO PEAK
              (hrs) = 7.017
   DURATION
               (hrs) = 13.667, (dddd|hh:mm:) = 0|13:40
   AVERAGE FLOW
               (cms)=
                      .353
   RUNOFF VOLUME
               (mm) = 145.537
   TOTAL RAINFALL (mm) = 193.000
   RUNOFF COEFFICIENT = .754
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
______
```

8/17/2020 12:52:09 PM

R\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\6-hour SCS\2-CYRSCS.out

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD 03:POST1+EXT |       | ID:NHYD      | AREA     | OPEAK | TPEAK   | R.V.    | DWF   |
|----------------------|-------|--------------|----------|-------|---------|---------|-------|
|                      |       | 12 111112    | (ha)     | (cms) | (hrs)   | (mm)    | (cms) |
|                      | ID 1  | 01:POST1     | 2.940    | .342  | 7.000   | 177.702 | .000  |
|                      | +ID 2 | 02:EXT       | 11.940   | 1.239 | 7.017   | 145.537 | .000  |
|                      | ===== |              | ======== |       | ======= |         |       |
|                      | SUM   | 03:POST1+EXT | 14.880   | 1.579 | 7.000   | 151.893 | .000  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\* SWM Facility

ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | =========== OUTLFOW STORAGE TABLE ========== ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms) .010 .1885E-01 .082 .5634E-01 | 1.421 . .000 .0000E+00| .010 .2100E-01 .140 .5989E-01 1.571 . .002 .9500E-03| .003 .1960E-02 .010 .2327E-01| .208 .6357E-01 1.732 . .004 .3050E-02 .011 .2566E-01 .285 .6738E-01| 1.906 . .005 .4220E-02 .011 .2818E-01 .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01 .462 .7545E-01 2.299 . .012 .3361E-01 .562 .7970E-01 .006 .6810E-02| 2.520 . .007 .8230E-02| .012 .3653E-01| .668 .8411E-01| 2.758 . .007 .9750E-02 .012 .3958E-01 .780 .8867E-01 .008 .1136E-01 .013 .4279E-01| .897 .9339E-01 3.291 . .008 .1308E-01| .013 .4614E-01| 1.020 .9827E-01| 3.588 . .013 .4964E-01 .009 .1489E-01| 1.148 .1033E+00 3.904 . .009 .1682E-01| .038 .5293E-01| 1.282 .1085E+00| 4.242 .

| ROUTING RESULTS     | AREA         | QPEAK | TPEAK | R.V.    |
|---------------------|--------------|-------|-------|---------|
|                     | (ha)         | (cms) | (hrs) | ( mm )  |
| INFLOW > 03:POST1-  | +EXT 14.880  | 1.579 | 7.000 | 151.893 |
| OUTFLOW < 04:SWM Fa | acili 14.880 | 1.561 | 7.033 | 151.892 |

PEAK FLOW REDUCTION [Qout/Qin](%)= 98.865 TIME SHIFT OF PEAK FLOW (min) = 2.00MAXIMIM STORAGE USED (ha.m.) = .1192E + 00

R0006:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

19/21

| CALIB STANDHYD | Area (ha)= | 05:POST2 | DT= 1.00 | Total Imp(%)= 21.00 | Dir. Conn.(%)= 10.50 IMPERVIOUS PERVIOUS (i)

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| ٧, | tırm i | -gerver | (Data) | Droi | ecte\ | 2015 | 15- | 319 | Degia | n\Storm | Teene | No1' | \SWMHYMO\ | DP\ | 6-hour | 9091 | 2-CVRSCS | 011+ |
|----|--------|---------|--------|------|-------|------|-----|-----|-------|---------|-------|------|-----------|-----|--------|------|----------|------|
|    |        |         |        |      |       |      |     |     |       |         |       |      |           |     |        |      |          |      |

| Surface Area     | (ha)=    | .18    | .67       |         |       |
|------------------|----------|--------|-----------|---------|-------|
| Dep. Storage     | (mm) =   | 2.00   | 5.00      |         |       |
| Average Slope    | (%)=     | 6.00   | 11.10     |         |       |
| Length           | ( m ) =  | 120.00 | 50.00     |         |       |
| Mannings n       | =        | .013   | .250      |         |       |
|                  |          |        |           |         |       |
| Max.eff.Inten.(n | nm/hr)=  | 43.00  | 44.82     |         |       |
| over             | (min)    | 2.00   | 9.00      |         |       |
| Storage Coeff.   | (min) =  | 2.33   | (ii) 8.99 | (ii)    |       |
| Unit Hyd. Tpeak  | (min) =  | 2.00   | 9.00      |         |       |
| Unit Hyd. peak   | (cms)=   | .50    | .13       |         |       |
|                  |          |        |           | *TOTALS | *     |
| PEAK FLOW        | (cms)=   | .01    | .08       | .094    | (iii) |
| TIME TO PEAK     | (hrs)=   | 6.92   | 7.00      | 7.000   |       |
| RUNOFF VOLUME    | ( mm ) = | 191.00 | 153.77    | 157.677 |       |
| TOTAL RAINFALL   | ( mm ) = | 193.00 | 193.00    | 193.000 |       |
| RUNOFF COEFFICIE | ENT =    | .99    | .80       | .817    |       |
|                  |          |        |           |         |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| R0006:C00008                           |             |      |  |
|--|-------------|------|--|
| R0006:C00002                           |             | <br> |  |
| R0006:C00002                           |             |      |  |
| FINISH                                 |             |      |  |
| ************************************** |             |      |  |
| Simulation ended on 2020-04-28         | at 12:05:03 |      |  |

| server | \Data\Projects                | \2015\15-            | -319\Design\Sto   | rm\Issue_No1\S    | MHYMO\PR\6-hour_SCS\2-CYRSCS.ou |
|--------|-------------------------------|----------------------|-------------------|-------------------|---------------------------------|
|        |                               |                      |                   |                   |                                 |
|        | Surface Area                  | (ha)=                | .18               | .67               |                                 |
|        | Dep. Storage<br>Everage Slope | ( mm ) =<br>( % ) =  | 2.00<br>6.00      | 5.00<br>11.10     |                                 |
|        | ength                         | (m)=                 | 120.00            | 50.00             |                                 |
|        | Mannings n                    | =                    | .013              | .250              |                                 |
|        |                               |                      |                   |                   |                                 |
| M      | lax.eff.Inten.(               |                      | 43.00             | 44.82             |                                 |
| S      | over<br>Storage Coeff.        | (min)<br>(min)=      | 2.00<br>2.33 (ii) | 9.00<br>8.99 (ii) |                                 |
|        | Init Hyd. Tpeak               |                      | 2.00              | 9.00              |                                 |
|        | Jnit Hyd. peak                |                      | .50               | .13               |                                 |
|        |                               |                      |                   |                   | *TOTALS*                        |
|        | PEAK FLOW                     | (cms)=               | .01               | .08               | .094 (iii)                      |
|        | IME TO PEAK                   | (hrs)=               | 6.92              | 7.00              | 7.000<br>157.677                |
|        | UNOFF VOLUME                  | ( mm ) =<br>( mm ) = | 191.00<br>193.00  | 153.77<br>193.00  | 193.000                         |
|        | UNOFF COEFFICI                |                      | .99               | .80               | .817                            |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      | TED FOR PERVIO    |                   |                                 |
|        | CN* = 84                      |                      | = Dep. Storage    |                   | THE CHODACE CORRECTED TO        |
|        | iii) PEAK FLOW                |                      |                   |                   | THE STORAGE COEFFICIENT.        |
| (      | _,                            |                      | 2                 |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
| FINI   | SH                            |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
| *****  | *****                         | ******               | *****             | *****             | *******                         |
|        | ARNINGS / ERRO                |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        | ulation ended                 |                      |                   | :05:03            |                                 |
|        |                               | =======              |                   | ========          |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
| 8/17/2 | 2020 12:52:09 P               | M                    |                   |                   | 21/2                            |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   | •                 |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |
|        |                               |                      |                   |                   |                                 |

| Post-Development Condition 4-hour Chicago Storm Distribution |
|--|

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.dat

```
Metric units
*#**********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller : [J. Lightheart]
*# Company
           : WMI & Associates Ltd.
*# License # : 2880720
*#*****************
* Post-Development Condition - Mansfield Ski Club
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
            TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1]
START
* %
               ["25mm4hr.stm"] <--storm filename
*8------
READ STORM STORM_FILENAME=["STORM.001"]
*8------
* SITE (POST1 - Controlled Area)
            ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.94](ha),
CALIB STANDHYD
              XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
              SCS curve number CN=[84],
              Pervious surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                              LGP=[6](m), MNP=[0.25], SCP=[0](min),
              Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                             LGI=[300](m), MNI=[0.013], SCI=[0](min),
              RAINFALL=[ , , , , ](mm/hr) , END=-1
*&-----
* EXTERNAL (Routed through SWM Facility)
              ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
              DWF=[0](cms), CN/C=[83], IA=[6.8](mm),
              N=[3], TP=[0.24]hrs,
              RAINFALL=[ , , , , ](mm/hr), END=-1
*%------
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
ADD HYD
*%------
* SWM Facility
ROUTE RESERVOIR
              IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                  TABLE of ( OUTFLOW-STORAGE ) values
                         (cms) - (ha-m)
                        [ 0.000 , 0.00000 ]
                        [0.0015 , 0.00095]
                        [0.0031 , 0.00196]
                        [0.0041 , 0.00305]
                        [0.0050 , 0.00422]
                        [0.0057 , 0.00547]
                        [0.0063 , 0.00681]
                        [0.0069 , 0.00823]
                        [0.0074 . 0.00975]
                        [0.0079 , 0.01136]
                        [0.0084 , 0.01308]
                        [0.0088 , 0.01489]
                        [0.0092 , 0.01682]
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\4-hour Chic\2-CYRCHI.dat

```
[0.0096 , 0.01885]
                              [0.0100 , 0.02100]
                              [0.0104 , 0.02327]
                              [0.0108 , 0.02566]
                              [0.0111 , 0.02818]
                              [0.0114 , 0.03083]
                              [0.0118 , 0.03361]
                              [0.0121 , 0.03653]
                              [0.0124 , 0.03958]
                              [0.0127 , 0.04279]
                              [0.0130 , 0.04614]
                              [0.0133 , 0.04964]
                              [0.0377 , 0.05293]
                              [0.0822 , 0.05634]
                              [0.1396 , 0.05989]
                              [0.2076 , 0.06357]
                              [0.2847 , 0.06738]
                              [0.3698 , 0.07134]
                              [0.4624 , 0.07545]
                              [0.5619 , 0.07970]
                              [0.6677 , 0.08411]
                              [0.7796 , 0.08867]
                              [0.8972 , 0.09339]
                              [1.0202 , 0.09827]
                              [1.1485 , 0.10332]
                              [1.2819 , 0.10854]
                              [1.4214 , 0.11394]
                              [1.5706 , 0.11951]
                              [1.7315 , 0.12526]
                              [1.9058 , 0.13120]
                              [2.0945 , 0.13732]
                              [2.2989 , 0.14363]
                              [2.5199 , 0.15014]
                              [2.7584 . 0.15655]
                              [3.0154 , 0.16308]
                              [3.2914 , 0.16974]
                              [3.5875 , 0.17653]
                              [3.9042 , 0.18344]
                              [4.2422 , 0.19049]
                              [ -1 , -1 ] (maximum one hundred pairs of points)
                              IDovf=[ ], NHYDovf=[" "],
*&_____|____
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
* SITE (POST2 - Uncontrolled Area)
                  ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.85](ha),
                  XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[84].
                  Pervious surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                     LGP=[50](m), MNP=[0.25], SCP=[0](min),
                  Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                     LGI=[120](m), MNI=[0.013], SCI=[0](min),
                  RAINFALL=[ , , , , ](mm/hr) , END=-1
```

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\*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2] ["2CHI4.stm"] <--storm filename \*8------\*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3] START \*% ["5CHI4.stm"] <--storm filename \*8\_\_\_\_\_| \*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] ["25CHI4.stm"] <--storm filename \*8------\*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr) START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5] ["100CHI4.stm"] <--storm filename \*\*-----\*% Timmins Regional Storm (12-hr) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[6] START ["12reqtim.o89"] <--storm filename FINISH

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.dat

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\4-hour Chic\2-CYRCHI.out \_\_\_\_\_\_ SSSSS W W M M H H Y Y M M 000 222 000 11 77777 == S WWW MM MM H H YY MM MM O O 2. 0 0 11 7 7 ннннн Y M M M 2 0 0 11 SSSSS W W W M M M 0 0 7 ww M M H H Y M M O O 222 0 0 11 S 7 == SSSSS 000 0 11 M M H H Y M M 2 Λ 0 0 11 7 # 2 StormWater Management HYdrologic Model 222 000 11 7 == \* \*\*\*\*\*\*\* A single event and continuous hydrologic simulation model \*\*\*\*\*\*\*\* \*\*\*\*\*\*\* based on the principles of HYMO and its successors OTTHYMO-83 and OTTHYMO-89. \* \*\*\*\*\*\*\*\*\*\*\*\* Distributed by: J.F. Sabourin and Associates Inc. Ottawa, Ontario: (613) 836-3884 Gatineau, Quebec: (819) 243-6858 \*\*\*\*\*\* +++++++++ E-Mail: swmhvmo@ifsa.com \* Barrie SERIAL#:2880720 \*\*\*\*\* ++++++ PROGRAM ARRAY DIMENSIONS ++++++ \*\*\*\*\*\*\*\*\*\*\* Maximum value for ID numbers : 11 +++++++++++++++ Max. number of rainfall points: 105408 +++++++++ Max. number of flow points : 105408 \* \* DETAILED OUTPUT \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* \*\*\*\*\* \* \* Input file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\4-hour\_Chic\2-CYRCHI.dat \* Output file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\4-hour Chic\2-CYRCHI out \* Summary file: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\Design\Storm\Issue\_ MO\PR\4-hour\_Chic\2-CYRCHI.sum \* User comments: \* 1:\_\_ \* 2:\_ \* 3:\_ \*

8/17/2020 12:41:57 PM

\*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] : WMI & Associates Ltd. \*# Company \*# License # : 2880720 \*#\* \* Post-Development Condition - Mansfield Ski Club | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\ TZERO = .00 hrs on METOUT= 2 (output = METRIC) NRUN = 0001 NSTORM= 1 # 1=25mm4hr.stm READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON. TIME RAIN TIME RATN TIME RATN TIME RATN TIME RATN TIME hh:mm mm/hr hh:mm mm/hr hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm 1:30 13.830 2:10 0:10 1.970 0:50 3.820 4.080 2:50 2.650 3:30 1:00 5.380 1:40 8.070 2.450 3:40 0:20 2.220 2:20 3.570 3:00 0:30 2.550 1:10 10.940 1:50 5.950 2:30 3.190 3:10 2.290 3:50 0:40 3.030 1:20 56.670 2:00 4.810 2:40 2.890 3:20 2.150 R0001:C00003-----\* SITE (POST1 - Controlled Area) CALIB STANDHYD (ha)= 2.94 | 01:POST1 | DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 2.03 .91 Dep. Storage (mm) =2 00 5 00 3 50 33 30 Average Slope (%)= 300.00 6.00 Length (m) =Mannings n 013 250 Max.eff.Inten.(mm/hr)= 56.67 23 86 over (min) 4 00 6 00 Storage Coeff. (min)= 4.26 (ii) 5.98 (ii) Unit Hvd. Tpeak (min)= 6.00 4.00 Unit Hyd. peak (cms)= \*TOTALS\* PEAK FLOW (cms)= 2.4 0.4 .274 (iii)

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue No1\SWMHYMO\PR\4-hour Chic\2-CYRCHI.out

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1.40

1.350

1.33

TIME TO PEAK

1/21

(hrs)=

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out RUNOFF VOLUME (mm)= 23.01 7.79 16.768 25.01 25 01 25.005 TOTAL RAINFALL (mm) = .31 .671 RUNOFF COEFFICIENT = .92 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. \_\_\_\_\_\_ R0001:C00004-----\* EXTERNAL (Routed through SWM Facility) CALIB NASHYD | Area (ha)= 11.940 Curve Number (CN)= 83.00 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= .240 Unit Hyd Qpeak (cms)= 1.900 PEAK FLOW .115 (i) (cms)= TIME TO PEAK (hrs)= 1.650 (hrs) = 5.667, (dddd|hh:mm:) = 0 | 05:40 DURATION AVERAGE FLOW (cms)= 028 RUNOFF VOLUME (mm)= 4.719 TOTAL RAINFALL (mm) = 25.005 RUNOFF COEFFICIENT = .189 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. R0001:C00005-----\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT) ADD HYD ID:NHYD 03:POST1+EXT AREA QPEAK TPEAK R.V. ( mm ) (ha) (cms) (hrs) (cms) ID 1 01:POST1 2.940 .274 1.350 16.768 000 11 940 .115 1.650 4.719 +TD 2 02:EXT \_\_\_\_\_\_ SUM 03:POST1+EXT 14.880 .300 1.367 7.100 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. R0001:C00006-----

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

| .002 | .9500E-03 | .010 | .2100E-01 | .140  | .5989E-01 | 1.571 |  |
|------|-----------|------|-----------|-------|-----------|-------|--|
| .003 | .1960E-02 | .010 | .2327E-01 | .208  | .6357E-01 | 1.732 |  |
| .004 | .3050E-02 | .011 | .2566E-01 | .285  | .6738E-01 | 1.906 |  |
| .005 | .4220E-02 | .011 | .2818E-01 | .370  | .7134E-01 | 2.095 |  |
| .006 | .5470E-02 | .011 | .3083E-01 | .462  | .7545E-01 | 2.299 |  |
| .006 | .6810E-02 | .012 | .3361E-01 | .562  | .7970E-01 | 2.520 |  |
| .007 | .8230E-02 | .012 | .3653E-01 | .668  | .8411E-01 | 2.758 |  |
| .007 | .9750E-02 | .012 | .3958E-01 | .780  | .8867E-01 | 3.015 |  |
| .008 | .1136E-01 | .013 | .4279E-01 | .897  | .9339E-01 | 3.291 |  |
| .008 | .1308E-01 | .013 | .4614E-01 | 1.020 | .9827E-01 | 3.588 |  |
| .009 | .1489E-01 | .013 | .4964E-01 | 1.148 | .1033E+00 | 3.904 |  |
| .009 | .1682E-01 | .038 | .5293E-01 | 1.282 | .1085E+00 | 4.242 |  |
|      |           |      |           |       |           |       |  |

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK | R.V.   |
|-------------------------|--------|-------|-------|--------|
|                         | (ha)   | (cms) | (hrs) | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | .300  | 1.367 | 7.100  |
| OUTFLOW < 04:SWM Facili | 14.880 | .083  | 2.300 | 7.100  |

PEAK FLOW REDUCTION [Qout/Qin](%)= 27.688
TIME SHIFT OF PEAK FLOW (min)= 56.00
MAXIMUM STORAGE USED (ha.m.)=.5640E-01

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001:C00007-

\_\_\_\_\_

|   | CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha) = Total Imp(%) = |              | Conn.(%)= 10.50 |
|---|------------------------------------|----------------------------|--------------|-----------------|
| - |                                    | IMPERVIOUS                 | PERVIOUS (i) |                 |
|   | Surface Area (ha)=                 |                            | .67          |                 |
|   | Dep. Storage (mm)=                 | 2.00                       | 5.00         |                 |
|   | Average Slope (%)=                 |                            |              |                 |
|   | Length (m)=                        | 120.00                     | 50.00        |                 |
|   | Mannings n =                       | .013                       | .250         |                 |
|   | Max.eff.Inten.(mm/hr)=             | 56.67                      | 11.01        |                 |
|   | over (min)                         | 2.00                       | 14.00        |                 |
|   | Storage Coeff. (min)=              | 2.09 (ii)                  | 13.75 (ii)   |                 |
|   | Unit Hyd. Tpeak (min)=             | 2.00                       | 14.00        |                 |
|   | Unit Hyd. peak (cms)=              | .54                        | .08          |                 |
|   |                                    |                            |              | *TOTALS*        |
|   | PEAK FLOW (cms)=                   | .01                        | .01          | .017 (iii)      |
|   | TIME TO PEAK (hrs)=                | 1.33                       | 1.55         | 1.333           |
|   | RUNOFF VOLUME (mm)=                | 23.00                      | 6.70         | 8.411           |
|   | TOTAL RAINFALL (mm)=               | 25.01                      | 25.01        | 25.005          |
|   | RUNOFF COEFFICIENT =               | .92                        | .27          | .336            |
|   |                                    |                            |              |                 |

<sup>(</sup>i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN\* = 84.0 Ia = Dep. Storage (Above)

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<sup>\*</sup> TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

<sup>\*</sup> SITE (POST2 - Uncontrolled Area)

<sup>(</sup>ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

<sup>(</sup>iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\4-hour_Chic\2-CYRCHI.out
   R0001:C00008-----
     ** END OF RUN : 0
    *****************************
    START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      ----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      TZERO = .00 hrs on
      METOUT= 2 (output = METRIC)
      NRUN = 0002
      NSTORM= 1
         # 1=2CHI4.stm
    *#***************************
    *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
    *# Date
             : 07-31-2017
    *# Modeller : [J. Lightheart]
    *# Company
              : WMI & Associates Ltd.
    *# License # : 2880720
    *#****************************
    * Post-Development Condition - Mansfield Ski Club
   R0002:C00002-----
     READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    Ptotal= 32.37 mm | Comments: 2-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
       TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME
       hh:mm mm/hr | hh:mm mm/hr | hh:mm mm/hr | hh:mm mm/hr | hh:mm
       0:10 2.552 0:50 4.945 1:30 17.908
                                        2:10 5.281 2:50 3.431 3:30
       0:20 2.869 1:00 6.961
                            1:40 10.450
                                        2:20 4.618
                                                  3:00 3.177 3:40
       0:30 3.301 1:10 14.171 1:50 7.709 2:30 4.124 3:10 2.963 3:50
       0:40 3.928 1:20 73.380 2:00 6.227 2:40 3.740 3:20 2.781 4:00
   R0002:C00003-----
    * SITE (POST1 - Controlled Area)
    ______
     CALIB STANDHYD | Area (ha)= 2.94
     01:POST1 DT= 1.00 | Total Imp(%)= 69.00 Dir. Conn.(%)= 59.00
                       IMPERVIOUS PERVIOUS (i)
       Surface Area (ha)= 2.03
                                  91
```

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

| Dep. Storage     | (mm) =   | 2.00   | 5.00      |         |         |
|------------------|----------|--------|-----------|---------|---------|
| Average Slope    | (%)=     | 3.50   | 33.30     |         |         |
| Length           | (m)=     | 300.00 | 6.00      |         |         |
| Mannings n       | =        | .013   | .250      |         |         |
| Max.eff.Inten.(  | nm/hr)=  | 73.38  | 41.45     |         |         |
| over             | (min)    | 4.00   | 5.00      |         |         |
| Storage Coeff.   | (min) =  | 3.84   | (ii) 5.22 | (ii)    |         |
| Unit Hyd. Tpeak  | (min) =  | 4.00   | 5.00      |         |         |
| Unit Hyd. peak   | (cms)=   | .29    | .22       |         |         |
|                  |          |        |           | *TOTAL: | S*      |
| PEAK FLOW        | (cms)=   | .32    | .07       | .38     | 5 (iii) |
| TIME TO PEAK     | (hrs)=   | 1.33   | 1.37      | 1.35    | 0       |
| RUNOFF VOLUME    | ( mm ) = | 30.37  | 12.54     | 23.06   | 4       |
| TOTAL RAINFALL   | ( mm ) = | 32.37  | 32.37     | 32.37   | 4       |
| RUNOFF COEFFICIE | ENT =    | .94    | .39       | .71     | 2       |
|                  |          |        |           |         |         |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  - CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0002:C00004-----

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD    | Area   | (ha) =   | 11.940 | Curve Number (CN   | )= 83.00 |
|-----------------|--------|----------|--------|--------------------|----------|
| 02:EXT DT= 1.00 | Ia     | ( mm ) = | 6.800  | # of Linear Res.(N | )= 3.00  |
|                 | U.H. T | p(hrs)=  | .240   |                    |          |

```
Unit Hyd Qpeak (cms)= 1.900
                     .229 (i)
PEAK FLOW
              (cms)=
TIME TO PEAK (hrs)=
                      1.617
DURATION
              (hrs) = 5.667, (dddd|hh:mm:) = 0|05:40
AVERAGE FLOW
             (cms)=
                       .049
RUNOFF VOLUME
              (mm) =
                      8 428
TOTAL RAINFALL (mm) = 32.374
RUNOFF COEFFICIENT =
                      . 260
```

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

R0002:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD 03:POST1+EXT |       | ID:NHYD      | AREA    | QPEAK | TPEAK | R.V.    | DWF   |
|----------------------|-------|--------------|---------|-------|-------|---------|-------|
|                      |       |              | (ha)    | (cms) | (hrs) | (mm)    | (cms) |
|                      | ID 1  | 01:POST1     | 2.940   | .385  | 1.350 | 23.064  | .000  |
|                      | +ID 2 | 02:EXT       | 11.940  | .229  | 1.617 | 8.428   | .000  |
|                      | ===== | =========    | ======= |       |       | ======= |       |
|                      | SUM   | 03:POST1+EXT | 14.880  | .459  | 1.367 | 11.320  | .000  |

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| NOTE: PEAK FLOWS DO                       | NOT INC | LUDE BASEFI | LOWS IF AN | TY.        |           |           |          |
|---|---------|-------------|------------|------------|-----------|-----------|----------|
| R0002:C00006* * SWM Facility              |         |             |            |            |           |           |          |
| ROUTE RESERVOIR ->  <br>  IN>03:POST1+EXT | _       |             | _          | _          |           |           |          |
| OUT<04:SWM Facili                         | ======  |             |            | OUTLFOW ST | ORAGE TAE | BLE ===== | ======== |
|   | OUTFLOW | STORAGE     | OUTFLOW    | STORAGE    | OUTFLOW   | STORAGE   | OUTFLOW  |
|   | (cms)   | (ha.m.)     | (cms)      | (ha.m.)    | (cms)     | (ha.m.)   | (cms)    |
|   | .000    | .0000E+00   | .010       | .1885E-01  | .082      | .5634E-01 | 1.421 .  |
|   | .002    | .9500E-03   | .010       | .2100E-01  | .140      | .5989E-01 | 1.571 .  |
|   | .003    | .1960E-02   | .010       | .2327E-01  | .208      | .6357E-01 | 1.732 .  |
|   | .004    | .3050E-02   | .011       | .2566E-01  | .285      | .6738E-01 | 1.906 .  |
|   | .005    | .4220E-02   | .011       | .2818E-01  | .370      | .7134E-01 | 2.095 .  |
|   | .006    | .5470E-02   | .011       | .3083E-01  | .462      | .7545E-01 | 2.299 .  |
|   |         |             |            | .3361E-01  |           |           |          |
|   |         |             |            | .3653E-01  |           |           |          |
|   |         |             |            | .3958E-01  |           |           |          |
|   | .008    | .1136E-01   | .013       | .4279E-01  | .897      | .9339E-01 | 3.291 .  |
|   |         |             |            | .4614E-01  |           |           |          |
|   |         |             |            | .4964E-01  |           |           | 3.904 .  |
|   |         |             |            | .5293E-01  |           | .1085E+00 | 4.242 .  |
| ROUTING RESULTS                           |         | AREA        | QPEAK      | TPEAK      | R.V.      |           |          |
|   |         |             |            |            | 4         |           |          |

| ROUTING RESULTS         | AREA   | QPEAK | TPEAK | R.V.   |
|-------------------------|--------|-------|-------|--------|
|                         | (ha)   | (cms) | (hrs) | ( mm ) |
| INFLOW > 03:POST1+EXT   | 14.880 | .459  | 1.367 | 11.320 |
| OUTFLOW < 04:SWM Facili | 14 880 | 230   | 1 883 | 11 320 |

PEAK FLOW REDUCTION [Qout/Qin](%) = 50.154
TIME SHIFT OF PEAK FLOW (min) = 31.00
MAXIMUM STORAGE USED (ha.m.) = .6469E-01

P0002:C00007-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

| CALIB STANDHYD        |   | Area  | (ha   | a)=  | .85      |      |           |       |  |
|-----------------------|---|-------|-------|------|----------|------|-----------|-------|--|
| 05:POST2 DT= 1.00     |   | Total | Imp(  | %)=  | 21.00    | Dir. | Conn.(%)= | 10.50 |  |
| ·<br>                 |   |       |       |      |          |      |           |       |  |
|                       |   | IMPER | .VIOU | S    | PERVIOUS | (i)  |           |       |  |
| Surface Area (ha)     | = |       | .18   |      | .67      |      |           |       |  |
| Dep. Storage (mm)     | = | 2     | 2.00  |      | 5.00     |      |           |       |  |
| Average Slope (%)     | = | 6     | 5.00  |      | 11.10    |      |           |       |  |
| Length (m)            | = | 120   | 0.00  |      | 50.00    |      |           |       |  |
| Mannings n            | = |       | 013   |      | .250     |      |           |       |  |
|                       |   |       |       |      |          |      |           |       |  |
| Max.eff.Inten.(mm/hr) | = | 73    | 3.38  |      | 22.33    |      |           |       |  |
| over (min             |   | 2     | 2.00  |      | 11.00    |      |           |       |  |
| Storage Coeff. (min   | = | 1     | .88   | (ii) | 10.67    | (ii) |           |       |  |
|                       |   |       |       |      |          |      |           |       |  |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out Unit Hyd. Tpeak (min)= 2.00 11.00 Unit Hyd. peak (cms)= .58 .11 \*TOTALS\* PEAK FLOW (cms)= .02 .03 .031 (iii) .02 .03 1.33 1.48 30.37 11.06 TIME TO PEAK (hrs)= 1.483 RUNOFF VOLUME (mm)= 13.091 32.37 32.37 TOTAL RAINFALL (mm)= 32.374 .94 .404 RUNOFF COEFFICIENT = .34 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN\* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. R0002:C00008-----R0002:C00002-----\*\* END OF RUN : 1 \* START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ ------ Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ TZERO = .00 hrs on METOUT= 2 (output = METRIC) NRUN = 0003 NSTORM= 1 # 1=5CHI4.stm \*#\* \*# Project Name: [Mansfield Ski Club] Project Number: [15-319] \*# Date : 07-31-2017 \*# Modeller : [J. Lightheart] \*# Company : WMI & Associates Ltd. \*# License # : 2880720 \* Post-Development Condition - Mansfield Ski Club R0003:C00002-----READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1\_Projects\15-319\ | Ptotal= 42.60 mm | Comments: 5-Year Chicago Storm Distribution (4-hour) Mansfield, ON.

TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME

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| hh:mm | mm/hr | hh:mm | mm/hr  | hh:mm | mm/hr  | hh:mm | mm/hr | hh:mm | mm/hr | hh:mm |
|-------|-------|-------|--------|-------|--------|-------|-------|-------|-------|-------|
| 0:10  | 3.347 | 0:50  | 6.492  | 1:30  | 23.565 | 2:10  | 6.934 | 2:50  | 4.502 | 3:30  |
| 0:20  | 3.764 | 1:00  | 9.144  | 1:40  | 13.736 | 2:20  | 6.062 | 3:00  | 4.168 | 3:40  |
| 0:30  | 4.331 | 1:10  | 18.640 | 1:50  | 10.128 | 2:30  | 5.413 | 3:10  | 3.887 | 3:50  |
| 0:40  | 5.155 | 1:20  | 96.860 | 2:00  | 8.178  | 2:40  | 4.908 | 3:20  | 3.648 | 4:00  |

RUUU3:CUUUU3-----

\* SITE (POST1 - Controlled Area)

| Ιc  | ALIB STANDHYD   | 1        | Area (ha)=    | 2.94     |      |           |         |
|-----|-----------------|----------|---------------|----------|------|-----------|---------|
| į o | 1:POST1 DT=     | 1.00     | Total Imp(%)= | 69.00    | Dir. | Conn.(%): | = 59.00 |
|     |                 |          |               |          |      |           |         |
|     |                 |          | IMPERVIOUS    | PERVIOUS | (i)  |           |         |
|     | Surface Area    | (ha) =   | 2.03          | .91      |      |           |         |
|     | Dep. Storage    | (mm) =   | 2.00          | 5.00     |      |           |         |
|     | Average Slope   | (%)=     | 3.50          | 33.30    |      |           |         |
|     | Length          | ( m ) =  | 300.00        | 6.00     |      |           |         |
|     | Mannings n      | =        | .013          | .250     |      |           |         |
|     |                 |          |               |          |      |           |         |
|     | Max.eff.Inten.( | mm/hr)=  | 96.86         | 67.61    |      |           |         |
|     | over            | (min)    | 3.00          | 5.00     |      |           |         |
|     | Storage Coeff.  | (min) =  | 3.44 (ii)     | 4.57     | (ii) |           |         |
|     | Unit Hyd. Tpeak | (min) =  | 3.00          | 5.00     |      |           |         |
|     | Unit Hyd. peak  | (cms)=   | .34           | .24      |      |           |         |
|     |                 |          |               |          |      | *TOTALS   | *       |
|     | PEAK FLOW       | (cms)=   | .44           | .13      |      | .554      | (iii)   |
|     | TIME TO PEAK    | (hrs)=   | 1.33          | 1.37     |      | 1.333     |         |
|     | RUNOFF VOLUME   | ( mm ) = | 40.60         | 19.99    |      | 32.151    |         |
|     | TOTAL RAINFALL  | (mm) =   | 42.60         | 42.60    |      | 42.603    |         |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

.47

.755

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

R0003:C00004-----

\* EXTERNAL (Routed through SWM Facility)

RUNOFF COEFFICIENT = .95

| CALIB NASHYD   |          | Area (ha)= 11.940 Curve Number (CN)= 83.00   |
|----------------|----------|--|
| 02:EXT DT= 1   | 1.00     | Ia $(mm)$ = 6.800 # of Linear Res.(N) = 3.00 |
|                |          | U.H. $Tp(hrs) = .240$                        |
|                | , ,      | 1 000  |
| Unit Hyd Qpeak | (cms)=   | 1.900  |
| PEAK FLOW      | (cms)=   | .433 (i)                                     |
| TIME TO PEAK   | (hrs)=   | 1.600  |
| DURATION       | (hrs)=   | 5.667, (dddd hh:mm:)= 0 05:40                |
| AVERAGE FLOW   | (cms)=   | .085   |
| RUNOFF VOLUME  | ( mm ) = | 14.595                                       |
| TOTAL RAINFALL | ( mm ) = | 42.603                                       |

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

RUNOFF COEFFICIENT = .343

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

R0003:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

| ADD HYD 03:POST1+EXT |      | ID:NHYD      | AREA   | QPEAK | TPEAK | R.V.   | DWF   |  |
|----------------------|------|--------------|--------|-------|-------|--------|-------|--|
|                      |      |              | (ha)   | (cms) | (hrs) | ( mm ) | (cms) |  |
|                      | ID 1 | 01:POST1     | 2.940  | .554  | 1.333 | 32.151 | .000  |  |
| +                    | ID 2 | 02:EXT       | 11.940 | .433  | 1.600 | 14.595 | .000  |  |
|                      |      |              |        |       |       |        |       |  |
| S                    | UM   | 03:POST1+EXT | 14.880 | .706  | 1.350 | 18.064 | .000  |  |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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\* SWM Facility

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| ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. | IN>03:POST1+EXT | | OUT<04:SWM Facili | ============ OUTLFOW STORAGE TABLE ============

-----OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | (cms) .000 .0000E+00 .010 .1885E-01| .082 .5634E-01 | 1.421 . .003 .1960E-02| .010 .2327E-01| .208 .6357E-01| 1.732 . .004 .3050E-02 .011 .2566E-01 .285 .6738E-01| 1.906 . .005 .4220E-02| .011 .2818E-01 .370 .7134E-01 2.095 . .006 .5470E-02 .011 .3083E-01 .462 .7545E-01 2.299 . .012 .3361E-01 .562 .7970E-01 .006 .6810E-02| 2.520 . .007 .8230E-02 .012 .3653E-01 .668 .8411E-01 2.758 . .007 .9750E-02| .012 .3958E-01| .780 .8867E-01 3.015 .

.013 .4279E-01|

1.717

.013 .4614E-01 | 1.020 .9827E-01|

18.064

.013 .4964E-01| 1.148 .1033E+00|

.897 .9339E-01|

3.291 .

3 588

3.904 .

.009 .1682E-01 | .038 .5293E-01 | 1.282 .1085E+00 | 4.242 .

ROUTING RESULTS AREA QPEAK TPEAK R.V.
------ (ha) (cms) (hrs) (mm)
INFLOW > 03:POST1+EXT 14.880 .706 1.350 18.064

.008 .1136E-01|

008 1308E-01

.009 .1489E-01

OUTFLOW < 04:SWM Facili 14.880

PEAK FLOW REDUCTION [Qout/Qin](%) = 68.869

TIME SHIFT OF PEAK FLOW (min) = 22.00

MAXIMUM STORAGE USED (ha.m.) = .7650E-01

R0003:C00007-----

.487

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

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#### \* SITE (POST2 - Uncontrolled Area)

\_\_\_\_\_

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| CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha)= Total Imp(%)= |            | ir. Conn.(%)= 10.50 |
|------------------------------------|--------------------------|------------|---------------------|
| <br>                               | IMPERVIOUS               | PERVIOUS ( | i)                  |
| Surface Area (ha)=                 |                          | .67        | -,                  |
| Dep. Storage (mm)=                 |                          | 5.00       |                     |
| Average Slope (%)=                 |                          |            |                     |
| Length (m)=                        |                          |            |                     |
| Mannings n =                       |                          | .250       |                     |
| Max.eff.Inten.(mm/hr)=             | 96.86                    | 46.11      |                     |
|                                    |                          | 8.00       |                     |
| Storage Coeff. (min)=              |                          | 8.26 (i    | i)                  |
| Unit Hyd. Tpeak (min)=             |                          |            | ,                   |
| Unit Hyd. peak (cms)=              | .62                      | .14        |                     |
|                                    |                          |            | *TOTALS*            |
| PEAK FLOW (cms)=                   | .02                      | .05        | .062 (iii)          |
| TIME TO PEAK (hrs)=                | 1.33                     | 1.42       | 1.350               |
| RUNOFF VOLUME (mm)=                | 40.60                    | 18.03      | 20.399              |
| TOTAL RAINFALL (mm)=               | 42.60                    | 42.60      | 42.603              |
| RUNOFF COEFFICIENT =               | .95                      | .42        | .479                |
|                                    |                          |            |                     |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- ${\tt CN^*=84.0}$  Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| R0003:C00002 |   |
|--------------|---|
|              |   |
| **********   | **************************  |
|              | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\  |
| START<br>    | Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\ |

.799

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\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

```
*#***********************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date : 07-31-2017
*# Modeller
          : [J. Lightheart]
*# Company : WMI & Associates Ltd.
*# License # : 2880720
*#***************************
* Post-Development Condition - Mansfield Ski Club
R0004:C00002-----
READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
Ptotal= 58.08 mm | Comments: 25-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
   TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME
                                                       RAIN
                                                           TIME
   hh:mm mm/hr| hh:mm mm/hr| hh:mm mm/hr| hh:mm
                                           mm/hr| hh:mm
                                                      mm/hr| hh:mm
   0:10 4.562 0:50 8.850 1:30 32.125 2:10
                                           9.453 2:50
                                                      6.138
    0:20 5.131 1:00 12.466 1:40 18.726 2:20
   0:30 5.904 1:10 25.411 1:50 13.807 2:30 7.379 3:10 5.299
    0:40 7.028 1:20 132.047 2:00 11.148 2:40 6.691 3:20 4.973
* SITE (POST1 - Controlled Area)
_____
| CALIB STANDHYD | Area (ha)= 2.94
IMPERVIOUS PERVIOUS (i)
   Surface Area (ha)=
                     2.03
                                .91
   Dep. Storage
                       2.00
                                 5.00
               ( mm ) =
   Average Slope
               ( % ) =
                       3.50
                                33.30
               (m)=
   Length
                      300.00
                                 6.00
   Mannings n
                       .013
                                .250
   Max.eff.Inten.(mm/hr) = 132.05
                               113.47
         over (min)
                      3.00
                                 4.00
   Storage Coeff. (min)=
                       3.03 (ii) 3.96 (ii)
   Unit Hyd. Tpeak (min)=
                       3.00
                                 4.00
                                 .28
   Unit Hyd. peak (cms)=
                       .37
                                         *TOTALS*
   PEAK FLOW
              (cms)=
                        .61
                                 .23
                                           .830 (iii)
   TIME TO PEAK
              (hrs)=
                       1.33
                                 1.35
                                           1.333
   RUNOFF VOLUME
              ( mm ) =
                       56.08
                                32.44
                                          46.388
   TOTAL RAINFALL (mm)=
                       58.08
                                58.08
                                          58.079
```

.97

RUNOFF COEFFICIENT =

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<sup>(</sup>i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN\* = 84.0 Ia = Dep. Storage (Above)

<sup>(</sup>ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

<sup>(</sup>iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

```
R0004:C00004-----
* EXTERNAL (Routed through SWM Facility)
 CALIB NASHYD
                         (ha)= 11.940 Curve Number (CN)= 83.00
                   Area
 02:EXT DT= 1.00 | Ia (mm)= 6.800 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)=
                               240
   Unit Hyd Qpeak (cms)= 1.900
   PEAK FLOW
              (cms)=
                     .810 (i)
   TIME TO PEAK
              (hrs) = 1.583
   DURATION
              (hrs) = 5.667, (dddd|hh:mm:) = 0|05:40
   AVERAGE FLOW
              (cms)=
                      .149
   RUNOFF VOLUME
              (mm) = 25.455
   TOTAL RAINFALL (mm) = 58.079
   RUNOFF COEFFICIENT =
   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0004:C00005-----
* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ADD HYD
 03:POST1+EXT ID:NHYD
                              AREA
                                      QPEAK TPEAK
                                                   R.V.
                                                          DWF
                                     (cms) (hrs)
                              (ha)
                                                   (mm) (cms)
              ID 1 01:POST1
                              2.940
                                     .830 1.333 46.388
                             11.940
                                     .810 1.583 25.455 .000
              _____
              SUM 03:POST1+EXT 14.880 1.160 1.350 29.591 .000
 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
R0004:C00006-----
* SWM Facility
 ROUTE RESERVOIR -> | Requested routing time step = 1.0 min.
 IN>03:POST1+EXT
 OUT<04:SWM Facili | =========== OUTLFOW STORAGE TABLE ==========
(cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms)
                  .000 .0000E+00|
                               .010 .1885E-01
                                             .082 .5634E-01
                                                         1.421 .
                   .002 .9500E-03|
                               .010 .2100E-01|
                                             .140 .5989E-01|
                                                         1.571 .
                   .003 .1960E-02|
                               .010 .2327E-01
                                             .208 .6357E-01 1.732 .
                   .004 .3050E-02|
                               .011 .2566E-01
                                             .285 .6738E-01 | 1.906 .
                   .005 .4220E-02|
                               .011 .2818E-01|
                                             .370 .7134E-01| 2.095 .
                   .006 .5470E-02
                               .011 .3083E-01
                                             .462 .7545E-01 2.299 .
                   .006 .6810E-02
                               .012 .3361E-01
                                            .562 .7970E-01| 2.520 .
                   .007 .8230E-02|
                               .012 .3653E-01|
                                             .668 .8411E-01| 2.758 .
                   .007 .9750E-02
                               .012 .3958E-01
                                             .780 .8867E-01 3.015 .
```

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```
.008 .1136E-01 .013 .4279E-01
                                                  .897 .9339E-01| 3.291 .
                    .008 .1308E-01|
                                    .013 .4614E-01| 1.020 .9827E-01|
                                                                  3 588
                                    .013 .4964E-01| 1.148 .1033E+00|
                    .009 .1489E-01|
                                                                   3.904 .
                                  .038 .5293E-01 | 1.282 .1085E+00|
                   .009 .1682E-01|
                                                                   4.242 .
ROUTING RESULTS
                        AREA
                                OPEAK
                                         TPEAK
                                                   R.V.
_____
                        (ha)
                                (cms)
                                         (hrs)
                                                  ( mm )
INFLOW > 03:POST1+EXT 14 880
                                1 160
                                        1 350
                                                 29 591
OUTFLOW < 04:SWM Facili 14.880
                              .928
                                      1.650
                                                29.591
            PEAK FLOW REDUCTION [Qout/Qin](%)= 79.995
            TIME SHIFT OF PEAK FLOW
                                      (min) = 18.00
            MAXIMUM STORAGE USED
                                      (ha.m.) = .9462E - 01
```

-----

0004:C00007

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- \* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)
- \* SITE (POST2 Uncontrolled Area)

| CALIB STANDHYD | Area (ha)=

| İ | 05:POST2 DT=    | 1.00     | Total Imp(%)= | 21.00 Dir    | . Conn.(%)= | 10.50 |
|---|-----------------|----------|---------------|--------------|-------------|-------|
| _ |                 |          | IMPERVIOUS    | PERVIOUS (i) |             |       |
|   | Surface Area    | (ha)=    | .18           | .67          |             |       |
|   | Dep. Storage    | ( mm ) = | 2.00          | 5.00         |             |       |
|   | Average Slope   | (%)=     | 6.00          | 11.10        |             |       |
|   | Length          | ( m ) =  | 120.00        | 50.00        |             |       |
|   | Mannings n      | =        | .013          | .250         |             |       |
|   |                 |          |               |              |             |       |
|   | Max.eff.Inten.( | mm/hr)=  | 132.05        | 82.34        |             |       |
|   | over            | (min)    | 1.00          | 7.00         |             |       |
|   | Storage Coeff.  | (min) =  | 1.49 (ii)     | 6.70 (ii)    |             |       |
|   | Unit Hyd. Tpeak | (min) =  | 1.00          | 7.00         |             |       |
|   | Unit Hyd. peak  | (cms)=   | .83           | .17          |             |       |
|   |                 |          |               |              | *TOTALS*    |       |
|   | PEAK FLOW       | (cms)=   | .03           | .10          | .115        | (iii) |
|   | TIME TO PEAK    | (hrs)=   | 1.33          | 1.40         | 1.333       |       |
|   | RUNOFF VOLUME   | (mm) =   | 56.06         | 29.88        | 32.633      |       |
|   | TOTAL RAINFALL  | ( mm ) = | 58.08         | 58.08        | 58.079      |       |
|   | RUNOFF COEFFICI | ENT =    | .97           | .51          | .562        |       |
|   |                 |          |               |              |             |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No1\SWMHYMO\PR\4-hour_Chic\2-CYRCHI.out
   R0004:C00002-----
     ** END OF RIN : 3
    **************************
    START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    -----Bainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
      TZERO = .00 hrs on
      METOUT= 2 (output = METRIC)
      NRUN = 0005
      NSTORM= 1
        # 1=100CHI4.stm
    ______
   *#************************
   *# Project Name: [Mansfield Ski Club] Project Number: [15-319]
   *# Date : 07-31-2017
   *# Modeller : [J. Lightheart]
   *# Company : WMI & Associates Ltd.
   *# License # : 2880720
    *#****************************
    * Post-Development Condition - Mansfield Ski Club
   R0005:C00002-----
    READ STORM | Filename: C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
    Ptotal= 70.93 mm | Comments: 100-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
       TIME RAIN TIME RAIN
                           TIME RAIN TIME RAIN
                                                 TIME RAIN
                                                            TIME
      hh:mm mm/hr | hh:mm mm/hr | hh:mm mm/hr | hh:mm
                                                      mm/hr| hh:mm
       0:10 5 571 0:50 10 808
                           1:30 39.231
                                      2:10 11 544
                                                 2:50 7.495 3:30
       0:20 6.266 1:00 15.223
                           1:40 22.869
                                       2:20 10.093 3:00 6.939 3:40
       0:30 7.210 1:10 31.032 1:50 16.861 2:30 9.012 3:10 6.472 3:50
       0:40 8.582 1:20 161.254 2:00 13.614 2:40 8.171 3:20 6.073 4:00
   R0005:C00003-----
   * SITE (POST1 - Controlled Area)
    CALIB STANDHYD | Area (ha)= 2.94
    | 01:POST1 | DT= 1.00 | Total Imp(%)= 69.00 | Dir. Conn.(%)= 59.00
                      IMPERVIOUS PERVIOUS (i)
       Surface Area
                (ha) = 2.03
                                 .91
                                  5 00
      Dep. Storage (mm)=
                         2.00
      Average Slope
                 (%)=
                         3.50
                                  33.30
```

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| Length          | (m)=     | 300.00 | 6.00      |             |
|-----------------|----------|--------|-----------|-------------|
| Mannings n      | =        | .013   | .250      |             |
|                 |          |        |           |             |
| Max.eff.Inten.( | mm/hr)=  | 161.25 | 151.92    |             |
| over            | (min)    | 3.00   | 4.00      |             |
| Storage Coeff.  | (min) =  | 2.80   | (ii) 3.62 | (ii)        |
| Unit Hyd. Tpeak | (min) =  | 3.00   | 4.00      |             |
| Unit Hyd. peak  | (cms)=   | .39    | .30       |             |
|                 |          |        |           | *TOTALS*    |
| PEAK FLOW       | (cms)=   | .75    | .32       | 1.062 (iii) |
| TIME TO PEAK    | (hrs)=   | 1.33   | 1.35      | 1.333       |
| RUNOFF VOLUME   | ( mm ) = | 68.93  | 43.47     | 58.488      |
| TOTAL RAINFALL  | ( mm ) = | 70.93  | 70.93     | 70.926      |
| RUNOFF COEFFICI | ENT =    | .97    | .61       | .825        |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

R0005:C00004-----

\* EXTERNAL (Routed through SWM Facility)

| CALIB NASHYD<br>  02:EXT DT= | 1.00   | Ia   |   | 6.800 |  |  |
|------------------------------|--------|------|---|-------|--|--|
| Unit Hyd Qpeak               | (cms)= | 1.90 | 0 |       |  |  |

PEAK FLOW (cms)= 1.168 (i)

TIME TO PEAK (hrs)= 1.567

DURATION (hrs)= 5.667, (dddd|hh:mm:)= 0|05:40

AVERAGE FLOW (cms)= .207

RUNOFF VOLUME (mm)= 35.404

TOTAL RAINFALL (mm)= 70.926

RUNOFF COEFFICIENT = .499

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

R0005:C00005-----

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)

ADD HYD ID:NHYD 03:POST1+EXT AREA QPEAK TPEAK R.V. DWF \_\_\_\_\_ (ha) (cms) (hrs) (mm) (cms) 2.940 1.062 1.333 TD 1 01:POST1 58.488 .000 +ID 2 02:EXT 11.940 1.168 1.567 35.404 .000 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 1.575 1.350 39.965 .000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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R0005:C00006-----\* SWM Facility ROUTE RESERVOIR -> | Requested routing time step = 1.0 min. TN>03:POST1+EXT OUT<04:SWM Facili | ============= OUTLFOW STORAGE TABLE ========== ------OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) | (cms) (ha.m.) | (cms) (ha.m.) | .000 .0000E+00| .010 .1885E-01| .082 .5634E-01| 1.421 . .002 .9500E-03| .010 .2100E-01| .140 .5989E-01 1.571 . .010 .2327E-01 .208 .6357E-01 .003 .1960E-02 1.732 . .011 .2566E-01 .004 .3050E-02| .285 .6738E-01| 1.906 . .005 .4220E-02| .011 .2818E-01| .370 .7134E-01 2.095 . .006 .5470E-02| .011 .3083E-01| .462 .7545E-01 2.299 . .006 .6810E-02| .012 .3361E-01 .562 .7970E-01| 2.520 . .007 .8230E-02| .012 .3653E-01 .668 .8411E-01 2.758 . .007 .9750E-02| .012 .3958E-01 .780 .8867E-01| 3.015 . .008 .1136E-01| .013 .4279E-01| .897 .9339E-01| 3.291 . .008 .1308E-01| .013 .4614E-01 | 1.020 .9827E-01| 3.588 . .009 .1489E-01| .013 .4964E-01 1.148 .1033E+00 3.904 . .009 .1682E-01| .038 .5293E-01| 1.282 .1085E+00| 4.242 . ROUTING RESULTS AREA OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 1.575 INFLOW > 03:POST1+EXT 14.880 1.350 39.965 OUTFLOW < 04:SWM Facili 14.880 39.965 1.331 1.633 PEAK FLOW REDUCTION [Qout/Qin](%)= 84.503 TIME SHIFT OF PEAK FLOW (min) = 17.00MAXIMUM STORAGE USED (ha.m.) = .1105E+00\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED) \* SITE (POST2 - Uncontrolled Area) CALIB STANDHYD Area (ha)= .85 05:POST2 DT= 1.00 | Total Imp(%)= 21.00 Dir. Conn.(%)= 10.50 IMPERVIOUS PERVIOUS (i) .18 Surface Area (ha)= 67 Dep. Storage (mm) =2.00 5 00 Average Slope (%)= 6.00 11.10 Length (m) =120 00 50.00 .013 .250 Mannings n Max.eff.Inten.(mm/hr)= 161.25 116 15 over (min) 1.00 6.00 Storage Coeff. (min)= 1.38 (ii) 5.92 (ii) 1 00 Unit Hvd. Tpeak (min) = 6 00 Unit Hyd. peak (cms)= 88 19

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

```
*TOTALS*
   PEAK FLOW
                       0.4
                                         .174 (iii)
              (cms)=
                                .15
   TIME TO PEAK
             (hrs)=
                       1.33
                                1.38
                                         1.333
   RUNOFF VOLUME
              ( mm ) =
                      68.92
                               40.51
                                         43.489
   TOTAL RAINFALL (mm)=
                      70.93
                               70.93
                                         70.926
   RUNOFF COEFFICIENT =
                       .97
                               .57
                                          .613
    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN^* = 84.0 Ia = Dep. Storage (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
R0005:C00002----
 ** END OF RUN : 4
*************************
START | Project dir.:C:\Users\BDANIELS\Desktop\COVID-19\1_Projects\15-319\
----- Rainfall dir.:C:\Users\BDANIELS\Desktop\COVID-19\1 Projects\15-319\
  TZERO = .00 hrs on
  METOUT= 2 (output = METRIC)
  NRUN = 0006
  NSTORM= 1
     # 1=12regtim.o89
*#****************
*# Project Name: [Mansfield Ski Club] Project Number: [15-319]
*# Date
          : 07-31-2017
*# Modeller
          : [J. Lightheart]
*# Company
          : WMI & Associates Ltd.
*# License # : 2880720
* Post-Development Condition - Mansfield Ski Club
R0006:C00002-----
                                                          18/21
```

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| READ STORM  <br>  Ptotal= 193.00 mm                 | Filena                | me: C:\Users\BD<br>ts: TIMMINS REG             | ANIELS\De                  | sktop\<br>RM (12      | COVID-19\1<br>-hour)        | _Projec                | ts\15-319                   | \                       |
|---|-----------------------|--|----------------------------|-----------------------|-----------------------------|------------------------|-----------------------------|-------------------------|
| TIME RAIN   hh:mm mm/hr   1:00 15.000   2:00 20.000 | hh:mm<br>3:00<br>4:00 | mm/hr   hh:mm<br>10.000   5:00<br>3.000   6:00 | mm/hr <br>5.000 <br>20.000 | hh:mm<br>7:00<br>8:00 | mm/hr <br>43.000 <br>20.000 | hh:mm<br>9:00<br>10:00 | mm/hr <br>23.000 <br>13.000 | hh:mm<br>11:00<br>12:00 |
| R0006:C00003 * SITE (POST1 - Contr                  | olled A               |  |                            |                       |                             |                        |                             |                         |
| CALIB STANDHYD 01:POST1 DT= 1                       | .00                   |  |                            | Dir.                  | Conn.(%)=                   | 59.00                  |                             |                         |
|   |                       | IMPERVIOUS                                     | PERVIOUS                   | (i)                   |                             |                        |                             |                         |
| Surface Area  | (ha)=                 |  | .91                        | ( ± )                 |                             |                        |                             |                         |
| Dep. Storage  | ( mm ) =              | 2.00   | 5.00                       |                       |                             |                        |                             |                         |
| Dep. Storage<br>Average Slope                       | (%)=                  | 3.50   | 33.30                      |                       |                             |                        |                             |                         |
| Length  | (m)=                  | 300.00   | 6.00                       |                       |                             |                        |                             |                         |
| Mannings n  |                       |  | .250                       |                       |                             |                        |                             |                         |
| Max.eff.Inten.(m                                    | m/hr)=                | 43.00  | 53.33                      |                       |                             |                        |                             |                         |
| over  | (min)                 | 5.00   | 6.00                       |                       |                             |                        |                             |                         |
| over<br>Storage Coeff.                              | (min)=                | 4.75 (ii)                                      | 6.00                       | (ii)                  |                             |                        |                             |                         |
| Unit Hyd. Tpeak                                     | (min)=                | 5.00   | 6.00                       |                       |                             |                        |                             |                         |
| Unit Hyd. peak                                      | (cms)=                | .23  | .19                        |                       |                             |                        |                             |                         |
|   |                       |  |                            |                       | *TOTALS*                    |                        |                             |                         |
|   | (cms)=                |  | .13                        |                       | .342 (                      | iii)                   |                             |                         |
| TIME TO PEAK  | (hrs)=                | 7.00   | 7.00                       |                       | 7.000                       |                        |                             |                         |
| RUNOFF VOLUME                                       | (mm) =                | 191.00   | 158.56<br>193.00           |                       | 177.702                     |                        |                             |                         |
| TOTAL RAINFALL<br>RUNOFF COEFFICIE                  | ( mm ) =              | 193.00   | 193.00                     |                       | 193.000<br>.921             |                        |                             |                         |
|   |                       |  |                            |                       | .,,,,                       |                        |                             |                         |
|   |                       | CTED FOR PERVIO                                |                            |                       |                             |                        |                             |                         |
|   |                       | = Dep. Storage                                 |                            |                       | omonac                      |                        | TOTENTO                     |                         |
| (ii) TIME STEP<br>(iii) PEAK FLOW                   |                       |  |                            |                       | THE STORAG                  | E COEFF                | ICIENT.                     |                         |
| (III) FEAR FLOW                                     | DOES NO               | I INCHODE BASEF                                | LOW IF AN                  |                       |                             |                        |                             |                         |
| R0006:C00004  |                       |  |                            |                       |                             |                        |                             |                         |
| * EXTERNAL (Routed th                               | rough S               |  |                            |                       |                             |                        |                             |                         |
| CALIB NASHYD  |                       | Area (ha)=                                     | 11 940                     | Curv                  | e Number                    | (CN)=                  | 83 00                       |                         |
| 02:EXT DT= 1  |                       |  |                            |                       |                             |                        |                             |                         |
|   |                       |  |                            |                       |                             |                        |                             |                         |
| Unit Hyd Qpeak                                      | (cms)=                | 1.900  |                            |                       |                             |                        |                             |                         |
| DEAK ELON   | ( am a ) -            | 1 220 /:\                                      |                            |                       |                             |                        |                             |                         |
| PEAK FLOW   | (cms)=                | 1.239 (1)                                      |                            |                       |                             |                        |                             |                         |
| DIDATION  | (hre)=                | 13 667 / 44-34                                 | hh · mm · ) =              | 011                   | 3 • 40                      |                        |                             |                         |
| TIME TO PEAK<br>DURATION<br>AVERAGE FLOW            | (ms)=                 | .353   | 1111 · mm · ) =            | 0   1                 | J.40                        |                        |                             |                         |
|   | ,,                    |  |                            |                       |                             |                        |                             |                         |
| 8/17/2020 12:41:57 PM                               |                       |  |                            |                       |                             |                        |                             | 19/21                   |

\* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT) ADD HYD 03:POST1+EXT ID:NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms) ID 1 01:POST1 2.940 .342 7.000 177.702 .000 +ID 2 02:EXT 11.940 1.239 7.017 145.537 \_\_\_\_\_ SUM 03:POST1+EXT 14.880 1.579 7.000 151.893 .000

\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue\_No1\SWMHYMO\PR\4-hour\_Chic\2-CYRCHI.out

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

RUNOFF VOLUME (mm) = 145.537 TOTAL RAINFALL (mm) = 193.000 RUNOFF COEFFICIENT = .754

R0006:C00006-----

\* SWM Facility -----

ROUTE RESERVOIR -> Requested routing time step = 1.0 min. IN>03:POST1+EXT ----- OUTFLOW STORAGE OUTFLOW STORAGE OUTFLOW (cms) (ha.m.) (cms) (ha.m.) (cms) (ha.m.) (cms) .000 .0000E+00 | .010 .1885E-01 | .082 .5634E-01 | 1.421 . .003 .1960E-02 | .010 .2327E-01 | .208 .6357E-01 | 1.732 . .004 .3050E-02 .011 .2566E-01 | .285 .6738E-01 | 1.906 . .011 .2818E-01 .370 .7134E-01 .005 .4220E-02| 2.095 . .011 .3083E-01 .006 .5470E-02 .462 .7545E-01 2.299 . .006 .6810E-02 .012 .3361E-01| .562 .7970E-01 2.520 . .012 .3653E-01 .668 .8411E-01 .007 .8230E-02 2.758 . .012 .3958E-01 .007 .9750E-02 .780 .8867E-01 3 015 .008 .1136E-01 .013 .4279E-01| .897 .9339E-01| 3.291 . .008 .1308E-01| .013 .4614E-01| 1.020 .9827E-01| .009 .1682E-01 | .038 .5293E-01 | 1.282 .1085E+00 | 4.242 .

AREA QPEAK ROUTING RESULTS TPEAK R.V. (ha) (cms) (hrs) ( mm ) INFLOW > 03:POST1+EXT 14.880 1.579 7.000 151.893 OUTFLOW < 04:SWM Facili 14.880 1.561 7.033 151.892

> PEAK FLOW REDUCTION [Qout/Qin](%)= 98.865 TIME SHIFT OF PEAK FLOW (min) = 2.00 MAXIMUM STORAGE USED (ha.m.) = .1192E + 00

8/17/2020 12:41:57 PM 20/21 \* TOTAL FLOW FROM TO SIDEROAD 15 CROSS CULVERT ((POST1+ EXT) CONTROLLED)

\* SITE (POST2 - Uncontrolled Area)

|   | CALIB STANDHYD   05:POST2 DT= 1.00 | Area (ha)=<br>Total Imp(%)= |          | Dir.  | Conn.(%)= | 10.50 |
|---|------------------------------------|-----------------------------|----------|-------|-----------|-------|
| - |                                    | IMPERVIOUS                  | DEDUTOUG | ( - ) |           |       |
|   |                                    |                             |          | ( I ) |           |       |
|   | Surface Area (ha)=                 |                             |          |       |           |       |
|   | Dep. Storage (mm)=                 | 2.00                        | 5.00     |       |           |       |
|   | Average Slope (%)=                 | 6.00                        | 11.10    |       |           |       |
|   | Length (m)=                        | 120.00                      | 50.00    |       |           |       |
|   | Mannings n =                       | .013                        | .250     |       |           |       |
|   | Max.eff.Inten.(mm/hr)=             | 43.00                       | 44.82    |       |           |       |
|   |                                    | 2.00                        |          |       |           |       |
|   | Storage Coeff. (min)=              |                             |          | (ii)  |           |       |
|   | Unit Hyd. Tpeak (min)=             | 2.00                        | 9.00     |       |           |       |
|   | Unit Hyd. peak (cms)=              | .50                         | .13      |       |           |       |
|   |                                    |                             |          |       | *TOTALS*  |       |
|   | PEAK FLOW (cms)=                   | .01                         | .08      |       | .094      | (iii) |
|   | TIME TO PEAK (hrs)=                | 6.92                        | 7.00     |       | 7.000     |       |
|   | RUNOFF VOLUME (mm)=                | 191.00                      | 153.77   |       | 157.677   |       |
|   | TOTAL RAINFALL (mm)=               |                             | 193 00   |       | 193.000   |       |
|   | RUNOFF COEFFICIENT =               |                             | .80      |       | .817      |       |
|   |                                    |                             |          |       |           |       |

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
  CN\* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

8/17/2020 12:41:57 PM 21/21

**APPENDIX E** 

TRAFFIC IMPACT OPINION LETTER



August 9, 2017

Via: Email

Mulmur Township 758070 2<sup>nd</sup> Line East Mulmur, Ontario L9V 0G8

Attention: Ms. Tracy Atkinson

**Township Planner** 

Re: Mansfield Ski Club

**Community of Mansfield, Mulmur Township** 

Traffic Impact Opinion WMI File No.: 15-319

Dear Ms. Atkinson

The following provides our opinion of the traffic impact associated with the proposed development within the existing Mansfield Ski Club (MSC) that is located in the Township of Mulmur, Ontario

#### Overview

The area of MSC that is proposed to be re-developed is accessed from the Ski Club's existing main entrance on the 15<sup>th</sup> Sideroad, approximately 0.7km east of the Airport Road and 15<sup>th</sup> Sideroad intersection.

The development is to comprise 93 residential units, as well as retail commercial units, and an expanded parking lot; all of which is to reside within existing site boundaries. It is understood that the purpose of the proposed development is to bolster the current membership by providing additional amenities and offering on-site accommodation.

#### **Existing Conditions:**

Access to MSC's main complex is off of 15<sup>th</sup> Sideroad, at the south end of the Club. The main complex currently contains a main Chalet building, a Skier services building, and a large gravel parking lot. From previous planning studies prepared for MSC, it has been identified that the observed parking capacity is approximately 356 vehicles (referenced from the Mansfield Ski Club Functional Assessment and Recommendations, Winter 2008/09 report, prepared by Stempski Kelly Associates Inc.). The most recent Mansfield Ski Club Master Plan (prepared by Brent Harley & Associates, 2015) further identifies that the existing parking lot is undersized.

Refer to the **Figure 1** for an illustration of the main complex's site layout.

#### **Proposed Conditions:**

The proposed development within the main complex is to be comprised of a village style layout which contains 93 residential units in the form of lofts and stacked townhomes, as well as ground floor commercial retail units. The new parking lot will be situated to the south and east of the commercial / retail units, and will be expanded to accommodate 360 vehicles. In addition to increased capacity, the new parking lot will also provide formalized vehicular circulation by the delineation of internal laneways and parking stalls.

It should be noted that the existing site access onto 15<sup>th</sup> Sideroad is proposed to be maintained.

Refer to the **Figure 2** for an illustration of the proposed development within the main complex of MSC.

#### Vehicular Trip Impact

It is understood that other factors that could otherwise greatly increase membership and associated vehicular trips (additional ski runs, lifts, etc.) are not currently proposed, but rather the primary intent of the project is to bolster existing membership by offering additional supporting amenities and on-site accommodation. It is likely that vehicular trips would increase a small amount as a result of the planned improvements and additional amenities. In this regard, it is expected that any potential increase in traffic (vehicular trips) will be directly related to the increase in proposed parking spaces.

Based on the previously referenced planning reports prepared for MSC, the existing observed vehicular capacity of the existing parking lot is determined to be 356. The capacity of the new parking lot, as a result of the proposed development, is 360 vehicles, which is an increase of 4 vehicles (or 1%) over the existing parking lot capacity.

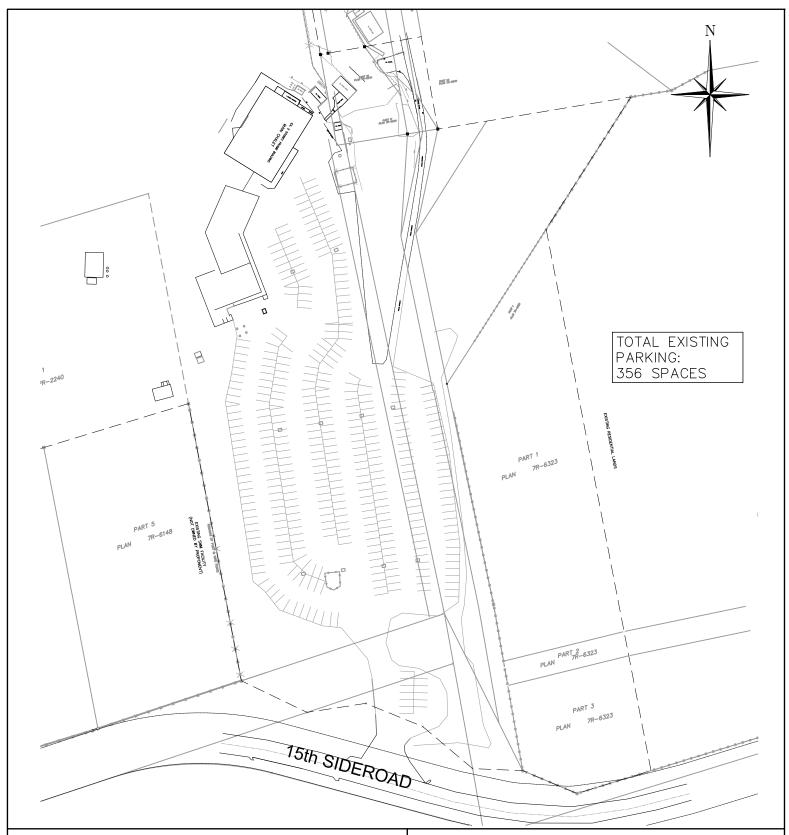
Since the scope of the estimated traffic increase (1%) is not far in excess of what would currently be experienced from existing Mansfield Ski Club operations during the winter season, it is expected that the proposed development can be accommodated by the existing road network without adverse impacts.

Should you have any questions or require additional information, please contact the undersigned.

Yours truly,

WMI & Associates Limited

Jonathan Reimer, P. Eng.



<u>Drawing Title</u>

EXISTING SKI CLUB SITE PLAN

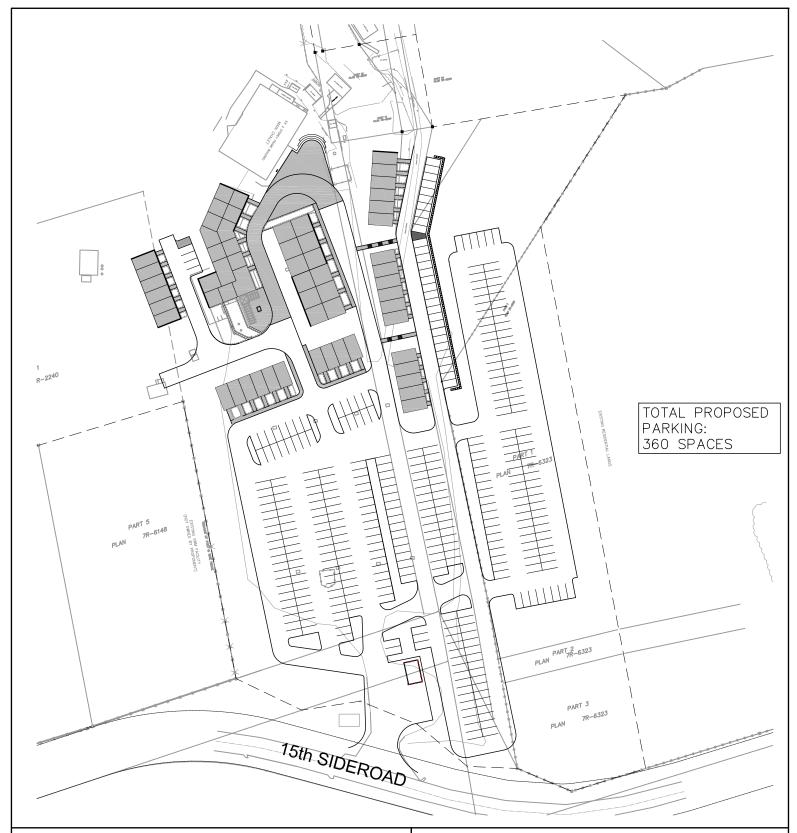
<u>Project Title</u>

MANSFIELD SKI CLUB



WMI & Associates Limited 119 Collier Street Barrie, Ontario L4M 1H5 705-797-2027 www.wmiengineering.ca

| Drawn By |        | Checked By  |        | Figure No. |
|----------|--------|-------------|--------|------------|
|          | JR     |             | JWL    |            |
| Scale    |        | Project No. |        | FIG1       |
|          | 1:1500 |             | 15-319 | •          |



<u>Drawing Title</u>

PROPOSED SKI CLUB SITE PLAN

<u>Project Title</u>

MANSFIELD SKI CLUB



WMI & Associates Limited 119 Collier Street Barrie, Ontario L4M 1H5 705-797-2027 www.wmiengineering.ca

| Drawn By |        | Checked By  |        | Figure No. |
|----------|--------|-------------|--------|------------|
|          | JR     |             | JWL    |            |
| Scale    |        | Project No. |        | FIG2       |
|          | 1:1500 |             | 15-319 |            |

**APPENDIX F** 

**EXISTING SEWAGE TREATMENT SYSTEM ANALYSIS** 



January 20, 2016

Via: Email

County of Dufferin 55 Zina Street, Orangeville, Ontario L9W 1E5

Attention: Rita Geurts, M.A.A.T.O., C.B.C.O.

**Building Inspector/Plans Examiner** 

Re: Ski House Development at the Mansfield Ski Club

**Sewage Treatment System Analysis** 

WMI File No. 15-319

Dear Rita,

Based on our recent emailed correspondence, please find enclosed documentation supporting the use of the existing sewage treatment system for the proposed Ski House development at the Mansfield Ski Club (MSC) in Mansfield, Ontario.

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current on-site sewage treatment system consists of a 150mm diameter gravity sanitary sewer which collects the on-site sewage from both the existing 2-storey service/operations building and the 2-storey main chalet building. The 150mm diameter sanitary sewer drains from the main chalet building, southeast to an existing sewage pump chamber. The existing pump chamber is located approximately 20m east of the main chalet at the east limit of the gravel parking area and just west of the top of bank of the existing slope located between the gravel parking area and the existing gravel driveway which provides access to existing chalets located northeast of the MSC's main chalet building. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2. Lastly from the GC-2 unit, the sewage is pumped southeast approximately 40m to an existing leaching bed located immediately east of the existing gravel driveway which provides access to the existing chalets located northeast of the MSC's main chalet building.

To determine the total daily sewage flow delivered to the sewage treatment system at the above mentioned site, the daily recorded water consumption records as well as the previously analyzed NPS systems batch meter records were analyzed. In addition to the review and analysis of the above mentioned data provided by the MSC, a site visit by WMI & Associates Limited on November 26, 2015 with Dave Morrison of the MSC present, was completed to confirm the existing layout and equipment is consistent with the background information provided by the client.

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records daily during times of operation, the water consumption for each of its sources of water. The MSC primary domestic water supply is provided via a drilled well located just north of the convergence between the east limit of the existing gravel parking area and the existing driveway which services the chalets located northeast of the MSC's main chalet building. One other source of potable water which is rarely used, is an existing bored well located north of the MSC's main chalet building. Lastly, the remaining water source which is only used in the existing water closets and urinals, is provided by the Pine River located immediately northeast of the MSC. Each water source is metered and recorded by the MSC. This information was provided to WMI & Associates Limited for the months of December 2014 to March 2015 and was analyzed to determine the total daily sewage flows experienced at the MSC during the most recent ski season in order to confirm actual sewage flow values experienced by the sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m<sup>3</sup>/day (6,600L/day). Refer to the attached Water Consumption Records Analysis spreadsheet provided herein for additional details.

In addition to the more recent water consumption records analysis provided above, please find attached supporting documentation from NPS which reports that based on the systems batch meter reading, during the ski season from December 2004 to April 2005, the average total daily sewage flow was approximately 7,350L/day.

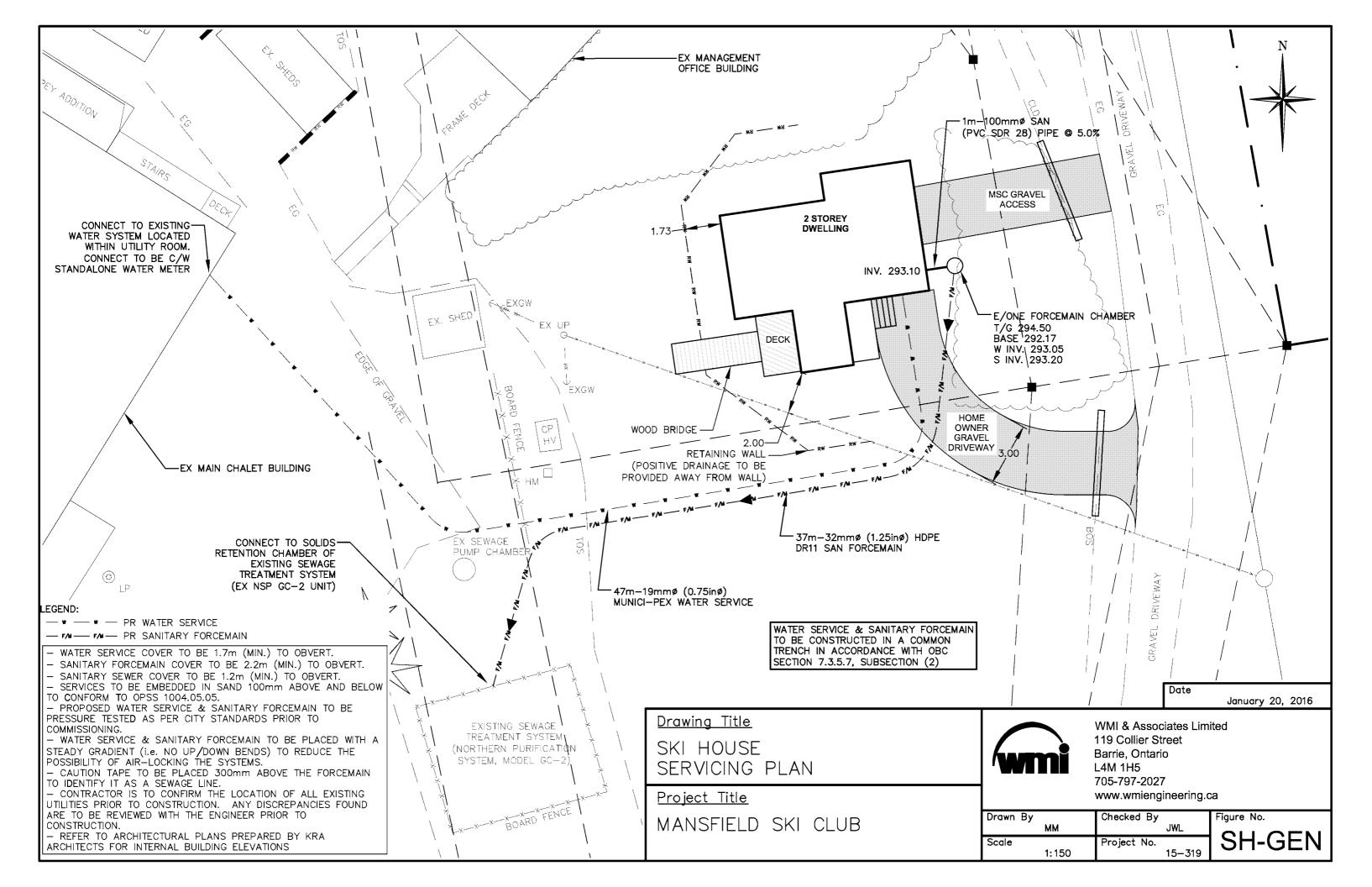
Based on a design flow of 1,600L/day for a 3 bedroom dwelling as per the Ontario Building Code (OBC), Section 8.2.1.3. Sewage System Design Flows, Table 8.2.1.3.A, Residential Occupancy, and the most recent water consumption log records as noted above, the anticipated total daily sewage flow experienced by the existing sewage treatment system at the MSC including the development of the proposed Ski House is 8,200L/day. Considering the 24-hour rated capacity of the existing sewage treatment system which is 22,700L/day as well as its reserve volume of 9,100L and the additional surge tank located immediately east of the NPS system of 18,000L, the existing sewage treatment system is considered more than capable of providing the necessary treatment for all sewage flows generated in the post-development condition.

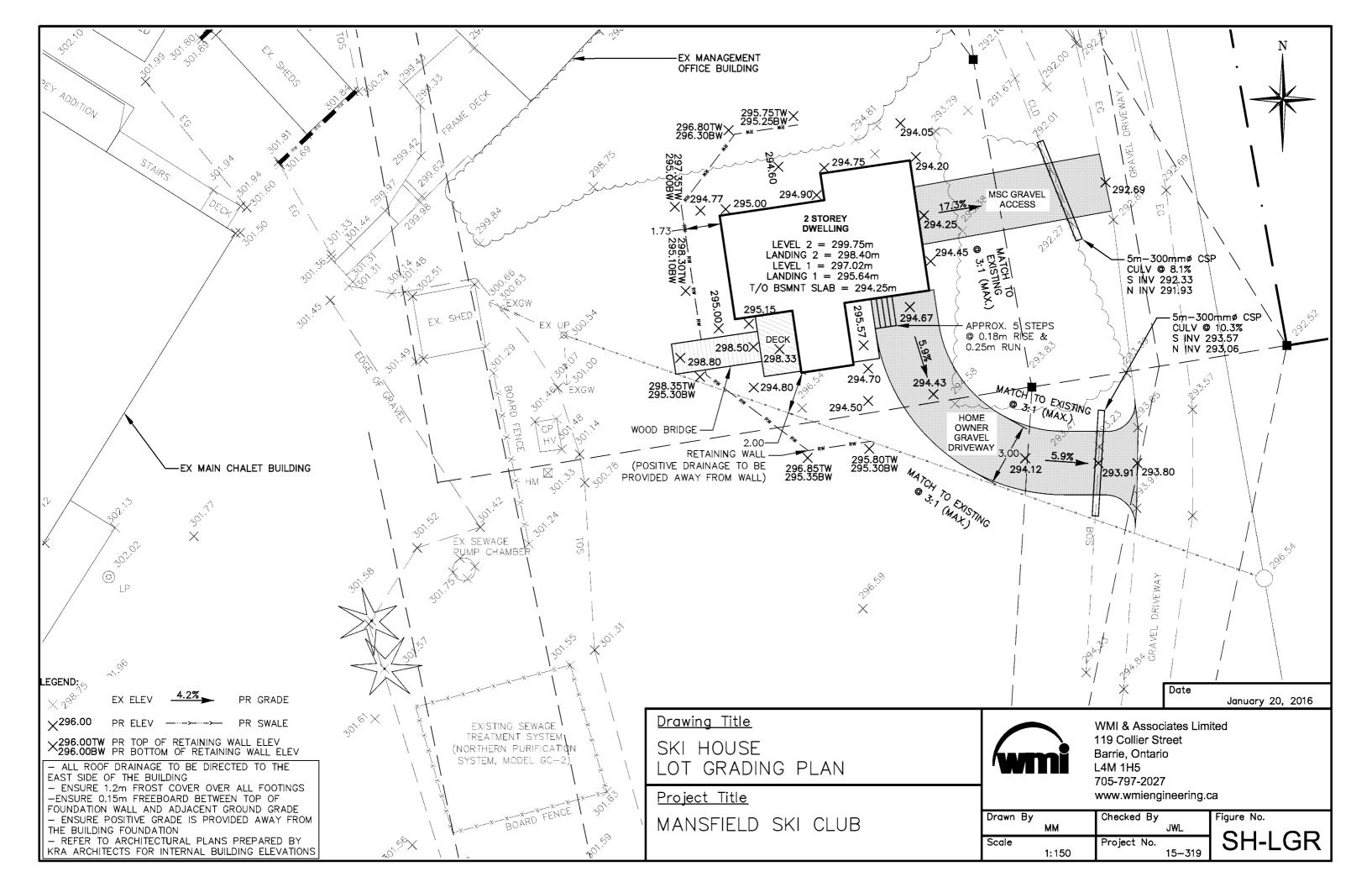
We trust the written confirmation provided above sufficiently addresses your requests outlined within our emailed correspondence dated January 7, 2016, but should you have any questions or require additional information please do not hesitate to contact the undersigned.

Yours truly,

**WMI & Associates Limited** 

Jeremy W. Lightheart, P. Eng.





#### WATER CONSUMPTION LOG RECORDS - MANSFIELD SKI CLUB

|              |              | DEC        | 2014       |          |              | JAN        | 2015       |          |              | FEB        | 2015       |          |              | MARC       | H 2015     |          |
|--------------|--------------|------------|------------|----------|--------------|------------|------------|----------|--------------|------------|------------|----------|--------------|------------|------------|----------|
|              | DRILLED WELL | BORED WELL | RIVER      |          | DRILLED WELL | BORED WELL | RIVER      |          | DRILLED WELL | BORED WELL | RIVER      |          | DRILLED WELL | BORED WELL | RIVER      |          |
| Days of the  | Flow Meter   | Flow Meter | Flow Meter | Daily    | Flow Meter   | Flow Meter | Flow Meter | Daily    | Flow Meter   | Flow Meter | Flow Meter | Daily    | Flow Meter   | Flow Meter | Flow Meter | Daily    |
| Month        | Reading      | Reading    | Reading    | Flow     |
|              | (m³)         | (m³)       | (m³)       | (m³/day) | (m³)         | (m³)       | (m³)       | (m³/day) | (m³)         | (m³)       | (m³)       | (m³/day) | (m³)         | (m³)       | (m³)       | (m³/day) |
| 1            |              |            |            |          |              |            |            | 6.35     |              |            |            | 6.32     | 1695.1       | 1749.5     | 4018.7     | 13.50    |
| 2            |              |            |            |          | 1527.3       | 1746.5     | 3759       | 6.35     |              |            |            | 6.32     |              |            |            | 4.50     |
| 3            |              |            |            |          | 1529.7       | 1746.5     | 3765.5     | 8.90     |              |            |            | 6.32     |              |            |            | 4.50     |
| 4            |              |            |            |          |              |            |            | 4.73     |              |            |            | 6.32     | 1699.6       | 1749.5     | 4027.7     | 4.50     |
| 5            |              |            |            |          |              |            |            | 4.73     | 1616.5       | 1747.8     | 3909.7     | 6.32     | 1701.5       | 1750       | 4030.3     | 5.00     |
| 6            |              |            |            |          |              |            |            | 4.73     | 1621.2       | 1748.3     | 3913       | 8.50     | 1703.3       | 1750       | 4033.2     | 4.70     |
| 7            |              |            |            |          |              |            |            | 4.73     | 1625.9       | 1748.3     | 3917.5     | 9.20     | 1706.7       | 1750       | 4038.1     | 8.30     |
| 8            |              |            |            |          |              |            |            | 4.73     | 1630.9       | 1748.3     | 3928.5     | 16.00    | 1709.3       | 1750       | 4045.7     | 10.20    |
| 9            |              |            |            |          | 1540.2       | 1747       | 3782.9     | 4.73     |              |            |            | 4.50     |              |            |            | 5.23     |
| 10           |              |            |            |          |              |            |            | 6.16     |              |            |            | 4.50     |              |            |            | 5.23     |
| 11           |              |            |            |          |              |            |            | 6.16     | 1635.8       | 1748.3     | 3937.1     | 4.50     | 1712         | 1755.6     | 4053.1     | 5.23     |
| 12           |              |            |            |          |              |            |            | 6.16     | 1638.7       | 1748.3     | 3938.8     | 4.60     | 1712.9       | 1756.6     | 4055.5     | 4.30     |
| 13           |              |            |            |          |              |            |            | 6.16     | 1640.1       | 1748.3     | 3941.6     | 4.20     | 1713.7       | 1757.5     | 4058.7     | 4.90     |
| 14           |              |            |            |          |              |            |            | 6.16     | 1642.7       | 1748.3     | 3944.8     | 5.80     | 1715.4       | 1758.5     | 4061.1     | 5.10     |
| 15           |              |            |            |          |              |            |            | 6.16     | 1648.2       | 1748.3     | 3955.5     | 16.20    | 1716.9       | 1760.3     | 4064.4     | 6.60     |
| 16           |              |            |            |          | 1555.1       | 1747.3     | 3810.8     | 6.16     | 1652.1       | 1748.3     | 3960.7     | 9.10     |              |            |            | 7.05     |
| 17           |              |            |            |          |              |            |            | 12.10    |              |            |            | 6.20     | 1719.7       | 1763.6     | 4072.4     | 7.05     |
| 18           |              |            |            |          | 1564.4       | 1747.3     | 3825.7     | 12.10    |              |            |            | 6.20     | 1720.8       | 1764.7     | 4075.5     | 5.30     |
| 19           |              |            |            |          |              |            |            | 4.63     | 1661.2       | 1748.3     | 3970.2     | 6.20     | 1722.1       | 1766.2     | 4079.2     | 6.50     |
| 20           | 1500         | 1745       | 3720       | -        |              |            |            | 4.63     | 1664         | 1748.3     | 3971.9     | 4.50     | 1723.6       | 1767.5     | 4083.5     | 7.10     |
| 21           | 1502         | 1745       | 3723.2     | 5.20     | 1568.9       | 1747.8     | 3834.6     | 4.63     | 1667.9       | 1748.3     | 3975.2     | 7.20     | 1725.1       | 1768.8     | 4087       | 6.30     |
| 22           | 1505.1       | 1745.6     | 3725.3     | 5.80     | 1571.3       | 1747.8     | 3839.9     | 7.70     | 1673.5       | 1748.3     | 3986       | 16.40    | 1726.2       | 1773.3     | 4093.3     | 11.90    |
| 23           | 1507.3       | 1746.2     | 3726.6     | 4.10     | 1573.7       | 1747.8     | 3842.4     | 4.90     |              |            |            | 5.07     |              |            |            | 1.90     |
| 24           |              |            |            | 1.17     | 1576.1       | 1747.8     | 3846.8     | 6.80     |              |            |            | 5.07     |              |            |            | 1.90     |
| 25           |              |            |            | 1.17     | 1582.3       | 1747.8     | 3858.4     | 17.80    | 1678.8       | 1748.3     | 3995.9     | 5.07     |              |            |            | 1.90     |
| 26           | 1509.9       | 1746.2     | 3727.5     | 1.17     |              |            |            | 4.97     | 1681.4       | 1749.5     | 3999.7     | 7.60     |              |            |            | 1.90     |
| 27           | 1511.2       | 1746.2     | 3728.7     | 2.50     |              |            |            | 4.97     | 1683.7       | 1749.5     | 4003.1     | 5.70     | 1730.5       | 1775.3     | 4096.5     | 1.90     |
| 28           | 1513.9       | 1746.2     | 3733.7     | 7.70     | 1587.8       | 1747.8     | 3867.8     | 4.97     |              |            |            | 13.50    |              |            |            |          |
| 29           | 1517.2       | 1746.5     | 3738.7     | 8.60     |              |            |            | 16.35    |              |            |            |          |              |            |            |          |
| 30           | 1519.8       | 1746.5     | 3745.6     | 9.50     | 1600.2       | 1747.8     | 3888.1     | 16.35    |              |            |            |          |              |            |            |          |
| 31           | 1522.1       | 1746.5     | 3751.5     | 8.20     |              |            |            | 6.32     |              |            |            |          |              |            |            |          |
| Monthly MAX  |              |            |            | 9.50     |              |            |            | 17.80    |              |            |            | 16.40    |              |            |            | 13.50    |
| Monthly MEAN |              |            |            | 5.01     |              |            |            | 7.17     |              |            |            | 7.41     |              |            |            | 5.65     |
| Monthly MIN  |              |            |            | 1.17     |              |            |            | 4.63     |              |            |            | 4.20     |              |            |            | 1.90     |
|              |              |            |            |          |              |            |            |          |              |            |            |          |              |            |            |          |

2014/2015 DAYS IN OPERATION

 MAX
 17.80
 m³/day

 MEAN
 6.57
 m³/day

 MIN
 1.17
 m³/day

NOTES: - For days with no daily flow meter reading, the following flow meter reading has been assumed to be averaged over the previous unrecorded days.

97



#### 8.2.1.3. Sewage System Design Flows

- (1) For residential occupancies, the total daily design sanitary sewage flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.A. (See Appendix A.)
- (2) For all other *occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.B. (See Appendix A.)
- (3) Where a building contains more than one establishment, the total daily design sanitary sewage flow shall be the sum of the total daily design sanitary sewage flow for each establishment.
- (4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining the total daily design *sanitary sewage* flow.

# **Table 8.2.1.3.A. Residential Occupancy**Forming Part of Sentence 8.2.1.3.(1)

| Residential Occupancy   | Volume, litres |
|---|----------------|
| Apartments, Condominiums, Other Multi-family Dwellings - per person <sup>(1)</sup>                    | 275            |
| Boarding Houses   |                |
| (a) Per person,   |                |
| (i) with meals and laundry facilities, or,  | 200            |
| (ii) without meal or laundry facilities, and  | 150            |
| (b) Per non-resident staff per 8 hour shift   | 40             |
| Boarding School - per person  | 300            |
| Dwellings   |                |
| (a) 1 bedroom dwelling  | 750            |
| (b) 2 bedroom dwelling  | 1 100          |
| (c) 3 bedroom dwelling  | 1 600          |
| (d) 4 bedroom dwelling  | 2 000          |
| (e) 5 bedroom dwelling  | 2 500          |
| (f) Additional flow for <sup>(2)</sup>  |                |
| (i) each bedroom over 5,  | 500            |
| (ii) (A) each 10 m <sup>2</sup> (or part of it) over 200 m <sup>2</sup> up to 400 m <sup>2</sup> (3), | 100            |
| (B) each 10 $m^2$ (or part of it) over 400 $m^2$ up to 600 $m^2$ (3), and                             | 75             |
| (C) each 10 m <sup>2</sup> (or part of it) over 600 m <sup>2</sup> (3), or                            | 50             |
| (iii) each fixture unit over 20 fixture units   | 50             |
| Hotels and Motels (excluding bars and restaurants)  |                |
| (a) Regular, per room   | 250            |
| (b) Resort hotel, cottage, per person   | 500            |
| (c) Self service laundry, add per machine   | 2 500          |
| Work Camp/Construction Camp, semi-permanent per worker  | 250            |
| Column 1  | 2              |

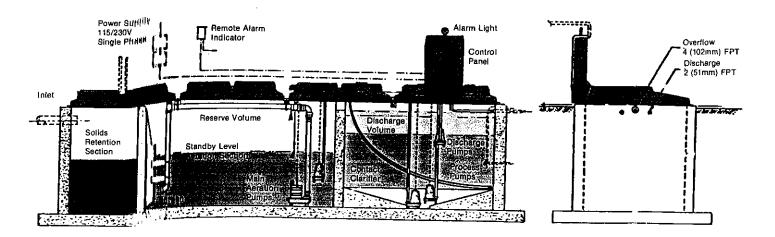
#### Notes to Table 8.2.1.3.A.:

- (1) The occupant load shall be calculated using Subsection 3.1.17.
- (2) Where multiple calculations of *sanitary sewage* volume is permitted, the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.
- (3) Total finished area, excluding the area of the finished basement.

# Larger capacity Systems

### GC SERIES

### CONCRETE TANK



STANDARE FOR MENT: NPS systems have modular assembled components that are interchangeable and easily serviced. Plants are totally enclosed with low maintenance, non-corroding fibreglass covers and hatches. Plastic pipe and office is modular automatic digital computer system. Fibreglass covers and hatches containing all piping and wiring hydraulic fragmentation and submersible aeration system. Submersible process pumps. Duplex alternator discharge pumps. Automatic control panel. Flow discharge recorder. Remote alarm indicator. Accessory equipment programmer.

POWER SUPER All systems require 115/240v - single phase - 60hz - 3 wire supply See Table below for supply amperage requirements. All systems are CSA approved.

DISCHARGE SYMMET Two discharge pumps alternate automatically, or can be preset to operate in single or tandem. If one pump malfunctions, the control activates the main alarm and alternates to the second pump.

INSTALLATION URAWINGS: Detailed drawings for tank slabs and concrete tank construction are supplied to the purchaser by NPA Material and work must conform to building code regulations and specifications.

| Plant<br>'Aodel                                  | IMPERIAL GALLONS   |  |   | METRIC m <sup>3</sup>                                 |  |   | PLANT LENGTH C                               |  | Shipping<br>Weight   | Power                                      |
|--|--|--|---|---|--|---|--|--|--|--|
|  | 24 14 Halind   | Discharge<br>Volume  | Reserve<br>Volume   | 24 Hr. Rated<br>Capacity                              | Discharge<br>Volume                                    | Reserve<br>Volume   | Ft.  | mm   | lbs.   | Supply<br>AMPS                             |
| GC-2<br>-3<br>-4<br>-5<br>-6<br>-7<br>-7S<br>-8S | 20,000<br>20,000<br>20,000<br>20,000<br>20,000<br>20,000<br>20,000<br>20,000<br>20,000 | 455<br>773<br>1,136<br>1,364<br>1,590<br>1,910<br>2,272<br>2,727 | 2,000<br>3,000<br>4,000<br>5,000<br>5,500<br>7,000<br>8,700<br>10,200 | 22.7<br>38.6<br>56.8<br>68.2<br>79.6<br>95.5<br>113.7 | 2.1<br>3.5<br>5.2<br>6.2<br>7.2<br>8.7<br>10.3<br>12.4 | 9.1<br>13.6<br>18.2<br>22.7<br>25.0<br>31.8<br>39.6<br>46.4 | 17<br>25<br>33<br>41<br>49<br>57<br>57<br>65 | 5,182<br>7,620<br>10,058<br>12,497<br>14,935<br>17,374<br>17,374 | 1,800 NO,2<br>001,2<br>002,2<br>003,2<br>000,2<br>000,8<br>000,8<br>000,8<br>000,8 | 60<br>60<br>60<br>100<br>100<br>100<br>100 |

(a) Based on 16 hour raw sewage inflow.

(b) Sized for 11 batches per 24 hours at full loading.

(c) Reserve/surge volume capacity based on standby figuid level.

## Northern Purification Systems 2614 Conc 4, R.R. #1 Loretto Ontario L0G-1L0

August 16/06

Re; MANSFIELD SKI CLUB

To Whom it May Concern

The sewage system located at Mansfield Ski Club is a Northern Purification System model GC-2 with a 24 hour rated capacity of 22,700 litres per day.

The system was installed in the summer of 1997 by Northern Purification Systems and has been serviced and maintained by same till present.

The batch count since installation is 3607 as of June 6/06. Each batch is 2100 litres. Being approx 8 years since start up this would be 2920 days. 3607 X 2100 = 7,574,700 litres Divided by 2920 days =2,594 litres per day. Average over the total time

Reports for the period from Dec 17/04 to Apr 28/05 being a time of peek flows show a total of 462 batches for 132 days.

462 X 2100 = 970,200 litres Divided by 132 days = 7,350 litres per day.

The above shows that the system is running at about one third of capacity.

I hope that this will be of help.

Any questions please call

**Yours Truly** 

Tom Musgrove. Principal

TM/mt

**APPENDIX G** 

MOECC PRE-CONSULTATION CORRESPONDENCE



Suite 202 - 501 Krug Street, Kitchener, ON N2B 1L3 | 519-576-1711

September 20, 2016 HESL Job #: J160071

Finley McEwen
20 Queen Street West, 5th Floor
Toronto, Ontario
M5H 3R4

Dear Mr. McEwen:

Re: Work Plan – Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to submit this work plan to complete a receiving water assessment for a surface discharge of treated domestic wastewater effluent to the Pine River from a proposed redevelopment/expansion of the Mansfield Ski Club (MSC), located at 628213 Side Rd 15, Mansfield, Ontario, in the Township of Mulmur.

The existing MSC operates seasonally from late December to early April. Sanitary servicing for the site (an existing Chalet Building and an Operations Building) is by a private on-site sewage treatment system (Northern Purification System) with subsurface disposal to a leaching bed. The proposed redevelopment of the site is to include the existing Chalet Building, and renovation of the Operations Building and new development providing a total of 1,595 m² of commercial retail space and 93 residential units.

The Site Servicing and Stormwater Management Report¹ (WMI 2016) for the redevelopment reported that sewage flows from the site will increase from 14,740 L/day to 116,765 L/day with the proposed redevelopment, which will necessitate a new sanitary sewage treatment system to accommodate the expanded flows. A package plant was proposed consisting of a Waterloo Biofilter System with UV disinfection and sodium aluminate dosing with disposal of the effluent to a new onsite wetland stormwater management facility. The effluent would then be conveyed off site a distance of 1,050 m via a series of grass-covered roadside ditches, swales and two existing dry ponds/basins for surface discharge to the Pine River as the ultimate receiver. The proposed effluent treatment objectives were 10.0 mg/L for carbonaceous oxygen demand (CBOD5) and total suspended solids (TSS), 0.5 mg/L for total phosphorus (TP), 3.0 mg/L for total ammonia nitrogen (TAN) and a geometric annual mean concentration of 100 organisms/100 mL for *Escherichia coli*. The proposed effluent treatment limits were 15 mg/L for CBOD5 and TSS, 1.0 mg/L for TP, 5.0 mg/L for TAN and a geometric annual mean concentration of 200 organisms/100 mL for *E. coli*.

As previously discussed, the proposed effluent conveyance route (i.e., roadside ditches, swales, dry ponds) would provide minimal dilution of the effluent and would thereby represent a 'dry ditch' discharge. The conveyance route passes through residential lands which could be of concern to local residents and the Ministry of Environment and Climate Change (MOECC). Moreover, the Pine River near the subject property

<sup>&</sup>lt;sup>1</sup> WMI & Associates Limited, 2016. Site servicing & stormwater management report. Mansfield Ski Club, Township of Mulmur. Report WMI 15-319. June 2016.

is a high quality receiver that supports a sensitive trout fishery and is used by local residents for recreation (swimming and fishing). Better treatment objectives are therefore likely warranted to protect the beneficial uses of the river. These concerns were also expressed by MOECC at the pre-consultation meeting at the Guelph District Office on August 9<sup>th</sup>, 2016, and further supported by the results of a site reconnaissance visit by HESL on August 10<sup>th</sup>, 2016.

Alternate methods of effluent disposal may be feasible including direct discharge to the Pine River to the northwest of the subject property at the existing pump house, or discharge to an onsite 3-5 acre pond that is located in the northeast corner of the subject property and draining to the Pine River through a conduit. These options would avoid issues associated with an open, dry ditch discharge, and be more amenable to the MOECC.

During our site visit, we observed five large trout in the Pine River upstream of the rock weir adjacent to the pump house on the subject property, confirming the presence of trout habitat. We collected water samples from the centre of the river immediately downstream of the weir, which were analysed for total phosphorus (TP), orthophosphate (PO4), total ammonia nitrogen (TAN), nitrate (NO3), nitrite (NO2) and total suspended solids (TSS). Results indicated that the river at this location had very low concentrations of phosphorus (TP = 0.0053 mg/L, PO4 = <0.003 mg/L), TAN (<0.02 mg/L) and TSS (<2.0 mg/L). NO3 was elevated at 2.1 mg-N/L but was below the Canadian Environmental Quality Guideline (CEQG) of 3.0 mg-N/L. A farm with cattle was located across the river just upstream of the sampling location that is likely a source of nitrate at this sampling location, in addition to other rural land uses upstream. Based on these results, the Pine River adjacent to the subject property likely has capacity to receive effluent from the MSC, however, additional data are required to confirm the status of the river, in particular for the period of operation of the MSC from December to April.

A surface discharge of treated effluent to the Pine River requires a receiving water assessment to determine the impacts of that effluent on water quality in the river. Key to this assessment is the determination of suitable effluent quality and a discharge location so that the size and quality of the effluent plume in the river meets the guidelines of the MOECC to protect water quality and beneficial uses. Based on our project understanding and input from the MOECC at the Pre-consultation Meeting, we have developed a comprehensive work plan to complete this assessment with the objectives to:

- 1. Characterize the existing water quality and flows of the Pine River at the proposed discharge location and determine its assimilative capacity to receive treated effluent,
- 2. Identify environmental and beneficial usage constraints for the discharge,
- 3. Recommend alternative discharge options (e.g., direct to river or via an existing man-made pond) and locations based on identified constraints,
- 4. Complete a mixing zone analysis at the point of effluent discharge to the Pine River to determine the size of the mixing zone and provide recommendations for a discharge configuration to minimize the size of the mixing zone,
- 5. Recommend appropriate treatment objectives and limits based on the assimilative capacity of the river and results of the mixing zone analysis, and
- 6. Develop a water quality monitoring program to confirm the results of the assessment and to monitor the effects of the discharge on water quality of the Pine River.

#### **Work Plan**

We propose the following work plan tasks to complete the assessment:

#### Task 1. Compilation of Data and Background Information

We will work with WMI & Associates Limited to confirm and document details of the preferred servicing approach including expected effluent volumes, treatment objectives and the specific discharge location.

We will compile relevant water quality and flow data for the Pine River from the following sources:

- Water Survey of Canada Station Pine River near Everett (02ED014) located approximately 10 km downstream of the study site. Continuous flow data are available for this station from 1967 to present;
- Provincial Water Quality Monitoring Network (PWQMN) Station 03005701002 located upstream of the Nottawasaga River at Mill Street, Angus, ON. Long-term data are available for this site from 1972 to 2015, which is typically monitored monthly from April to November by the Nottawasaga Valley Conservation Authority (NVCA).

We will also contact the MOECC and the NVCA to request any additional water quality monitoring data or information that may be relevant to the assessment including fish inventories, fish habitat and benthic invertebrate assessments.

#### Task 2. Field Work

While the above water quality and flow data exist for the Pine River, site-specific data closer to the proposed discharge location and for the full period of discharge are required for the assimilative capacity assessment and the mixing zone analysis (Task 6). We therefore propose to sample water quality and stream flows monthly from September 2016 until April 2017 at two locations in the river (immediately downstream of the rock weir near the MSC pump house and at the crossing of the river at Airport Road (Regional Road 18). Water quality monitoring parameters will include:

- Field parameters (pH, temperature, dissolved oxygen, conductivity);
- ♣ TP;
- Nitrogen species (TAN, NO3, NO2, and total Kjeldahl nitrogen (TKN));
- Total suspended solids (TSS);
- Carbonaceous biochemical oxygen demand (CBOD5); and
- E. coli.

Water samples will be shipped to ALS Laboratories in Waterloo, Ontario, for analysis of all chemical parameters. River discharge will be measured at both sampling locations using the transect method and a Flo Mate or equivalent meter.

It is our understanding that the NVCA has conducted fish habitat and benthic invertebrate assessments in the Pine River that are likely suitable to document these biological characteristics for the purposes of the receiving water assessment. If additional information is required, we will submit a revised work plan to collect this information.

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#### Task 3. Low Flow Analysis

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity of a stream or river. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge.

We will calculate the 7Q20 flows in the Pine River at the proposed discharge site using the most recent 20-year data record from WSC Station, pro-rated and for the watershed area upstream of the proposed discharge location and verified with the measured flows from Task 2. We will also use this dataset to calculate the mean, minimum, maximum, and lower quartile (25th percentile) flows to fully describe flow and dilution potential of the river.

#### Task 4. Water Quality Summary

We will summarize water quality data from the PWQMN Station and results of the Task 2 monitoring. Data will be assessed against applicable Provincial Water Quality Objectives (PWQO) to determine the policy status of the Pine River to receive treated effluent at the proposed discharge location in accordance with MOECC policies and guidelines<sup>2</sup>:

- Policy 1 In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives;
- Policy 2 Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

#### Task 5. Documentation of Natural Heritage and Beneficial Use Constraints

We will perform a desk-top search to document natural heritage features and beneficial uses of the Pine River in the vicinity of the proposed discharge that may pose constraints to siting the discharge location and configuration of the effluent plume, to include:

- Water takings for drinking water,
- Recreation (swimming and fishing) areas,
- Sensitive fish habitat,
- Natural heritage features, and
- Aquatic Species at Risk (SAR) and critical habitat

Ontario Ministry of Environment and Energy (MOEE), 1994. Water Management, Policies, Guidelines, Provincial Water Quality Objectives. Queen's Printer for Ontario. 32 pp.



#### Task 6. Assimilative Capacity Assessment

The assimilative capacity assessment will be completed using a mass balance modeling approach to determine water quality in the Pine River at the point of complete mixing of the effluent and a CORMIX model to determine the size and shape of the mixing zone. CORMIX is a software system developed by Cornell University for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies<sup>3</sup>. CORMIX requires a small number of inputs in order to generate meaningful simulation data, which will be gathered from our background review and field work (Tasks 1 to 3).

Modeling will be conducted for low flow conditions over the proposed operational period of the package plant (to be determined) to inform recommendations for effluent limits and the discharge configuration under different flow, water quality and temperature regimes of the river. A preferred discharge location and configuration (i.e., single port discharge versus multi-port discharge) will be recommended that provides the most rapid assimilation but that also considers any identified constraints from Task 4. Factors including temperature (water density) of the water, the number of ports, and the location of the discharge in relation to banks and the river bottom all affect the resulting discharge mixing zone.

Recommendations for effluent limits will be based on the above modeling and MOECC's requirements in *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters*<sup>4</sup>, which provides requirements for point-source discharges and the procedures for determining effluent requirements for an Environmental Compliance Approval (ECA). This assessment will also consider the need to meet the condition of "no acute lethality" at the discharge point to the creek based on unionized ammonia concentration.

#### Task 7. Reporting and Meetings

Completion of the full receiving water assessment will not be possible until early summer of 2017 once the field work in Task 2 is completed. To permit design planning to move forward, we will prepare a technical memorandum that documents the preliminary results of Tasks 1 to 5 (to include results of two Task 2 field events) in October 2016. We anticipate that this technical memorandum will provide sufficient information for pre-consultation with MOECC to further discuss the design concept, to be refined and finalized once all data have been collected. This will allow MOECC to comment on a) the proposed field study in advance of the critical operation period of the MSC from December to April, and b) the approach to the assimilative capacity assessment and mixing zone modelling (Task 6). At this meeting, we will also discuss the potential for extending the operating season of the MSC, and hence the effluent discharge period. We will prepare meeting minutes from the pre-consultation meeting and revise our work plan if necessary to address MOECC concerns.

We will complete a technical report for submission to the MOECC Guelph District Office for review and concurrence by the Technical Support Unit, which is required for the Environmental Compliance Approval application. The report will summarize the field investigations, constraints, assimilation assessment,

Ontario Ministry of the Environment (MOE). 1994. Deriving receiving water based point source effluent requirements for Ontario waters. PIBS#3302 Procedure B-1-5.



<sup>&</sup>lt;sup>3</sup> Doneker, R. L. and G. H. Jirka, 2007. CORMIX User Manual, USEPA: EPA-823-K-07-001.

recommendations for effluent limits and for continued water quality monitoring to track the influence of the discharge in the future.

Over the course of the project, we will provide monthly updates on the progress of the study.

#### **Schedule**

The following schedule is proposed to complete the ACS:

Technical Memorandum of preliminary results – October 28, 2016 MOECC Pre-consultation Meeting – Week of October 31, 2016 Field Work – September, 2016 to April, 2017 (monthly) Final Report – May 31, 2017

We thank MSC for inviting Hutchinson Environmental Sciences Ltd. to submit this work plan. Please do not hesitate to contact us if you have any questions.

6

Sincerely,

Hutchinson Environmental Sciences Ltd.

Tammy Karst-Riddoch, Ph.D.

Senior Aquatic Scientist

V. KRR

tammy@environmentalsciences.ca

#### **Jeremy Lightheart**

From: Spencer, Michael (MOECC) < Michael.Spencer@ontario.ca>

**Sent:** April 4, 2017 2:56 PM

**To:** Tomlinson, Gary (MOECC); Jeremy Lightheart

**Cc:** 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch' **Subject:** RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Hi Jeremy,

I have been in field sampling and only received the emails today. Any discussion on the Receiving Water Assessment and options would be best after I've reviewed the report, and I won't be getting to it this month. Please schedule in May. Thanks.

Michael Spencer
Surface Water Group Leader
Ministry of Environment and Climate Change
119 King Street West, 12th Flr
Hamilton, ON L8P 4Y7
Ph (905) 521-7734

----Original Message-----

From: Tomlinson, Gary (MOECC) Sent: April 04, 2017 9:42 AM

To: Jeremy Lightheart; Spencer, Michael (MOECC)

Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for the short notice but at this point it looks to me as if Mike is not available to participate in a telecon this morning. I understand he will be passing you some available dates and times a bit later in the month to make this happen.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286 Original Message

From: Jeremy Lightheart

Sent: Monday, April 3, 2017 16:00

To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)
Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

#### Gary/Mike,

Please find attached an agenda as well the "Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River" for your review prior to the conference call tomorrow morning at 10:30am.

Mike, if you could please confirm that you will be available for the call tomorrow it would be greatly appreciated.

#### Regards,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited 119 Collier Street Barrie, ON. L4M 1H5 Office 705-797-2027 Ext 104 Fax 705-797-2028 wmiengineering.ca

----Original Message----

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]

Sent: April 3, 2017 11:44 AM

To: Jeremy Lightheart < jlightheart@wmiengineering.ca>; Spencer, Michael

(MOECC) < Michael. Spencer@ontario.ca>

Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

I can call in at 10:30 but will need the phone number and access code again.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286 Original Message

From: Jeremy Lightheart

Sent: Monday, April 3, 2017 11:41

To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)

Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

#### Gary/Mike,

Just following up to confirm that you are both still available for tomorrow mornings conference call at 10:30am? I trust you both have received Finley McEwen's invite via email which outlines the call details/instructions for calling in?

Your earliest response would be much appreciated.

Regards,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited 119 Collier Street Barrie, ON. L4M 1H5 Office 705-797-2027 Ext 104 Fax 705-797-2028 wmiengineering.ca

----Original Message-----

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]

Sent: March 20, 2017 10:53 PM

To: Jeremy Lightheart <jlightheart@wmiengineering.ca> Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca> Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for being a while getting back to you but things here have been real busy.

I'm afraid I will not be able to do a face to face any time the week of 03 April. I might be able to call into a meeting on the 4th provided it is happening in the middle of the morning or mid pm. I understand that Mike Spencer is available on the 4th so possibly we can make this happen this way.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change

Tel: 519 826 4272
Fax: 519 826 4286
Original Message

From: Jeremy Lightheart

Sent: Friday, March 10, 2017 10:36 To: Tomlinson, Gary (MOECC) Cc: Spencer, Michael (MOECC)

Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

#### Gary,

It has been a while since we last spoke but now that we are part way through the Assimilation Capacity Study work for the above mentioned site and have now received some feedback via public meetings, etc., we would like to sit back down with you and your colleagues to have an updated pre-consultation meeting if possible?

Would you be available to meet myself, Finley McEwen (Mansfield Ski Club) and Tammy Karst-Riddoch (Hutchinson Environmental Sciences Ltd.) any time on Tuesday April 4th?

Thanks in advance for your assistance,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited

119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

#### ----Original Message----

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]

Sent: September 21, 2016 10:35 AM

To: Jeremy Lightheart <jlightheart@wmiengineering.ca> Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>

Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

#### Thanks Jeremy.

G.W. Tomlinson Provincial Officer Senior Environmental Officer Guelph District Office West Central Region

Ontario Ministry of Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286 Original Message From: Jeremy Lightheart

Sent: Wednesday, September 21, 2016 09:27

To: Tomlinson, Gary (MOECC) Cc: Spencer, Michael (MOECC)

Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

#### Gary,

As promised, please find attached the revised Assimilative Capacity Study Work Plan for your review. Should you have any questions, please do not hesitate to contact me.

#### Regards,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited 119 Collier Street Barrie, ON. L4M 1H5 Office 705-797-2027 Ext 104 Fax 705-797-2028 wmiengineering.ca

#### ----Original Message-----

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]

Sent: September 16, 2016 12:53 PM

To: Jeremy Lightheart < jlightheart@wmiengineering.ca>

Cc: Spencer, Michael (MOECC) < Michael. Spencer@ontario.ca>

Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

Great. Thanks.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region

Ontario Ministry of Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286

From: Jeremy Lightheart

Sent: Friday, September 16, 2016 11:57

To: Tomlinson, Gary (MOECC) Cc: Spencer, Michael (MOECC)

Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

#### Gary,

Sorry for the delay in getting back to you, I was off yesterday. Based on my discussions with Tammy at Hutchison Environmental, the first round of sampling was completed on Wednesday and they plan to begin with the other tasks next week.

Tammy has promised to get me the revised work plan today. I hope to have the work plan to you either later today or early next week.

Regards,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited 119 Collier Street Barrie, ON. L4M 1H5 Office 705-797-2027 Ext 104 Fax 705-797-2028 wmiengineering.ca

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]

Sent: September 15, 2016 9:15 AM

To: Jeremy Lightheart < jlightheart@wmiengineering.ca>

Cc: Spencer, Michael (MOECC) < Michael. Spencer@ontario.ca>

Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

Jeremy:

Just curious, has the ACS work gone forward and is there a modified work plan floating around somewhere that someone can send us?

G.W. Tomlinson Provincial Officer Badge # 132

Senior Environmental Officer

Guelph District Office West Central Region

Ontario Ministry of the Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286

Gary.Tomlinson@ontario.ca<mailto:Gary.Tomlinson@ontario.ca>

Spills Action Centre 1 800 268 6060

[Peace\_Officer\_Exemplary\_Service\_Medal\_Ribbon]

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From: Tomlinson, Gary (MOECC) Sent: September-01-16 3:07 PM

To: 'Jeremy Lightheart'

Cc: Spencer, Michael (MOECC)

Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work

Plan)

Jeremy:

MOECC's comments on the 29 August, 2016 Mansfield Ski Club Work Plan are as follows:

- 1.) Overall the Work Plan is acceptable with the following exceptions\comments:
- 2.) The 29 August, 2016 Work Plan identifies that the operational period of the proposed redevelopment\expansion of the Mansfield Ski Club as from December to April. During the 09 August, 2016 pre-consultation meeting our notes indicate that the discussion was around an expanded operational period, (that being some point in September to some point in April). As such, the proposed sewage discharge period needs to be clarified\identified;
- 3.) In Task 1, the Work Plan identified that the Water Survey of Canada station Pine River station near Everett, (02ED014), has flow data from 1967 to 1970. This may be a typing error since this station appears to have flow records from 1967 to present;

- 4.) In Task 7, the Work Plan identified that a technical memorandum will
- be submitted in October of this year to document the preliminary results of Tasks 1 through 5 in order to provide information to the Ministry for approval in concept on the design, which will be refined and finalized once all the data has been collected. The Work Plan identified that this will allow the Ministry to comment on the proposed field study in advance of the December to April, (or September to April), period and the approach to the assimilative capacity assessment/mixing zone modelling. It should be noted that this Ministry does not review preliminary results for these type of assessments, especially since the Work Plan already contains the proposed field study and the approach to the assimilative capacity assessment\mixing zone which the Ministry has reviewed and commented on. Having said that, if the proponent requires an additional meeting through the process, Staff from both the District Office and Technical Support Unit can make themselves available to attend, and;
- 5.) The final report will need to be submitted to the MOECC Guelph
  District Office for review and concurrence by the MOECC Technical Support Unit prior before an Environmental
  Compliance Approval application being submitted.

I would suggest that based on the comments provided above that it would be acceptable for the proponent to commence with the activities identified in the Work Plan at such time as it modifies the Work Plan accordingly, (and provides the modified Work Plan to this Office).

G.W. Tomlinson
Provincial Officer
Badge # 132
Senior Environmental Officer
Guelph District Office
West Central Region

Ontario Ministry of the Environment and Climate Change

Tel: 519 826 4272 Fax: 519 826 4286

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Spills Action Centre 1 800 268 6060

[Peace\_Officer\_Exemplary\_Service\_Medal\_Ribbon]

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From: Jeremy Lightheart [mailto:jlightheart@wmiengineering.ca]

Sent: August-31-16 9:05 AM To: Tomlinson, Gary (MOECC)

Subject: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

Please find attached our proposed work plan for the required Assimilative Capacity Study associated with the above mentioned project. If you could please review the work plan and confirm your acceptance it would be greatly appreciated. Please note that there are a few time sensitivity items which require monitoring to start immediately.

#### Regards,

Jeremy W. Lightheart, P. Eng. WMI & Associates Limited 119 Collier Street Barrie, ON. L4M 1H5 Office 705-797-2027 Ext 104 Fax 705-797-2028 wmiengineering.ca

### Ministry of the Environment and Climate Change **West Central Region**

119 King Street West 12th Floor Hamilton, Ontario L8P 4Y7 Tel.: 905 521-7640

Fax: 905 521-7820

July 14, 2017

### Ministère de l'Environnement et de l'Action en matière de changement climatique Direction régionale du Centre-Ouest

119 rue King Ouest Hamilton (Ontario) L8P 4Y7

12e étage Tél.: 905 521-7640 Téléc.: 905 521-7820



### **MEMORANDUM**

To: Gary Tomlinson

Senior Environmental Officer

**Guelph District Office** 

From: Michael Spencer

> Surface Water Group Leader **Technical Support Section**

RE: Mansfield Ski Club Redevelopment Project

**Preliminary Receiving Water Assessment** 

Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

February 10, 2017 Memo, Re: Mansfield Ski Club, Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River, Hutchinson Environmental Sciences Ltd.

### Background

The Mansfield Ski Club redevelopment project includes renovation of the Operations Building and a new development including commercial retail and residential. A sewage effluent discharge to the Pine River is proposed. The preliminary Receiving Water Assessment (Feb. 10, 2017) contains the results of the monitoring and the study to date and is based on the September 20, 2016 work plan which was previously reviewed by the Ministry.

### Comments

Based on my review of the preliminary Receiving Water Assessment (Feb. 10, 2017), I have the following comments:

1. Based on my July 6, 2017 telephone conversation with Deborah Sinclair, Hutchinson Environmental, it is my understanding that the Mansfield Ski Club is now considering a year round sewage effluent discharge and the monthly water quality sampling program is continuing. As such, the final receiving water assessment should incorporate a monthly assessment in regards to the low flow analysis (ie. monthly 7Q20) and the corresponding

assimilative capacity study. The submitted preliminary Receiving Water Assessment was based on a seasonal assessment period since a seasonal discharge was proposed at the time of writing.

- 2. Table 4 and 5 listed the PWQO (or CWQG) for un-ionized ammonia as 16 ug/L. The PWQO for un-ionized ammonia is 20 ug/L and the CWQG is 19 ug/L.
- 3. The need for a DO sag assessment should be determined and included in the final receiving water assessment as needed.
- 4. The preliminary Receiving Water Assessment identified that further study is required in regards to the presence and habitat of snapping turtles and the presence of wetlands which I concur with.
- 5. The preliminary Receiving Water Assessment identified that a site specific assessment is recommended to characterize sensitive aquatic communities and fish habitat near the proposed effluent outfall which I concur with.

Michael Spencer Surface Water Group Leader Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No. File H-04-PI-32-01

Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Ministry of the Environment, **Conservation and Parks Drinking Water and Environmental Compliance Division West Central Region** 

Ministère de l'Environnement de la Protection de la nature et des Parcs Division de la conformité en matière d'eau potable et d'environnement Direction régionale du Centre-Ouest



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January 31, 2019

### **MEMORANDUM**

To: Gary Tomlinson

> **Environmental Officer Guelph District Office**

From: Michael Spencer

> Surface Water Group Leader **Technical Support Section**

RE: Mansfield Ski Club

**Receiving Water Assessment for New Wastewater Treatment Plant** 

Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

Pine River Receiving Water Assessment - Final Report, Mansfield Ski Club, Hutchinson Environmental Sciences Ltd., May 17, 2018.

### Background

The Mansfield Ski Club is located at 628213 15<sup>th</sup> Sideroad in the Town of Mansfield, Township of Mulmur. The site currently operates seasonally from late December to early April with sanitary servicing provided by a sewage treatment system with subsurface disposal. The proposed redevelopment includes renovation of existing buildings, a new commercial space and new residential units for year round occupancy. To accommodate redevelopment with expanded sewage flows, a package plant (Waterloo Biofilter with UV disinfection and phosphorus removal) is proposed with continuous discharge to the Pine River.

The Pine River near Mansfield Ski Club has very good water quality with low concentrations of nutrients and total suspended solids. The river water quality was determined to be surface water Policy 1 for total phosphorus and un-ionized ammonia near the site. As well, dissolved oxygen concentrations were better the PWQO. The Pine River provides spawning habitat and supports various fish species including Chinook salmon and rainbow trout. Available dilution in the Pine River (7Q20 = 432 L/s) for the proposed effluent discharge (1.39 L/s) was determined to be

311:1. A mass balance assessment was completed as well as Cormix modelling for a diffuser discharge.

### Comments

Based on my review of the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018), I have the following comments:

1. The report assessed the end-of-pipe acute toxicity threshold with an un-ionized ammonia value of 0.27 mg/L based on the US EPA document "Draft 2009 Update Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater, Dec. 2009". The assessment used a total ammonia nitrogen concentration of 5 mg/L (proposed effluent limit), temperature of 22°C and pH of 8.0.

Historically and procedurally West Central Region has used a non-acutely lethal end-of-pipe un-ionized ammonia concentration of 0.1 mg/L. That being said, the report's assessment can be considered very conservative since a pH of 8.0 was used while it identified for comparison purposes that a 75<sup>th</sup> percentile pH of 7.2 was calculated for the Caledonia and Hagersville Wastewater Treatment Plants. Using an un-ionized ammonia concentration of 0.1 mg/L for a non-acutely lethal discharge, a pH of 7.65 would have to be consistently reached which is higher than the Caledonia and Hagersville Wastewater Treatment Plants. As such, the proposed total ammonia nitrogen effluent limit of 5 mg/L is acceptable.

- 2. The report recommended that the effluent be discharged directly to the Pine River at the pump house based on the water quality analysis and aquatic habitat requirements which is acceptable.
- 3. The report's proposed effluent objectives and limits listed below are acceptable and can be incorporated into an ECA.

| <u>Parameter</u>       | <u>Objective</u> | <u>Limit</u> |
|------------------------|------------------|--------------|
| cBOD5                  | 10 mg/L          | 15 mg/L      |
| Total Suspended Solids | 10 mg/L          | 15 mg/L      |
| Total Phosphorus       | 0.5 mg/L         | 1 mg/L       |
| Total Ammonia N.       | 3 mg/L           | 5 mg/L       |
| E.coli (per 100mL)     | 100              | 200          |

4. The report proposed a pH effluent objective of 8.0 and limit of 8.5. However, I recommend the ECA include the standard pH range effluent objective (6.5 to 8.5) and limit (6.0 to 9.0).

5. The ECA should incorporate effluent loading limits as listed below. The loading for total phosphorus and total ammonia nitrogen is the same as Table 9 in the report. However, I have recommended 1.8 kg/d for cBOD5 and total suspended solids since it seems that Table 9 rounded off the value (2 kg/d).

ParameterLoading LimitcBOD51.8 kg/dTotal Suspended Solids1.8 kg/dTotal Phosphorus0.12 kg/dTotal Ammonia N.0.6 kg/d

- 6. The ECA should incorporate standard effluent toxicity testing (ie. rainbow trout and *Daphnia magna*).
- 7. The report identified that additional information about snapping turtles, wetlands and other natural heritage features will be examined in an Environmental Impact Study during the site plan approval which is acceptable.

### Conclusion

In conclusion, the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018) is acceptable with the recommendations discussed above. The proposal can proceed forward to Environmental Approvals and Permissions Branch accordingly.

### Original Signed By

Michael Spencer Surface Water Group Leader Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No. 2063-AZGRZ7 File H-04-PI-32-01

Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

**APPENDIX H** 

Geotechnical Investigations Reports & Addendum

June 21, 2018 Ref. No.: T18733



Mansfield Ski Club 628213 Sideroad 15 Mulmur. Ontario L9V 3M6

Attention: Mr. Finley McEwen

Dear Mr. McEwen,

RE: FEASIBILITY ASSESSMENT

PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED DEVELOPMENT

**MANSFIELD SKI CLUB** 

628213 SIDEROAD 15, MULMUR, ONTARIO

Please find enclosed the Feasibility Assessment - Preliminary Geotechnical Investigation Report prepared for the above-mentioned project. Should you have any questions or require any clarifications, please do not hesitate to contact our office.

We thank you for giving us this opportunity to be of service to you.

Sincerely,

Shad & Associates Inc.

Houshang Shad, Ph.D., P. Eng.

Principal

# FEASIBILITY ASSESSMENT PRELIMINARY GEOTECHNICAL INVESTIGATION PROPOSED DEVELOPMENT MANSFIELD SKI CLUB 628213 SIDEROAD 15, MULMUR, ONTARIO

Submitted to:

Mansfield Ski Club 628213 Sideroad 15 Mulmur, Ontario L9V 3M6

Attention:

Mr. Finley McEwen

Submitted by:

**Shad & Associates Inc.** 83 Citation Drive, Unit 9

Vaughan, Ontario, L4K 2Z6
Canada

Tel: (905) 760-5566 Fax: (905) 760-5567

June 21, 2018

T18733

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario

Reference Number: T18733

June 21, 2018

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### STATEMENT OF LIMITATIONS

### **FIGURES**

Figure 1: Site Location Plan
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### **RECORD OF BOREHOLES**

RECORD OF BOREHOLES (BH 1 to 8) EXPANATION OF BOREHOLE LOGS

### **ENCLOSURES**

Enclosure A: Laboratory Test Results

Enclosure B: Slope Stability Analysis Results

### **APPENDECIES**

Appendix A: Site Specific Seismic Hazard Parameters as Per 2015 NBC of Canada

.../... Page (i)

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario

Reference Number: T18733

June 21, 2018

### 1.0 INTRODUCTION

Shad & Associates Inc. was retained by Mansfield Ski Club ('Client') to carry out a preliminary geotechnical investigation for the proposed development being considered at 628213 Sideroad 15 in Mulmur, Ontario. The site location is shown in Figure 1. We understand that the preliminary geotechnical report is required to confirm the general viability of each of the following proposed works:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad:
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

The Client requested the following boreholes to be drilled:

- one borehole in the vicinity of the 6.6 m snow making pond;
- three boreholes for the top of the ski hill where 25 m of fill will be placed;
- three boreholes in the vicinity of proposed buildings, water treatment plant and firefighting tanks; and
- one borehole in the vicinity of the dry detention basin.

Authorization to proceed with this investigation was provided by Mr. Dave Morrison of Mansfield Ski Club on May 18, 2018. The work carried out for this investigation was completed in accordance with Shad Proposal P18666-Revised, dated May 7, 2018.

The purpose of the current preliminary geotechnical feasibility assessment was to obtain some general information about the subsurface conditions at the site by means of a number of boreholes. Based on our interpretation of the data obtained, some preliminary recommendations are provided on the geotechnical aspects of design for the proposed development.

This report contains the findings of our geotechnical investigation, together with our recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineer.

We recommend on-going liaison with Shad & Associates Inc. during the design and construction phases of the project to ensure that the recommendations provided in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to Shad & Associates Inc. for further elaboration and/or clarification.

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario Reference Number: T18733

June 21, 2018

### 2.0 INVESTIGATION PROCEDURES

The fieldwork for the investigation was performed during the period of May 24, 25, 29 and 30, 2018, and it consisted of drilling and sampling altogether eight boreholes down to depths ranging from approximately 4.7 m to 12.3 m below the existing ground surface. The borehole locations were stake-out by the Client and their approximate locations are shown in Figure 2. The Client also provided us with a base plan showing some limited existing topographical information at the development site as well as proposed grading information (un-dated, un-numbered plan 161117-Baseplan-15-319-1 as well as the landscape architectural plan prepared by Stempski Kelly Associates Inc. (Figure 2, dated 2009)). These plans were used to extrapolate the "approximate" existing ground surface elevations at the borehole locations. However, the elevations should only be considered as being approximate and should be confirmed once the actual survey information is received from the Client. We have assumed the elevations to be Geodetic.

The boreholes were advanced using solid and hollow stem continuous flight augers, with a track-mounted drilling rig, under the full-time supervision of geotechnical personnel from our office. Soil samples were taken at 0.76 to 1.5 m intervals for the full depth of the investigation and the Standard Penetration Test (SPT) was performed in accordance with ASTM D1586. This consists of freely dropping a 63.5 kg (140 lbs) hammer a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter o.d. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) is recorded as the SPT 'N'-value of the soil and this gives an indication of the consistency or the relative density of the soil deposit.

Upon completion of boreholes, the soil samples were transported to our Soils Laboratory for further examination and laboratory testing. Soil laboratory testing, consisting of moisture content determination, gradation analysis (Sieve and Hydrometer tests) and Atterberg Limits (Liquid and Plastic Limits), were performed on selected representative soil samples. The results of the in-situ and laboratory tests are presented on the corresponding Record of Borehole Sheets as well as in Enclosure A.

Samples obtained during this investigation will be stored in our Soils Laboratory for three months and will be disposed thereafter.

### 3.0 SUB-SURFACE CONDITIONS

The stratigraphic units and groundwater conditions are briefly discussed in the following sections for each of the proposed works. For more detailed information, reference should be made to the Record of Borehole Sheets.

### 3.1 Proposed Snow Making Pond (Borehole 1)

The snow making pond is proposed to be located on the north end of the property, adjacent to 17

Preliminary Geotechnical Investigation Proposed Development

628213 Sideroad 15, Mulmur, Ontario Reference Number: T18733

June 21, 2018

Sideroad. As requested, Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this borehole, the site is underlain by topsoil and fill extending down to a depth of about 0.8 m below existing grade. It should however be noted that the thickness and quality of topsoil and fill can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill was then underlain by gravelly sand and layers of sand deposits with occasional gravel, silty sand interbeddings, trace to some silt and clay, extending to the completion of the borehole at approximately 9.0 m below existing ground surface.

Standard Penetration Tests were performed at the site and the recorded 'N'-values within the gravelly sand and sand layers were found to range widely from 8 to more than 50 blows/0.3m, indicating a loose to very dense, but generally compact relative density. Samples from these deposits were also tested for natural moisture content and the results were found to generally range from 8 to 19%. Considering these results as well as visual and tactile examination of the recovered soil samples, the deposits were generally wet.

Representative samples from the sand deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

|                       | BH 1: S5                 | BH 1: S8 | BH 1: S10 |  |  |  |
|-----------------------|--------------------------|----------|-----------|--|--|--|
| Gravel:               | 1%                       | 0%       | 11%       |  |  |  |
| Sand:                 | 92%                      | 74%      | 87%       |  |  |  |
| Silt and Clay:        | 7%                       | 26%*     | 2%        |  |  |  |
| * (Silt: 10%, Clay: 1 | * (Silt: 10%, Clay: 16%) |          |           |  |  |  |

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

**Table 1: Measured Groundwater data** 

| Borehole | "Approx."                                   | Measured Groundwater Depth / Elevation (m) |               |               |  | Measured Groundwater Depth / Elevation (m) |  |  |
|----------|---|--|---------------|---------------|--|--|--|--|
|          | Geodetic Ground<br>Surface<br>Elevation (m) | Upon June 6, 2018<br>Completion            |               | June 13, 2018 |  |  |  |  |
| BH 1     | ~264  | 2.0 / 262                                  | + 0.9 / 264.9 | + 0.8 / 264.8 |  |  |  |  |

It should be mentioned that the groundwater condition at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario

Reference Number: T18733

June 21, 2018

### 3.2 Heightening the Top of the Existing Ski Hill (Boreholes 2 to 4)

Boreholes 2, 3 and 4 were drilled for this proposed work and they encountered some surficial topsoil that was underlain by fill, generally consisting of silty clay/clayey silt with occasional organic stains, trace to some rootlets and topsoil, that extended down to depths ranging from approximately 0.7 m in Borehole 2 to 5.2 m in Borehole 3. The fill at Borehole 2 was in turn underlain by a 0.3 m thick topsoil (may be the original topsoil layer). The recorded 'N'-values within the silty clay to clayey silt fill ranged from about 6 to 12 blows/0.3 m. Samples from the fill layer were also tested for moisture content and the results were found to generally range from 12 to 23%. The collected fill samples were generally damp and the higher measured moisture content values could be due to the presence of organic content within the fill deposit. Considering the above results, we are of the opinion that the fill has received some non-systematic compaction and quality control. It should however be noted that the thickness and quality of topsoil and fill can vary significantly between and beyond the boreholes locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates.

Native silty clay/clayey silt was encountered below the fill layer in Boreholes 2 and 4 and below the lower topsoil layer in Borehole 3 and it extended down to depths ranging from about 0.8 m to 10.0 m below existing grade, where it was in turn underlain by highly weathered to weathered shale.

The measured 'N'-values within the silty clay/clayey silt ranged from about 14 to more than 30 blows/0.3 m, indicating a stiff to hard, but generally very stiff to hard consistency. Representative samples from this layer were also tested for natural moisture content and the results were found to range from 10 to 17%. Based on these results as well as visual and tactile examination of the recovered soil samples, the silty clay/clayey silt was generally damp. A representative sample from this deposit was analyzed for gradation and Atterberg Limits. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

BH 4: S54

 Gravel:
 0%

 Sand:
 4%

 Silt:
 52%

 Clay:
 44%

Liquid Limit: 36%
Plastic Limit: 21%
Plasticity Index: 15%

Considering the above results, the silty clay/clayey silt has medium plasticity.

Highly weathered to weathered shale was encountered below the silty clay to clayey silt at all

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario

Reference Number: T18733

June 21, 2018

three boreholes. This was further confirmed by drilling additional two shallower boreholes at a 2 m radius around Borehole 4 to ensure that a large cobble or boulder was not being encountered. The recorded 'N'-values within the highly weathered to weathered shale deposit were all well in excess of 50 blows/0.3 m. The natural moisture content test results performed on selected samples ranged from 5 to 9%. It should however be noted that the quality and the surface elevation of the highly weathered to weathered shale as described in the borehole logs should be considered as approximate only, as they were inferred from the observations during drilling rather than proven by rock coring.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 3. The results are summarized in Table 2, below:

|          | Table 2. Measured Orbaniawater data         |  |              |              |  |  |
|----------|---|--|--------------|--------------|--|--|
| Borehole | "Approx."                                   | Measured Groundwater Depth / Elevation (m) |              |              |  |  |
|          | Geodetic Ground<br>Surface Elevation<br>(m) | Upon June 6, 2018 June 13, 201 Completion  |              |              |  |  |
| BH 2     | ~377  | Dry  | -            | -            |  |  |
| BH 3     | ~385  | 12.2 / 372.8                               | 11.1 / 373.9 | 11.1 / 373.9 |  |  |
| BH 4     | ~374  | Dry  | -            | -            |  |  |

**Table 2: Measured Groundwater data** 

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

# 3.3 Proposed Housing Units, Buildings, Water Treatment Plant & Firefighting Tanks (Boreholes 5 to 7)

As requested, Boreholes 5 to 7 were drilled to obtain some general information below the proposed six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. Based on the subsurface conditions encountered at these boreholes, fill soils generally consisting of silty sand to sandy silt, granular fill and clayey silt were contacted at all boreholes that extended down to depths ranging from approximately 0.7 m (at Boreholes 5 and 7) to 2.2 m (at Borehole 6) below existing ground surface. However, at Borehole 6, a topsoil layer was also contacted interbedded within the fill deposit. It should be noted that the thickness and quality of fill and topsoil can vary significantly in between and beyond the borehole locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill layer at all boreholes was then underlain by glacial deposits, generally consisting of silty sand till and/or sandy silt till, that extended down to the completion of the boreholes at 4.9 to 5.0

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m below existing grade. The recorded 'N'-values within the glacial deposits ranged from 16 to more than 50 blows/0.3 m penetration, indicating a compact to very dense, but generally dense to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results within the sandy silt till were 12 and 13% and within the silty sand till ranged from 7 to 11%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and sandy silt till deposits were generally damp and occasionally damp to moist or moist.

Representative samples from the silty sand till and sandy silt till deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

|         | <u>BH 5: S2</u> | BH 5: S5 | BH 7: S2 |
|---------|-----------------|----------|----------|
| Gravel: | 13%             | 5%       | 2%       |
| Sand:   | 59%             | 59%      | 24%      |
| Silt:   | 28%             | 35%      | 69%      |
| Clay:   | 0%              | 1%       | 5%       |

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 7. The results are summarized in Table 3 below:

|          | rabio of modoaroa of canamator data         |  |             |             |  |  |  |
|----------|---|--|-------------|-------------|--|--|--|
| Borehole | "Approx."                                   | Measured Groundwater Depth / Elevation (m) |             |             |  |  |  |
|          | Geodetic Ground<br>Surface<br>Elevation (m) | Upon<br>Completion                         |             |             |  |  |  |
| BH 5     | ~307  | 3.2 / 303.80                               | -           | -           |  |  |  |
| BH 6     | ~302  | 4.3 / 297.7                                | -           | -           |  |  |  |
| BH 7     | ~286  | 4.5 / 281.5                                | 2.6 / 283.4 | 2.8 / 283.2 |  |  |  |

**Table 3: Measured Groundwater data** 

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

### 3.4 Proposed Dry Detention Pond Basin (Borehole 8)

The dry basin is proposed to be located south of the proposed building structures, on the southeast portion of the site. Based on the subsurface conditions encountered at Borehole 8 drilled for this structure, the site is underlain by a surficial topsoil layer followed by fill that extended down to approximately 4.4 m below the ground surface. The fill generally consisted of sandy silt

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with trace clay, organic stains and some topsoil. The fill was found to overlie a layer of deeper topsoil (may be the original topsoil layer) that extended to about 4.8 m below existing grade. It should be noted that the thickness and quality of fill and topsoil can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill deposit was then underlain by a relatively thin layer of silty sand to sandy silt that extended to approximately 5.2 m below grade. The recorded 'N'-value with this deposit was 6 blows/0.4 m with a moisture content of more than 40%, indicating a loose and wet condition.

The silty sand to sandy silt was then underlain by glacial till deposits consisting of silty sand till or silty sand to sandy silt till that extended down to the completion of the borehole. The measured 'N'-values within these layers ranged widely from 22 to more than 50 blows/0.3 m penetration, indicating a compact to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results were found to range from 9 to 13%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and/or sandy silt till deposits were wet at higher elevations and became damp to moist with increased depth.

A representative sample from the silty sand to sandy silt till deposit was tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

<u>BH 8: S11</u>

Gravel: 3%
Sand: 50%
Silt: 42%
Clay: 5%

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

**Table 4: Measured Groundwater data** 

| Borehole | "Approx."                                   | Measured Groundwater Depth / Elevation (m) |             |             |  |
|----------|---|--|-------------|-------------|--|
|          | Geodetic Ground<br>Surface<br>Elevation (m) | Upon June 6, 2018 June 13, 2 Completion    |             |             |  |
| BH 8     | ~296  | 4.6 / 291.4                                | 3.7 / 292.3 | 3.8 / 292.2 |  |

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be

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expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

### 4.0 DISCUSSION AND RECOMMENDATIONS

According to the preliminary information provided to us, we understand that the general viability of the following works is being considered at the site:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad;
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six blocks of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-ongrade structures; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

Considering the above information and the subsurface conditions encountered at the borehole locations, some discussions and recommendations are provided in this section. However, they should be considered as general in nature and will need to be reviewed and confirmed by supplementary geotechnical investigations once the exact project details are known.

### 4.1 Construction of a Snow Making Pond

According to the information provided to us, the pond will be located on the north end of the property, adjacent to 17 Sideroad and will be 6.0 m deep with a base elevation of 257.40 m and an approximate side slope of 3H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 263 to 264 m and therefore the pond will be generally in cut.

Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within gravelly sand and sand deposits with the exception of the top part of the pond walls, where some engineered fill will be required to replace any existing topsoil and silty sand fill. Furthermore, the short-term groundwater level in the monitoring well installed in this borehole is measured above the existing ground surface, at Elevations 264.8 to 264.9 m and this will fluctuate with time.

Considering the above information, the stability of the pond walls was assessed by assuming a representative Section A, as shown in Figure 3. The section was analysed by assuming

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conservative soil parameters, as summarized in Table 5 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

**Table 5: Assumed Conservative Geotechnical Parameters** 

| Weight  | O:                   |                                    |  |   |
|---------|----------------------|------------------------------------|--|---|
| (kN/m³) | C'<br>(kPa)          | Φ'<br>(degree)                     | C <sub>u</sub><br>(kPa)  | $\Phi_{\mathrm{u}}$ (degree)  |
| 16.5    | 0                    | 20                                 | 10   | 10  |
|         |                      |                                    |  |   |
| 19.0    | 0                    | 30                                 | 0  | 30  |
|         |                      |                                    |  |   |
| 21.0    | 0                    | 32                                 | 0  | 32  |
|         |                      |                                    |  |   |
| 19.0    | 0                    | 30                                 | 0  | 30  |
|         | 16.5<br>19.0<br>21.0 | (kN/m³) (kPa) 16.5 0 19.0 0 21.0 0 | (kN/m³)         (kPa)         (degree)           16.5         0         20           19.0         0         30           21.0         0         32 | (kN/m³)         (kPa)         (degree)         (kPa)           16.5         0         20         10           19.0         0         30         0           21.0         0         32         0 |

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used. For a slope to be assessed as being stable, a minimum Factor of Safety of 1.5 is normally required under a static loading condition.

The assumed cross-section was analysed under the following conditions:

- -During Construction (Undrained Analysis); and
- -Full Pool (Drained Analysis).

Furthermore, the pond wall was analysed under seismic loading conditions. The site specific seismic hazards as per National Building Code of Canada (2015) were obtained from Earthquakes Canada website (www.EarthquakesCanada.ca) and are provided in Appendix A. The peak ground acceleration (PGA) for 2 percent probability in 50 years (0.000404 per annum or return period of 2,475 years) for the site is 0.062g corresponding to Site Class C. For this study, although a geophysical assessment was not completed in assessing the applicable seismic site classification, considering the subsurface conditions encountered at the boreholes drilled at the site, a site Class D (Stiff Soil) is recommended for the property. Therefore, the peak ground acceleration corresponding to Site Class D at the site will be PGA=1.3×0.062g=0.0806g. According to industry standards, the acceleration used in pseudostatic analysis is equal to 0.5 × PGA. Based on these values and in accordance to the Canadian Foundation Manual (4<sup>th</sup> Edition), the following parameters were used for seismic stability evaluations:

Horizontal Seismic Coefficient = 0.5 X 0.0806g=0.0403g

Vertical Seismic Coefficient = 0

For a stable slope under seismic loading using pseudostatic analysis, a minimum FOS of 1.1 is normally recommended.

Considering the above details, the stability of the assumed representative cross-section under construction and ponding conditions was analysed and some of the results are shown in

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Enclosures B-1 to B-3. The results indicate that the calculated Factors of Safety for static and seismic loading conditions were all above the recommended minimum values. Based on these results, the pond walls are considered to be stable.

It should be noted that as the pond base and the walls will be constructed in sandy deposits with high groundwater levels, they would need proper protection against erosion and washout. Furthermore, if a permanent water level has to be maintained in the pond, a suitable impermeable liner would be required. The liner would need to be designed against uplift hydrostatic pressures due to high groundwater levels measured at the site. We will review and provide additional recommendations once the pond information is finalized.

The pond excavation would require temporary dewatering to lower the groundwater level to below the pond base. This should be provided by the Project Dewatering Consultant.

### 4.2 Heightening of the Top of the Ski Hill

According to the information provided to us, we understand that the top of the existing ski hill is proposed to be raised by as much as 25 m on the front side and also a retaining wall system, ranging in height from approximately 4 to more than 18 m, is being considered for the backside.

Boreholes 2, 3 and 4 were drilled within the proposed heightening part of the hill. Based on the subsurface conditions encountered at these boreholes, below some surficial topsoil, the existing top of the hill has about 5 m of silty clay/clayey silt fill at Borehole 3 and this reduces to about 0.2 m at Borehole 2 and to about 1.5 m at Borehole 4. The fill at Borehole 3 was in turn underlain by a 0.3 m thick deeper topsoil layer. The field and laboratory test results appear to indicate that the existing fill has received some relatively non-systematic low compaction and quality control. The topsoil and fill layers were in turn underlain by still to hard silty clay/clayey silt that was found to overlie highly weathered to weathered shale.

Based on the provided topographic survey information, two sections were assumed that pass through the front of the ski hill (i.e. Sections B and C). The sections were analysed by assuming conservative soil parameters, as summarized in Table 6 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

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**Table 6: Assumed Conservative Geotechnical Parameters** 

|  | Bulk Unit         | Shear Strength Paramete |             | ters                    |                     |
|--|-------------------|-------------------------|-------------|-------------------------|---------------------|
| Soil Type                                    | Weight<br>(kN/m³) | C'<br>(kPa)             | Φ' (degree) | C <sub>u</sub><br>(kPa) | $\Phi_{u}$ (degree) |
| Topsoil                                      | 16.5              | 0                       | 15          | 20                      | 0                   |
| Silty Clay/Clayey Silt Fill                  | 17.0              | 0                       | 22          | 35                      | 0                   |
| Stiff<br>Silty Clay Clayey Silt              | 17.5              | 0                       | 25          | 40                      | 0                   |
| Very Stiff to Hard<br>Silty Clay/Clayey Silt | 19.5              | 5                       | 30          | 100                     | 0                   |
| Highly Weathered to<br>Weathered Shale       | -                 | -                       | -           | -                       | -                   |
| Engineered Fill (Clayey)                     | 19.0              | 0                       | 30          | 90                      | 0                   |

The assumed cross-sections were analysed under the following conditions:

- -During and Immediately After Construction (Undrained Analysis);
- -Long-term after Construction (Drained Analysis); and
- -Seismic Loading.

Considering the above details, the stability of the assumed representative cross-sections for during and after construction was analysed and some of the results are shown in Enclosure B-4 to B-9. The results indicate that the calculated Factors of Safety under static and seismic loading conditions were all above the recommended minimum values. Based on these results, the proposed slope heightening would have adequate factor of safety against slope failure for the front slope. However, additional boreholes should be drilled within the proposed filling area as well as at lower elevations down the slope face in order to better define the existing subsurface conditions.

For raising the slope, the following 'preliminary' placement procedure is recommended.

- (i) The area to receive the engineered fill should be stripped of any topsoil and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.
- (ii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 100% of its Standard Proctor Maximum Dry Density.

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The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning, wetting or drying. It should also be noted that the sandy and silty deposits are sensitive to moisture and they will require a more strict control on their moisture content if they are to be used in the engineered fill operation.

- (iii) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.
- (iv) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The proposed fill will settle under self-weight and it will also cause settlement of the underlying existing fill and native soils. Assuming the above procedure, the total settlement is estimated to range from approximately 40 to 60 cm. However, depending on the actual organic content within the existing fill, the settlement values could be higher. Also, considering the cohesive nature of the existing fill and assuming that a similar soil type is used for raising the hill, the settlements should occur over several years. We would however recommend that the settlements at the site (within the proposed fill areas as well as down the existing hill) to be instrumented and monitored by surveying. Due to the non-homogeneous nature of the existing fill and the presence of topsoil and organic matters within the fill, some excessive differential settlement should also be expected.

With respect to the proposed retaining walls for the backside of the hill, we would recommend that global slope stability analysis to be performed once the wall designs are available. Additional boreholes would be required along the proposed wall to better identify the subsurface conditions. The wall designer should also confirm the internal stability of the walls (sliding, overturning and bearing capacity). We would recommend the walls to be placed on the native and competent silty clay/clayey silt deposit, properly engineered fill or on the highly weathered to weathered shale. Based on these as well as the wall design, additional geotechnical parameters and recommendations will be provided.

4.3 Proposed Housing Units, Buildings, Water Treatment Plant & Fire Fighting Tanks

According to the Client, six blocks of chalet type housing units, two buildings, a water treatment plant and firefighting tanks are being assessed for construction on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-on-grade structures. Boreholes 5, 6 and 7 were drilled in this area. Based on the subsurface conditions encountered

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at these boreholes, below some fill and/or topsoil, the site is predominantly underlain by compact to very dense silty sand till and/or sandy silt till. Furthermore, the groundwater level over our short-term monitoring program was measured below a depth of about 2.6 m below existing ground surface.

### 4.3.1 Site Grading

The development of the site will require clearing and stripping of all topsoil and fill. Where residential lots or structures are being considered, it is recommended that all fill be placed as engineered fill to provide competent subgrade. Prior to placement of engineered fill, all the surficial topsoil and fill should be stripped from planned fill areas to expose the inorganic subgrade. The exposed subgrade should then be proof-rolled with a suitably heavy roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer. Reference is made to Section 4.3.4 for recommendations regarding engineered fill placement.

Provided the above recommendations are followed, and all topsoil and compressible materials are stripped or sub-excavated, the existing deposits are not considered to be highly compressible and long-term settlements should be minimal.

### 4.3.2 Foundations

Based on the subsurface conditions encountered at Boreholes 5, 6 and 7 drilled at the site, the footings would need to be extended down to the competent undisturbed native deposits or be placed on properly compacted engineered fill. The recommended spread footing depths and allowable soil bearing pressures are given in the following table.

**Table 7: Recommended Soil Bearing Capacity Values** 

| Borehole | Depth Below<br>Existing Grade<br>(m) | Recommended<br>Geotechnical Reaction<br>at SLS *<br>(kPa) | Factored Geotechnical<br>Resistance at ULS (with a<br>Geotechnical Resistance<br>Factor of 0.5), (kPa)* |
|----------|--------------------------------------|---|---|
| BH 5     | ± 1.1                                | 150   | 225   |
| BH 6     | ± 2.3                                | 150   | 225   |
| BH 7     | ± 1.1                                | 150   | 225   |

<sup>\*</sup> Higher Allowable Soil Bearing Capacity values are available at lower elevations, if required.

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code.

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The footing subgrade should be inspected and evaluated by the Geotechnical Engineer prior to concreting to ensure that the footings are founded on competent subgrade capable of supporting the recommended design pressure.

Design frost penetration depth for the general area is 1.6 m. Therefore, a permanent soil cover of 1.6 m or its thermal equivalent is required for frost protection of foundations. All exterior footings and footings beneath unheated areas should have at least 1.6 m of earth cover or equivalent synthetic insulation for frost protection.

Where necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) and no individual footing step should be greater than 0.6 m and may have to be as low as 0.3 m if weaker soils are encountered.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits for most types of structures.

### 4.3.3 Earthquake Considerations

In conformance to the Criteria in Table 4.1.8.4.A, Part 4, Division B of the National Building Code (NBC 2005), for footings designed as recommended in Section 4.3.2, the subject site is classified as Site Class "D-Stiff Soil". The four values of the Spectral Response Acceleration  $S_a(T)$  for the different periods and the peak ground acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the NBC (2005). The design values of  $F_a$  and  $F_v$  for the project site should be calculated in accordance to Table 4.1.8.4.B and C.

### 4.3.4 Engineered Fill

Depending on the proposed grades for the site, engineered fill may be required to replace the existing fill and topsoil as well as to raise the site grades for the possible support of footings and floor slabs. Engineered fill could be placed after stripping all topsoil, any soils containing excessive organics and otherwise unsuitable soils, within an area extending at least 2.5 m beyond the perimeter of the footprint of the proposed structures. Engineered fill would then be suitable to support the foundations including the slabs provided that the following criteria are strictly followed. Engineered fill may also be carried out to raise the existing grades below the proposed roads and parking lots.

The following placement procedure is recommended.

(i) The areal extent of engineered fill should be controlled by proper surveying techniques to ensure that the top of the engineered fill extends a minimum of 2.5 m beyond the perimeter

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of the buildings to be supported. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the building should be increased by at least 1.0 m for each 1.0 m depth of fill.

- (ii) The area to receive the engineered fill should be stripped of any topsoil, fill and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.
- (iii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 98% of its Standard Proctor Maximum Dry Density.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning.

- (iv) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.
- (v) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The allowable soil bearing pressure is 150 kPa for footings supported by at least 1.0 m of engineered fill constructed in accordance with the above recommendations. We also recommend that the footing subgrade be evaluated by the geotechnical engineer prior to placing the formwork. It is recommended to increase the rigidity of foundations of structures erected over engineered fill, and this is generally achieved by making the footings at least 0.5 m wide, and adding reinforcing rebars to the footings and walls. This measure helps to bridge over eventual weak spots in the fill.

All footings should have at least 1.6 m of earth cover or equivalent artificial insulation for frost protection.

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For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits.

### 4.3.5 Excavating and Dewatering

All temporary excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

-Topsoil / Fill Type 4

-Compact Silty Sand/Sandy Silt Till Type 3

-Dense to Very Dense Silty Sand/Sandy Silt Till

(above groundwater level or when dewatered)

Accordingly, for Type 3 Soils, a side slope of 1H:1V is required for excavations in accordance with the Ontario Health and Safety Regulations. Within Type 4 Soils, the side slope of the excavation would need to be flattened to at least 3H:1V. In Type 2 soils, the bottom 1.2 m of the excavation could be carried out close to vertical.

Stockpiles of excavated materials should be kept at least 5 m away from the edge of the excavation to avoid slope instability. This distance should be increased for any stockpiling along the top of the existing slopes (we should be informed to provide additional recommendations if soil stockpiling on top of slopes is being considered). Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

Based on the subsurface conditions encountered at the boreholes, within the recommended depth for footings provided in Table 7, we anticipate all footing excavations to be above the measured groundwater levels, either in engineered fill or within native deposits. Considering this, we do not anticipate major dewatering problems for footing excavations, although some dewatering may have to be carried out for excavations due to surface runoff, from any perched water within the fill layer or groundwater seepage. We are of the opinion that these should be manageable by pumping from temporary sumps protected against erosion. Such sumps should be dug outside the footprint of the structures to minimize disturbance to the footing grade. We recommend that once the structure footing invert information are known and prior to construction, the groundwater conditions at the site to be further assessed by test pitting.

### 4.3.6 Building Slab Construction & Drainage

Concrete floor slab may be built on properly prepared subgrade or engineered fill. If the existing topsoil/fill is left underneath the slab, long-term settlement and/or cracks may occur. The existing

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fill and topsoil should be removed and replaced with compacted engineered fill in order to support the floor slab. For engineered fill subgrade, Section 4.3.4 should be followed.

Underneath the building slabs, a 150 mm thick base course consisting of 20 mm size clear stone or OPSS Granular A should be placed to improve the support for the floor slab and function as drainage layer. This base course should be compacted with vibratory equipment to a uniform high density. If the subgrade is wet, the clear stone or OPSS Granular A base should be separated from the subgrade by an approved filter fabric (e.g. non-woven geotextile, with FOS of 75 - 150  $\mu$ m, Class II).

The site should be graded for drainage away from foundations. A minimum cross fall of three percent (3%) immediately adjacent to foundations is recommended to allow for some settlement and promote good surface drainage.

### 4.4 Proposed Dry Detention Basin

Based on the information provided to us we understand that a 1.2 to 2.2 m deep dry detention basin is proposed to be constructed on the southeast portion of the site, south of the proposed building structures. The dry pond base will be at Elevation 293.80 m and the top of the pond at Elevation 296.35 m. The pond will have a side slope of 4H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 295 to 297 m and therefore the pond will generally in cut.

Borehole 8 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within sandy silt fill with occasional topsoil interbeddings. Furthermore, the short-term highest groundwater level in the monitoring well installed in this borehole was measured at depth of about 3.7 m below existing ground surface and this will fluctuate with time.

Considering the above information, the pond will be placed within a fill deposit which appears to have received little to no compactive effort or quality control and will not provide a long-term stable pond structure. We would therefore recommend the fill to be removed and then the area to be engineered up. For recommendations on the construction of the engineered fill reference should be made to Section 4.3.4. It should be noted that the pond is designed as a dry pond and threfeore by definition it will not be holding a permanent water level. We would however recommend the pond side slopes to be protected against erosion and washout.

Considering the above information, the stability of the pond wall was assessed by assuming a representative section (i.e., Section F), as shown in Figure 5. The section was analysed by assuming conservative soil parameters, as summarized in Table 8 below, based on the borehole

Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario

Reference Number: T18733

June 21, 2018

information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

**Table 8: Assumed Conservative Geotechnical Parameters** 

|                         | Bulk Unit         | Shear Strength Parameters  C' Φ' C <sub>u</sub> Φ <sub>u</sub> (degree) (kPa) (degree) |    | eters               |    |
|-------------------------|-------------------|--|----|---------------------|----|
| Soil Type               | Weight<br>(kN/m³) |  |    | $\Phi_{u}$ (degree) |    |
| Engineered Fill (Sandy) | 19.0              | 0  | 30 | 0                   | 30 |

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used.

The assumed cross-section was analysed under the following conditions:

- -During Construction (Undrained Analysis);
- -Normal Water Level (Drained Analysis); and
- -Seismic Loading.

Considering the above details, the stability of the assumed representative cross-section was analysed under construction, normal water level as well as seismic loading conditions. Some of the results are shown in Enclosure B-10 to B-15. The results indicate that the calculated Factors of Safety were all above the recommended minimum values for static and seismic loading conditions. Based on these results, the pond walls are considered to be stable.

The pond excavation would require temporary dewatering to lower the groundwater level down to the native deposit, so that the engineered fill could be constructed. Recommendations on the dewatering methodology should be provided by the Project Dewatering Consultant.

Manfield Ski Club Feasibility Assessment Preliminary Geotechnical Investigation Proposed Development 628213 Sideroad 15, Mulmur, Ontario Reference Number: T18733

June 21, 2018

### 5.0 CLOSURE

As requested, the viability of some proposed works at the ski club was investigated and this preliminary feasibility report was prepared to summarise the subsurface findings at the requested borehole locations together with some preliminary geotechnical comments and recommendations. We would however recommend that once the development details are finalized and a detailed topographic survey map is available, our recommendations should be reviewed for their specific applicability and the recommendations to be finalized. A supplemental geotechnical investigation will be required.

OFESSION

H. SHAD

The attached Report Limitations are an integral part of this report.

Sincerely,

Shad & Associates Inc.

Stephen Chong, P. Eng. Senior Engineer

Houshang Shad, Ph. D., P. Eng. Principal

### **STATEMENT OF LIMITATION**

The conclusions and recommendations given in this report are based on information obtained at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or foreseen at the time of the site investigation.

The information contained herein in no way reflects on the environmental aspects of the project, unless stated otherwise.

The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as planning, grading, excavating, etc.

The design recommendations given in this report are project as well as site specific and then only if constructed substantially in accordance with the details stated in this report. We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of the testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

We recommend that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third party. We accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

### **FIGURES**

Figure 1: Site Location Plan

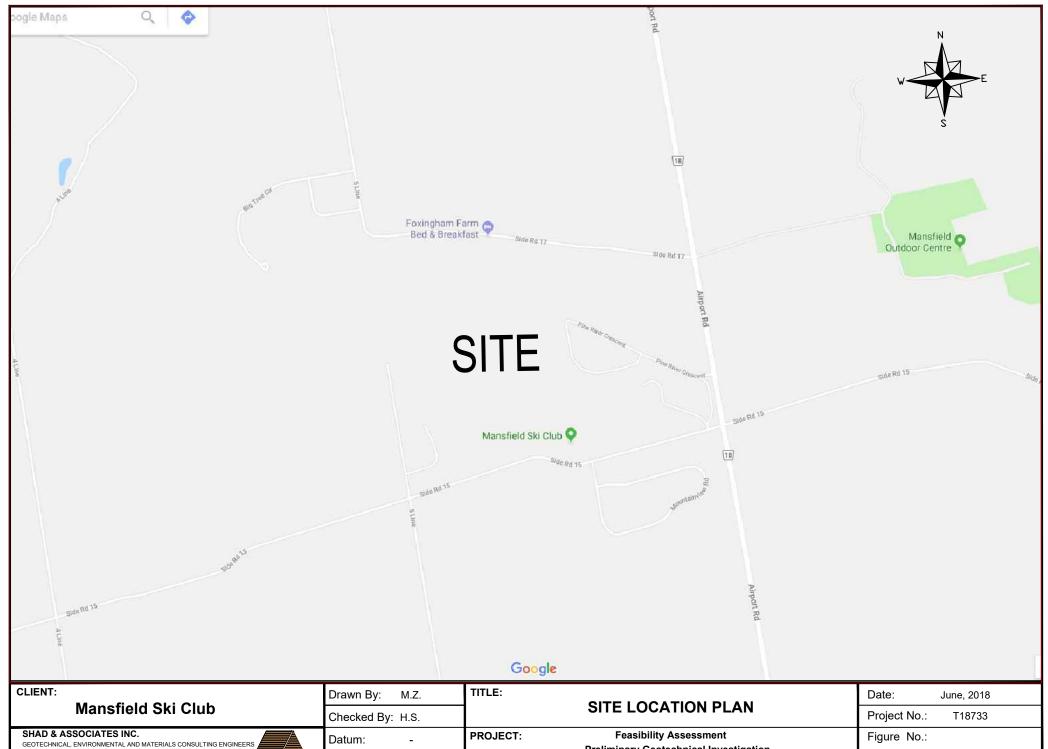
Figure 2: Borehole Location Plan

Figure 3: Assumed Section for Slope Stability Analysis for the Snow Making Pond

Figure 4: Assumed Sections for Slope Stability Analysis for the Ski Hill Heightening

Assumed Section for Slope Stability Analysis for the Dry Detention Pond

Figure 5:



83 Citation Drive, Unit 9 Vaughan, Ontaruio, L4K 2Z6 Tel: (905) 760-5566 Fax: (905) 760-5567

Projection: Scale: N.T.S.

**Preliminary Geotechnical Investigation** Proposed Development

628213 Sideroad 15

Mulmur, Ontario

1



N.T.S.

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# LEGEND:

BH 1



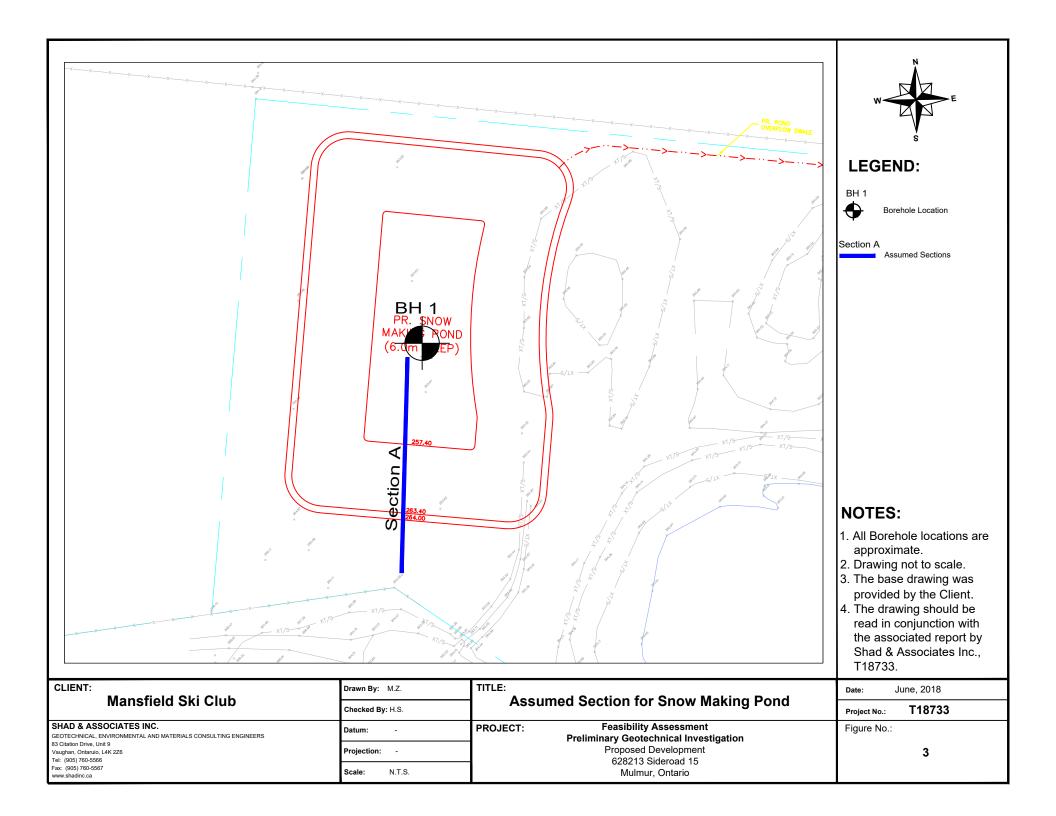
Borehole Location

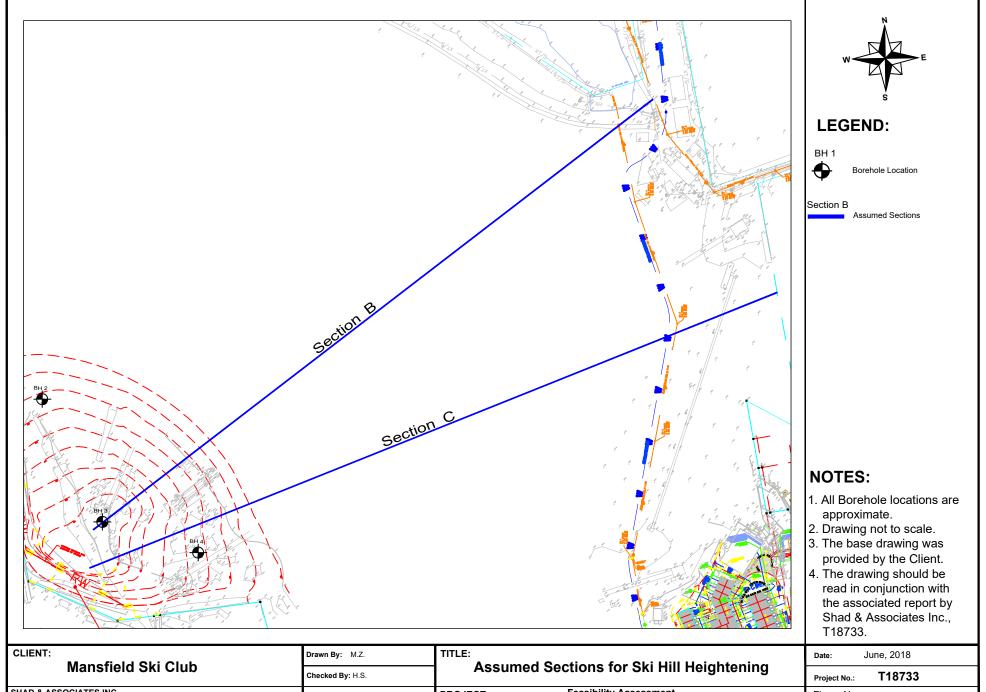
### **NOTES:**

- 1. All Borehole locations are approximate
- 2. Drawing not to scale.
- 3. The base drawing was
- provided by Client.
  4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc.,

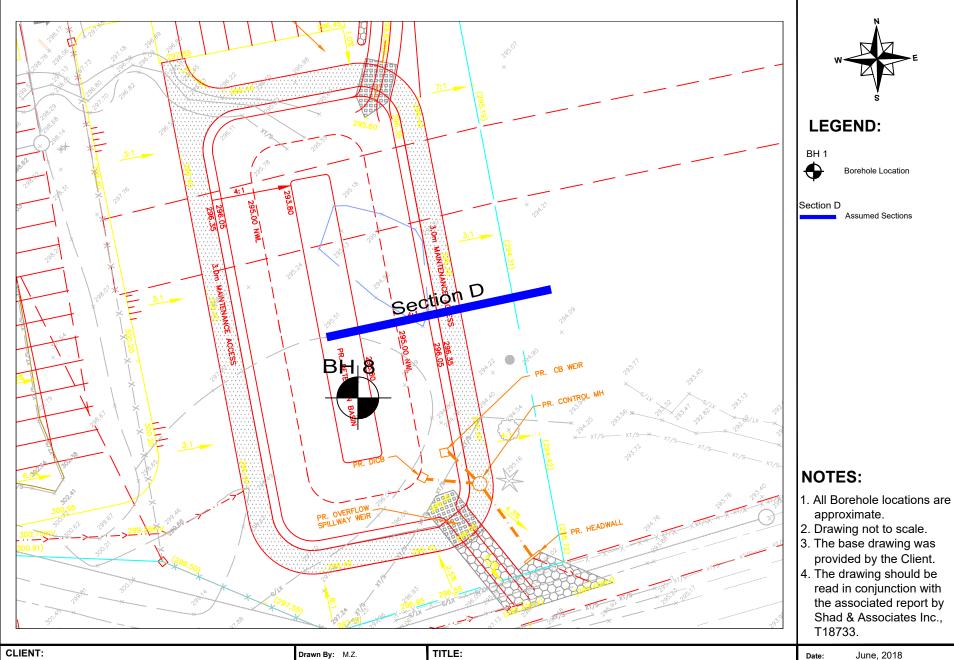
|   |                  |  | 118733.             |
|---|------------------|--|---------------------|
| CLIENT:   | Drawn By: M.Z.   | Borehole Location Plan   | Date: June, 2018    |
| Mansfield Ski Club  | Checked By: H.S. | Borenole Location Flam   | Project No.: T18733 |
| SHAD & ASSOCIATES INC. GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS | Datum: -         | PROJECT: Feasibility Assessment Preliminary Geotechnical Investigation | Figure No.:         |
| 83 Citation Drive, Unit 9<br>Vaughan, Ontarilo, L4K 2Z6<br>Tel: (905) 760-5568        | Projection: -    | Proposed Development   | 2                   |
| Fax: (905) 760-5567   |                  | 628213 Sideroad 15   | _                   |

Mulmur, Ontario





| Mansfield Ski Club  |                  | Accumed Coctions for Cki Hill Heightoning                              |                     |
|---|------------------|--|---------------------|
| Mansheid Ski Club   | Checked By: H.S. | Assumed Sections for Ski Hill Heightening                              | Project No.: T18733 |
| SHAD & ASSOCIATES INC. GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS | Datum: -         | PROJECT: Feasibility Assessment Preliminary Geotechnical Investigation | Figure No.:         |
| 83 Citation Drive, Unit 9<br>Vaughan, Ontaruio, L4K 2Z6<br>Tei: (905) 760-5566        | Projection: -    | Proposed Development<br>628213 Sideroad 15                             | 4                   |
| Fax: (905) 760-5567<br>www.shadinc.ca   | Scale: N.T.S.    | Mulmur, Ontario  |                     |



#### Mansfield Ski Club **Assumed Section for Dry Detention Pond** Checked By: H.S. T18733 Project No.: SHAD & ASSOCIATES INC. **Feasibility Assessment** PROJECT: Figure No.: GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS **Preliminary Geotechnical Investigation** 83 Citation Drive, Unit 9 Proposed Development Projection: -Vaughan, Ontaruio, L4K 2Z6 5 628213 Sideroad 15 Tel: (905) 760-5566 Fax: (905) 760-5567 N.T.S. Mulmur, Ontario www.shadinc.ca

Borehole Location

Assumed Sections

approximate.

T18733.

provided by the Client.

read in conjunction with the associated report by Shad & Associates Inc.,

June, 2018

## RECORD OF BOREHOLES

RECORD OF BOREHOLES (BH 1 to 8) EXPANATION OF BOREHOLE LOGS

#### **RECORD OF BOREHOLE 1** Project No.: T18733 ORIGINATED BY: M.Z. CLIENT: Mansfield Ski Club May 24, 2018 DATE: LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 BOREHOLE TYPE: Hollow Stem Augers DATUM: CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 MONITORING GROUND WATER CONDITIONS SAMPLE NUMBER **GRAIN SIZE** <u>E</u> DEPTH SCALE (metres) PLOT WFII DISTRIBUTION 'N" VALUES ELEVATION (metres) RECOVERY DESCRIPTION (%) STRATA SHEAR STRENGTH kPa TYPE GR SA SI CL 80 100 5 15 25 35 264.0 Ground Surface >40 Topsoil SS 60 1 5 263.6 23 dark brown to black Silty Sand Fill 263.2 some rootlets, occ. organic stains some gravel, wet 9 occ. organic stains 2 SS 23 21 1greyish brown **Gravelly Sand** wet, compact 2018 May 24, 2 8 3 SS 20 28 grey 261.9 2grey Fine Sand 19 occ. gravel SS 10 wet, compact 3-Gradation Analysis, S(5): 19 SS 5 25 11 19 SS 41 6 16 The high 'N'-Value very dense could be due to the presence of gravel 14 particles within the SS 35 7 100 occ. silty sand interbeddings soil matrix. 5occ. gravel 258.5 grey Fine Sand trace to some clay and silt 6 wet, loose Gradation Analysis, 19 S(8): 0 74 10 16 8 SS 28 8 257.3 grey Sand 11 some gravel, occ. silty sand/sandy silt 7seams 9 SS 35 47 wet, dense

### **RECORD OF BOREHOLE 1** Project No.: T18733 CLIENT: ORIGINATED BY: M.Z. Mansfield Ski Club DATE: May 24, 2018 LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 BOREHOLE TYPE: Hollow Stem Augers DATUM: CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 MONITORING GROUND WATER CONDITIONS SAMPLE NUMBER **GRAIN SIZE** (E) DEPTH SCALE (metres) WELL STRATA PLOT DISTRIBUTION 'N" VALUES ELEVATION (metres) RECOVERY ( DESCRIPTION (%) SHEAR STRENGTH kPa TYPE GR SA SI CL 40 60 80 100 5 15 25 35 Gradation Analysis, 14 S(10): 11 87 occ. gravel, compact 10 SS 30 26 8 255.8 grey Fine to Medium Sand occ. gravel, wet, very dense 17 11 SS 30 77 255.0 9 **End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion: 2.0m Measured Groundwater in Installed Monitoring Well on: June 6, 2018: 0.9m above ground June 13, 2018: 0.8m above ground 10 11 12-13-14

|                       |             |   |   | -             | REC  | OR            | D OF B       | ORE                        | HOLE 2  |                  |      |             |                       |  |
|-----------------------|-------------|---|---|---------------|------|---------------|--------------|----------------------------|---|------------------|------|-------------|-----------------------|--|
| Project               | No.:        | T18733  | CLIENT  | :             |      | Ма            | nsfield Ski  | Club                       |   | ORIGINA          | TED  | BY: M.Z.    |                       |  |
| DATE:                 |             | May 29, 2018  | LOCATI  | ON:           |      | Mu            | lmur, Ontar  | io                         |   | COMPIL           | ED B | Y: M.Z.     | SHAD & ASS            | OCIATES INC.                                     |
| DATUM                 |             | Approximate Geodetic  | BOREH   | OLE           | TYPE | : Sol         | id Stem Au   | gers                       |   | CHECKE           | D BY | ': H.S.     | 83 Citation Dr Unit 9 |  |
|                       |             | SOIL PROFILE  |   |               | S    | AMP           | LES          |                            |   |                  | WAT  | TER CONTENT |                       | REMARKS AND                                      |
| ELEVATION<br>(metres) | DEPTH SCALE | DESCRIPTION   | STRATA PLOT                                   | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES | GROUND WATER<br>CONDITIONS | DYNAMIC CONE PERESISTANCE 20 40 60  SHEAR STREN  20 40 60 | E PLOT<br>80 100 | -    | (%)         | MONITORING<br>WELL    | GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
| 377.0                 |             | Ground Surface  |   |               |      |               |              | _                          |   |                  |      |             |                       |  |
| 376.6                 |             | Topsoil   | <i>\\\</i> }\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | 1             | SS   | 46            | 5            |                            |   |                  |      | 28          |                       |  |
| 376.4                 |             | mottled brown Silty Clay/Clayey Silt Fill occ. organic stains, damp |   |               |      |               |              | -                          |   |                  |      | 0           |                       |  |
| 376.2                 |             | reddish brown, occ. greyish brown Silty Clay/Clayey Silt            | /[1 <u>1</u>                                  | 2             | SS   | 13            | 50/8cm       |                            |   |                  | 6    |             |                       |  |
|                       | 1           | damp, stiff reddish brown   |   |               |      |               |              | 1                          |   |                  |      |             |                       |  |
|                       |             | Highly Weathered Shale occ. limestone seams/fragments               |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             |   |   | 3             | SS   | 15            | 50/8cm       | 1                          |   |                  | 7    |             |                       | Hard Augering                                    |
|                       |             |   |   |               | "    |               |              |                            |   |                  |      |             |                       |  |
|                       | 2           | Weathered Shale   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | occ. limestone seams/interbedding                                   |   |               | 00   | 45            | 50/8cm       | +                          |   |                  | 5    |             |                       |  |
|                       |             |   | H-1-1-1-1                                     | 4             | SS   | 15            | 00/00111     | +                          |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       | 3           | 3-  |   |               |      |               |              | 4                          |   |                  | 7    |             |                       |  |
|                       |             |   |   | 5             | SS   | 13            | 50/5cm       | -                          |   |                  |      |             |                       |  |
|                       |             |   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       | 4           | ı <u> </u>  |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | -   |   |               |      |               |              |                            |   |                  | 9    |             |                       |  |
| 372.3                 |             | End of Borehole   |   | 6             | SS   | 8             | 50/8cm       | +                          |   |                  | o    |             |                       |  |
|                       | 5           | Cave-in Depth on Completion: None                                   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | Groundwater Depth on Completion: Dr                                 | y   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             |   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       | 6           | 3   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | -   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             |   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       | _           | , ]   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       | 7           |   |   |               |      |               |              |                            |   |                  |      |             |                       |  |
|                       |             | _   |   |               |      |               |              |                            |   |                  |      |             |                       |  |

|                    |                               |   |             | F             | REC  | OR            | D OF B        | ORE                        | HOLE 3   |                              |              |                        |   |
|--------------------|-------------------------------|---|-------------|---------------|------|---------------|---------------|----------------------------|--|------------------------------|--------------|------------------------|---|
| Project            | No.:T                         | 18733   | CLIENT      | :             |      | Mai           | nsfield Ski ( | lub                        |  | ORIGINA                      | TED BY: M.Z. |                        |   |
| DATE:              |                               | lay 29, 2018  | LOCATI      | ON:           |      | Mul           | mur, Ontari   | 0                          |  | COMPIL                       | ED BY: M.Z.  | SHAD & ASSOCIATES INC. |   |
| DATUM              | l: A                          | pproximate Geodetic   | BOREH       | OLE           | TYPE | : Hol         | low Stem A    | ugers                      |  | CHECKE                       | D BY: H.S.   | 83 Citation            | n Dr, Unit 9,<br>ntario, L4K 2Z6                      |
|                    |                               | SOIL PROFILE  |             |               |      | AMPI          |               |                            |  |                              |              | ruug, c.               |   |
| ELEVATION (metres) | DEPTH SCALE<br>(metres)       | DESCRIPTION   | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | N " VALUES    | GROUND WATER<br>CONDITIONS | DYNAMIC CONE PI RESISTANCE 20 40 60  SHEAR STREN  20 40 60 | E PLOT<br>80 100<br>IGTH kPa | (%)          | MONITORING<br>WELL     | REMARKS AND  GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL |
|                    | <u>a</u> -                    |   | <u> </u>    | /S            | ۲    | 2             | -             | ច ប                        | 20 40 00   | 00 100                       | 5 15 25 35   |                        |   |
| 385.0              | 0                             | Ground Surface Topsoil  |             |               |      |               |               |                            |  |                              | 21           |                        |   |
| 384.8              | -                             | some rootlets, occ. organic stains  | 7/7         | 1             | SS   | 28            | 7             |                            |  |                              | 18           |                        |   |
|                    | 1—<br>1—                      | reddish brown, occ. greyish brown<br>Silty Clay/Clayey Silt Fill<br>occ. gravel, damp |             | 2             | SS   | 10            | 6             |                            |  |                              | 21           |                        |   |
|                    | -<br>-<br>-                   |   |             |               |      |               |               |                            |  |                              | 19           |                        |   |
|                    | 2-                            |   |             | 3             | SS   | 18            | 7             | -                          |  |                              |              |                        |   |
|                    | -<br>-<br>-<br>-              |   |             | 4             | SS   | 15            | 12            |                            |  |                              | 16           |                        |   |
|                    | 3                             |   |             | 5             | SS   | 28            | 12            | -                          |  |                              | 16           |                        |   |
|                    | -<br>-<br>-<br>-<br>4         | occ. organic stains   |             | 6             | SS   | 25            | 10            | -                          |  |                              | 16           |                        |   |
|                    | -<br>-<br>-<br>-              |   |             |               |      |               |               | _                          |  |                              | 12           |                        |   |
| 379.8              | 5—<br>5—                      | occ. rootlets   |             | 7             | SS   | 23            | 9             |                            |  |                              |              |                        |   |
| 070 -              | -                             | Topsoil   | \{\}        | _             |      |               |               | -                          |  |                              | 18           |                        |   |
| 379.5              | -<br>-<br>-<br>-              | - reddish brown, occ. greyish brown Silty Clay/Clayey Silt occ. shale fragments       | H.          | 8             | SS   | 15            | 17            |                            |  |                              | 16           |                        |   |
|                    | 6 <del>-</del><br>-<br>-<br>- | damp, very stiff  |             | 9             | SS   | 28            | 21            | _                          |  |                              | 17<br>°      |                        |   |
|                    | -                             |   | H<br>H      |               |      |               |               | 1                          |  |                              | 17           |                        |   |
|                    | 7                             | -   | ###         | 10            | SS   | 25            | 18            | -                          |  |                              | 0            |                        |   |

|                       |                         |  |             | F             | REC  | OR            | D OF B       | ORE                        | HO | LE :  | 3     |        |                |     |      |       |       |              |  |
|-----------------------|-------------------------|--|-------------|---------------|------|---------------|--------------|----------------------------|----|-------|-------|--------|----------------|-----|------|-------|-------|--------------|--|
| Project N             | lo.:]                   | T18733   | CLIENT:     |               |      | Ma            | nsfield Ski  | Club                       |    |       |       |        | ORIGIN         | ATE | D BY | ': M. | Z.,   |              |  |
| DATE:                 |                         | May 29, 2018   | LOCATI      | ON:           |      | Mu            | mur, Ontar   | io                         |    |       |       |        | COMPII         | LED | BY:  | М.    | z.    | SUADA        | OCIATES INC                                      |
| DATUM:                |                         | Approximate Geodetic   |             |               | TYPF |               | low Stem A   |                            |    |       |       |        | CHECK          |     |      |       |       | 83 Citatio   | n Dr, Unit 9,                                    |
| DATION.               |                         | SOIL PROFILE   | DONLIN      |               |      | AMP           |              | T T                        |    |       |       |        | OnLon          |     |      |       |       |              | ntario, L4K 2Z6                                  |
|                       |                         |  |             | æ             |      |               |              | <b>~</b>                   |    | RES   | ISTAN | ICE PI | TRATION<br>LOT | W   |      |       | ITENT | MONITORING   | REMARKS AND                                      |
| ELEVATION<br>(metres) | DEPTH SCALE<br>(metres) | DESCRIPTION  | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES | GROUND WATER<br>CONDITIONS | 20 | SHEAI | R STR | ENGT   | <b>A</b>       |     |      | (%)   | - 25  | WELL         | GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
| 3                     | <u> </u>                |  | S           | δS            |      | 22            |              | 88                         | 20 | ) 4(  | 0 6   | 0 8    | 0 100          | 5   | 15   | ) Z   | 5 35  |              |  |
|                       |                         | reddish brown, occ. greyish brown Silty Clay/Clayey Silt occ. shale fragments damp, hard |             | 11            | SS   | 30            | 38           |                            |    |       |       |        |                |     | 10   |       |       |              |  |
|                       | 8-                      | - damp, nard   | H.          |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | -  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | -  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       | 9-                      |  | H:          |               |      |               |              | -                          |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | -  |             | 12            | SS   | 46            | 32           |                            |    |       |       |        |                |     | 14   |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
| 375.0                 |                         | _  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
| 070.0                 | 10 -                    |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              | Hard Augering                                    |
|                       |                         | reddish brown, occ. greyish brown  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              | Hard Augering                                    |
|                       |                         | Highly Weathered Shale   |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       | 2018         |  |
|                       |                         |  |             | 13            | ss   | 8             | 50/10cm      |                            |    |       |       |        |                | 5   |      |       |       | June 6, 2018 |  |
|                       | 11 -                    | -  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              | , 29, 2018                 |    |       |       |        |                |     |      |       |       |              |  |
|                       | 12                      | Weathered Shale  |             |               |      |               |              | May 2                      |    |       |       |        |                |     |      |       |       |              |  |
| 372.6                 |                         | Weathered Shale  End of Borehole   |             | 14            | SS   | 10            | 50/13cm      | <b>→</b>                   |    |       |       |        |                |     | 9    |       |       |              |  |
|                       |                         | Cave-in Depth on Completion: N/A Groundwater Depth on Completion: 12.2m                  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       | 13                      | Measured Groundwater in Installed  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | Monitoring Well on:  June 6, 2018: 11.1m   |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | June 13, 2018: 11.1m   |             |               |      |               |              |                            |    |       |       |        |                | +   |      |       |       |              |  |
|                       |                         | -  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       | 14                      |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         |  |             |               |      |               |              |                            |    |       |       |        |                |     |      |       |       |              |  |
|                       |                         | -  |             |               |      |               |              |                            |    |       |       |        |                | 41  |      |       |       |              |  |

#### **RECORD OF BOREHOLE 4** Project No.: T18733 Mansfield Ski Club ORIGINATED BY: M.Z. CLIENT: DATE: May 25, 2018 LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 BOREHOLE TYPE: Hollow Stem Augers DATUM: CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 GROUND WATER CONDITIONS MONITORING SAMPLE NUMBER **GRAIN SIZE** Ē DEPTH SCALE (metres) PLOT WFII DISTRIBUTION ELEVATION (metres) . N " VALUES RECOVERY DESCRIPTION (%) STRATA SHEAR STRENGTH kPa TYPE GR SA SI CL 60 80 5 15 25 35 374.0 Ground Surface Additionally drilled Topsoil Boreholes 4A and 373.7 4B about 2m west SS 41 6 1 some topsoil 23 and east of Borehole 4 to reddish brown confirm the shale Silty Clay/Clayey Silt Fill deposit. occ. organic stains, trace rootlets, damp 18 BH 4A: 2 SS 30 11 Approx. Depth: 4.6m Highly Weathered Shale @~ 3.0m with a SPT value of 50 blow/2cm and 20 moisture content of 372.2 3 SS 28 14 reddish brown Silty Clay/Clayey Silt 2 BH 4B: occ. silt seams Approx. Depth: damp, stiff 4.6m Highly Weathered 13 Shale @~ 3.0m with a SPT value of occ. shale fragments, hard SS 41 50 blow/10cm and moisture content of 371.1 16%. 3 reddish brown **Highly Weathered Shale** 50/10cm SS 18 5 occ. limestone fragments Gradation Analysis & Atterberg Limits, S(4): 0 4 52 44 LL: 36% 7 PL: 21% PI: 15% 50/8cm SS 15 6 6 Weathered Shale 7 SS 15 50/3cm 5-6 50/10cm 8 SS 8

|                       |                      |                                     |             |               | DEC  | ·OB           | D OE B             |                            | - 110 |                     |                |                       |                  |                 |                |       |   |  |  |
|-----------------------|----------------------|-------------------------------------|-------------|---------------|------|---------------|--------------------|----------------------------|-------|---------------------|----------------|-----------------------|------------------|-----------------|----------------|-------|---|--|--|
| Proiect               | No.:                 | T18733                              | CLIEN       |               | KEU  |               | D OF Bonsfield Ski |                            |       |                     | 4              |                       | ORIGINA          | TED             | BY: I          | W.Z.  |   |  |  |
|                       |                      | T18733                              |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
| DATE:                 |                      | May 25, 2018                        | LOCA        | TION:         |      | Mul           | lmur, Ontar        | io                         |       |                     |                |                       | COMPIL           | ED B            | Y: [           | M.Z.  |   | SHAD & ASSO  |  |
| DATUM                 |                      | Approximate Geodetic                | BORE        | IOLE          | TYPE | : Hol         | low Stem A         | ugers                      |       |                     |                |                       | CHECKE           | D BY            | ': <u>.</u> .! | H.S.  |   | 83 Citation Dr, Unit 9,<br>Vaughan, Ontario, L4K 2Z6 |  |
|                       |                      | SOIL PROFILE                        |             |               |      | AMPI          | LES                |                            | DYN   | IAMIC               | CONE           | PENET                 | RATION           | WA <sup>-</sup> | TER C          | ONTEN | т |  | REMARKS AND                                      |
| ELEVATION<br>(metres) | DEPTH SCALE (metres) | DESCRIPTION                         | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES       | GROUND WATER<br>CONDITIONS | 1     | RES<br>20 4<br>SHEA | 0 60<br>R STRI | CE PLO<br>80<br>ENGTH | OT<br>100<br>kPa | 5               | <b>(</b> %     | 25 3  | 5 | MONITORING<br>WELL                                   | GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|                       |                      | reddish brown                       |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | - Weathered Shale                   |             | 9             | SS   | 10            | 50/13cm            |                            |       |                     |                |                       |                  | 8               |                |       |   |  |  |
|                       | 8-                   | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | -                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 9-                   | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  | 6               |                |       |   |  |  |
| 364.7                 |                      | End of Borehole                     |             | 10            | SS   | 10            | 50/10cm            | -                          |       |                     |                |                       |                  | 0               |                |       |   |  |  |
|                       |                      | Cave-in Depth on Completion: None   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | Groundwater Depth on Completion: Dr | у           |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 10                   | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | -                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 11 .                 |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 12                   | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | 1                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 12                   |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 13                   |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | =                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       | 14                   | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      | _                                   |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |
|                       |                      |                                     |             |               |      |               |                    |                            |       |                     |                |                       |                  |                 |                |       |   |  |  |

#### **RECORD OF BOREHOLE 5** Project No.: T18733 Mansfield Ski Club ORIGINATED BY: M.Z. CLIENT: DATE: May 30, 2018 LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 DATUM: BOREHOLE TYPE: Solid Stem Augers CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 NUMBER MONITORING GROUND WATER CONDITIONS **GRAIN SIZE** Ē DEPTH SCALE (metres) PLOT WFII DISTRIBUTION 'N" VALUES ELEVATION (metres) RECOVERY DESCRIPTION (%) SAMPLE N STRATA SHEAR STRENGTH kPa TYPE GR SA SI CL 40 60 80 100 20 5 15 25 35 307.0 Ground Surface 15 dark brown Silty Sand/Sandy Silt Fill 1 SS 30 3 some topsoil, trace clay, moist 12 306.3 .0,0, occ. organic stains Gradation Analysis, 11 S(2): 13 59 28 0 2 SS 41 1-16 Silty Sand Till °С. occ. oxidized fissures moist, compact ٠٥٠ 0,0, 8 damp 3 SS 41 30 2-0,0,0,0,0,0,0,0, -----7 verv dense SS 30 30, 2018 3-May Gradation Analysis, S(5): 5 59 35 1 8 SS 30 5 87 0,0,0,0,0, 4moist 6 % 10 SS 28 50/13cm 302.1 · () °

End of Borehole

Cave-in Depth on Completion: 4.1m Groundwater Depth on Completion: 3.2m

5-

6

|                       |                                   |  |  | F             | REC  | OR            | D OF B        | ORE                        | HOLE 6                                       |                |              |  |   |  |
|-----------------------|-----------------------------------|--|--|---------------|------|---------------|---------------|----------------------------|--|----------------|--------------|--|---|--|
| Project               | No.: <u>T</u>                     | 18733  | CLIENT                                 |               |      |               | nsfield Ski ( |                            |  | ORIGINA        | TED BY: M.Z. |  |   |  |
| DATE:                 |                                   | May 30, 2018   | LOCATI                                 | ON:           |      | Mul           | mur, Ontar    | io                         |  | COMPIL         | ED BY: M.Z.  |  |   |  |
| DATUM                 |                                   | pproximate Geodetic  | BOREH                                  | OLE           | TYPE |               | id Stem Au    |                            |  |                | DBY: H.S.    | 83 Citation Dr, Unit 9,<br>Vaughan, Ontario, L4K 2Z6 |   |  |
|                       |                                   | SOIL PROFILE   |  |               |      | AMPL          |               |                            |  |                |              | Vaugilaii, Oi  |   |  |
| ELEVATION<br>(metres) | DEPTH SCALE<br>(metres)           | DESCRIPTION  | STRATA PLOT                            | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES  | GROUND WATER<br>CONDITIONS | DYNAMIC CONE PEI   RESISTANCE   20   40   60 | PLOT<br>80 100 | (%) 5 15 25  | MONITORING<br>WELL                                   | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |  |
| 302.0                 | 0-                                | Ground Surface   |  |               |      |               |               |                            |  |                |              |  |   |  |
|                       | 0<br>-<br>-<br>-<br>-<br>-        | Granular Fill  |  | 1             | SS   | 48            | 14            |                            |  |                | 14           |  |   |  |
| 300.9                 | -<br>-<br>-<br>1                  | some clayey silt fill occ. organic stains  |  | 2             | SS   | 41            | 17            |                            |  |                | 8 0          |  |   |  |
|                       | -<br>-<br>-                       | Topsoil  | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ |               |      |               |               |                            |  |                | 27           |  |   |  |
| 300.3                 | -<br>-<br>-<br>2                  | brown, occ. dark brown Sandy Silt Fill some clay, some organic stains                    | ~                                      | 3             | SS   | 35            | 2             |                            |  |                | 26           |  |   |  |
| 299.8                 | -                                 | moist to wet brown   | · Δ°                                   |               |      |               |               |                            |  |                |              |  |   |  |
|                       | -<br>-<br>-<br>-                  | Silty Sand Till<br>damp, dense   | . D.                                   | 4             | SS   | 35            | 47            |                            |  |                | 8 0          |  |   |  |
|                       | 3-                                | damp, very dense   | , D.<br>, D.<br>, D.                   | 5             | SS   | 20            | 50/13cm       |                            |  |                | 7 0          |  |   |  |
|                       | -<br>-<br>-                       |  | . B.                                   |               |      |               |               | 2018                       |  |                |              |  |   |  |
|                       | 4                                 |  |  |               |      |               |               | . May 30,                  |  |                | -            |  |   |  |
| 297.0                 | -<br>-<br>-<br>-                  |  | . 0°                                   | 6             | SS   | 35            | 93            |                            |  |                | 8 0          |  |   |  |
|                       | 5—<br>-<br>-<br>-<br>-            | End of Borehole  Cave-in Depth on Completion: 4.3m Groundwater Depth on Completion: 4.3r | n                                      |               |      |               |               |                            |  |                |              |  |   |  |
|                       | 6 -<br>-<br>-<br>-<br>-<br>-<br>- |  |  |               |      |               |               |                            |  |                |              |  |   |  |
|                       | -<br>-<br>7 —<br>-<br>-<br>-      |  |  |               |      |               |               |                            |  |                |              |  |   |  |

#### **RECORD OF BOREHOLE 7** Project No.: T18733 Mansfield Ski Club ORIGINATED BY: M.Z. CLIENT: DATE: May 30, 2018 LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 BOREHOLE TYPE: Hollow Stem Augers DATUM: CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 GROUND WATER CONDITIONS MONITORING SAMPLE NUMBER **GRAIN SIZE** Ē DEPTH SCALE (metres) PLOT WFII DISTRIBUTION 'N" VALUES ELEVATION (metres) RECOVERY DESCRIPTION (%) STRATA SHEAR STRENGTH kPa TYPE GR SA SI CL 60 80 100 5 15 25 35 286.0 Ground Surface dark brown, some topsoil 17 mottled brown 43 1 SS 4 Clayey Silt Fill some organic stains, some topsoil 285.3 some rootlets, damp brown Gradation Analysis, Sandy Silt Till S(2): 2 24 69 5 12 trace clay, occ. oxidized fissures 2 SS 30 18 occ. sand seams damp, compact dense 13 3 SS 28 44 some sand interbeddings/zones 2-283.9 June 6, 2018 ۰٥۰ June 13, 2018 greyish brown 7 • O ° . D. Silty Sand Till SS damp, very dense 3-. Δ° . Δ° 7 SS 5 35 78 , 2018 . D. May 30, ٠٥° damp to moist ۰0° 8 SS 30 6 80 281.0 5-End of Borehole Cave-in Depth on Completion: N/A Groundwater Depth on Completion:4.5m Measured Groundwater in Installed Monitoring Well on: June 6, 2018: 2.6m June 13, 2018: 2.8m 6-

|                    |                         |  |                       | F             | REC  | OR            | D OF B       | ORE                        | HOLE 8   |                              |                |                            | $\nearrow$                              |
|--------------------|-------------------------|--|-----------------------|---------------|------|---------------|--------------|----------------------------|--|------------------------------|----------------|----------------------------|---|
| Project            | No.:T                   | 18733  | CLIENT                | :             |      | Mar           | nsfield Ski  | Club                       |  | ORIGINA                      | ATED BY: M.Z.  |                            |   |
| DATE:              |                         | ay 30, 2018  | LOCATI                | ON:           |      | Mul           | mur, Ontai   | rio                        |  | COMPIL                       | ED BY: M.Z.    | SHAD & ASSO                | OCIATES INC.                            |
| DATUM              | l: <u>A</u>             | pproximate Geodetic  | BOREH                 | OLE           | TYPE | : Hol         | low Stem A   | ugers                      | i  | CHECK                        | ED BY: H.S.    | 83 Citation                | n Dr, Unit 9,<br>Itario, L4K 2Z6        |
|                    |                         | SOIL PROFILE   |                       |               | 5    | AMPI          | _ES          |                            |  |                              | WATER CONTENT  | , and <b>g</b> . and , and | REMARKS AND                             |
| ELEVATION (metres) | DEPTH SCALE<br>(metres) | DESCRIPTION  | STRATA PLOT           | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES | GROUND WATER<br>CONDITIONS | PYNAMIC CONE P RESISTANC 20 40 60  SHEAR STREN  20 40 60 | E PLOT<br>80 100<br>NGTH kPa | (%) 5 15 25 35 | MONITORING<br>WELL         | GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
| 296.0<br>295.9     | 0                       | Ground Surface   |                       |               |      |               |              |                            |  |                              |                |                            |   |
| 290.9              | -<br>-<br>-<br>-<br>-   | Topsoil  dark brown, occ. mottled brown Sandy Silt Fill trace clay, occ. organic stains some topsoil, damp |                       | 1             | SS   | 35            | 6            |                            |  |                              | 11 0           |                            |   |
|                    | 1-                      |  |                       | 2             | SS   | 30            | 5            |                            |  |                              | 34             |                            |   |
|                    | 2-                      | topsoil interbeddings  |                       | 3             | SS   | 33            | 4            |                            |  |                              | 15             |                            |   |
|                    | -<br>-<br>-<br>-        | dark greyish brown   |                       | 4             | SS   | 46            | 3            |                            |  |                              | 24             |                            |   |
|                    | 3                       | moist  |                       | 5             | SS   | 46            | 4            |                            |  |                              | 21             | ne 6, 2018                 |   |
|                    | 4—                      | moist to wet   |                       | 6             | SS   | 46            | 2            | 2018                       |  |                              | 27             | June                       |   |
| 291.6              | -                       |  |                       |               |      |               |              | May 30, 2018               |  |                              |                |                            |   |
| 291.3              | _                       | Topsoil  | \{\}\}\\              |               |      |               | _            |                            |  |                              |                | 40                         |   |
| 290.8              | 5-                      | rusty brown Silty Sand/Sandy Silt trace organic stains moist to wet, loose                                 |                       | 7             | SS   | 30            | 6            |                            |  |                              | <u> </u>       | 40                         |   |
|                    | -<br>-<br>-<br>-        | brown<br>Silty Sand Till<br>wet, compact   | . B.<br>. B.          |               | SS   | 28            | 22           |                            |  |                              | 13             |                            |   |
|                    | 6-                      |  | . O.                  |               |      |               |              |                            |  |                              |                |                            |   |
| 000 0              | -                       |  | . 6°<br>. 6°          | 9             | SS   | 28            | 29           |                            |  |                              | 11 0           |                            |   |
| 289.3              | -                       | greyish brown<br>Silty Sand/Sandy Silt Till  | ۰۵۰<br>۱۳۰۶:<br>۱۳۰۶: |               |      |               |              |                            |  |                              | 9              |                            |   |
|                    | 7                       | possible cobbles/boulders<br>damp to moist, very dense   | . O.                  | -10           | SS   | 2             | 50/5cm       | -                          |  |                              |                |                            |   |

## **RECORD OF BOREHOLE 8** Project No.: T18733 CLIENT: ORIGINATED BY: M.Z. Mansfield Ski Club DATE: May 30, 2018 LOCATION: Mulmur, Ontario COMPILED BY: M.Z. 83 Citation Dr, Unit 9, Vaughan, Ontario, L4K 2Z6 BOREHOLE TYPE: Hollow Stem Augers DATUM: CHECKED BY: H.S. Approximate Geodetic **SOIL PROFILE SAMPLES** WATER CONTENT REMARKS AND DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 MONITORING GROUND WATER CONDITIONS SAMPLE NUMBER **GRAIN SIZE** (E) DEPTH SCALE (metres) WELL STRATA PLOT DISTRIBUTION " N " VALUES ELEVATION (metres) RECOVERY ( DESCRIPTION (%) SHEAR STRENGTH kPa TYPE GR SA SI CL 40 60 80 100 5 15 25 35 greyish brown Gradation Analysis, ٠٥٠ Silty Sand/Sandy Silt Till S(11): 3 50 42 5 occ. oxidized fissures . C. 9 damp to moist, very dense 11 SS 20 50/13cm 288.1 ۰۵۰ 8 End of Borehole Cave-in Depth on Completion: N/A Groundwater Depth on Completion:4.6m Measured Groundwater Level in Installed Monitoring Well on: June 6, 2018: 3.7m June 13, 2018: 3.8m 9-10 11 12-13-14



#### **EXPLANATION OF BOREHOLE LOG**

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

#### **GENERAL INFORMATION**

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

## **SOIL LITHOLOGY**

### Elevation and depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

#### Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

#### Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology (Ref. Unified Soil Classification System):

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

| Compactness of Cohesionless Soils | SPT N-Value |
|-----------------------------------|-------------|
| Very loose                        | 0 to 4      |
| Loose                             | 4 to 10     |
| Compact                           | 10 to 30    |
| Dense                             | 30 to 50    |
| Very Dense                        | > 50        |
|                                   |             |

| Consistency of | SPT N-Value  | Undrained Shear Strength |              |  |  |  |  |  |
|----------------|--------------|--------------------------|--------------|--|--|--|--|--|
| Cohesive Soils | SPI IN-Value | kPa                      | psf          |  |  |  |  |  |
| Very soft      | 0 to 2       | 0 to 12                  | 0 to 250     |  |  |  |  |  |
| Soft           | 2 to 4       | 12 to 25                 | 250 to 500   |  |  |  |  |  |
| Firm           | 4 to 8       | 25 to 50                 | 500 to 1000  |  |  |  |  |  |
| Stiff          | 8 to 15      | 50 to 100                | 1000 to 2000 |  |  |  |  |  |
| Very stiff     | 15 to 30     | 100 to 200               | 2000 to 4000 |  |  |  |  |  |
| Hard           | > 30         | Over 200                 | Over 4000    |  |  |  |  |  |

#### Soil Sampling

Sample types are abbreviated as follows:

| SS | Split Spoon  | TW | Thin Wall Open (Pushed)   | RC | Rock Core     |
|----|--------------|----|---------------------------|----|---------------|
| AS | Auger Sample | TP | Thin Wall Piston (Pushed) | WS | Washed Sample |

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

### Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

#### Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

#### **Comments**

This column is used to describe non-standard situations or notes of interest.



#### MODIFIED \* UNIFIED CLASSIFICATION SYSTEM FOR SOILS

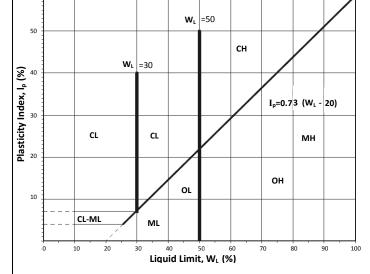
\*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1

March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

|   |  |                               | March 1      | 1953.) modified slightly so that an inc   | organic clay of "medium plasticity" is recognized.        |   |  |   |  |   |  |  |
|---|--|-------------------------------|--------------|---|---|---|--|---|--|---|--|--|
|   | MAJOR DIVISION   |                               | GROUP SYMBOL | TY  | YPICAL DESCRIPTION  | LABORATORY CLASSIFICATION CRITERIA  |  |   |  |   |  |  |
| TH:   | HAN<br>HAN   | CLEAN<br>GRAVELS              | GW           | WELL GRADED GRAVELS, G  | GRAVEL-SAND MIXTURES, LITTLE OR NO FINES                  | $C_u = \frac{D_{60}}{D_{10}} > 4$ ; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ |  |   |  |   |  |  |
| BY WEIG   | IORE TH<br>COARS<br>ARGER T  | (TRACE OR NO<br>FINES)        | GP           |   | ADED GRAVELS, GRAVEL-SAND<br>IRES, LITTLE OR NO FINES     | NOT MEETING ABOVE REQUIREMENTS  |  |   |  |   |  |  |
| νν HALF<br>π)   | GRAVELS MORE THAN<br>HALF THE COARSE<br>FRACTION LARGER THAN<br>4.75mm | DIRTYGRAVELS<br>(WITH SOME OR | GM           | SILTY GRAVEL  | S, GRAVEL-SAND- SILT MIXTURES                             | ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4   |  |   |  |   |  |  |
| ORE THA   | GR<br>FRAC   | MORE FINES)                   | GC           | CLAYEY GRAVE  | LS, GRAVEL-SAND-CLAY MIXTURES                             | ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7   |  |   |  |   |  |  |
| SOILS (M  | TON<br>imm   | CLEAN SANDS<br>(TRACE OR NO   | SW           | WELL GRADED SANDS   | S, GRAVELLY SANDS, LITTLE OR NO FINES                     | $C_u = \frac{D_{60}}{D_{10}} > 6$ ; $C_C = \frac{(D_{20})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ |  |   |  |   |  |  |
| COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT<br>LARGER THAN 75 m) | SANDS MORE THAN HALF<br>THE COARSE FRACTION<br>SMALLER THAN 4.75mm     | FINES)                        | SP           | POORLY GRADED GRAVELS,  | GRAVEL- SAND MIXTURES, LITTLE OR NO FINES                 | NOT MEETING ABOVE REQUIREMENTS  |  |   |  |   |  |  |
| ARSE GF   | DS MORI<br>COARS   | DIRTY SANDS                   | SM           | SILTY SA  | ANDS, SAND-SILT MIXTURES                                  | ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4  |  |   |  |   |  |  |
| Ö   | SAN  | (WITH SOME OR<br>MORE FINES)  | sc           | CLAYEY S  | ANDS, SAND-CLAY MIXTURES                                  | ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7  |  |   |  |   |  |  |
| RE THAN HALF BY WEIGHT SMALLER<br>THAN 75μm)                        | SILTS BELOW "A"<br>LINE MEGLIGBLE<br>ORGANIC CONTENT                   | WL < 50%                      | ML           | INORGANIC SILTS AND VERY FI   | NE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT<br>PLASTICITY |   |  |   |  |   |  |  |
| 3Y WEIGH  | SILTS<br>LINE<br>ORGAI   | W <sub>L</sub> < 50%          | МН           | INORGANIC SILTS, MICACEOUS  | OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS                | CLASSIFICATION IS BASED UPON PLASTICITY CHART   |  |   |  |   |  |  |
| AN HALF E   | A" LINE  | W <sub>L</sub> < 30%          | CL           | INORGANIC CLAYS OF LOW PLA  | STICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN<br>CLAYS    | (SEE BELOW)   |  |   |  |   |  |  |
| 10RE TH.<br>THAN 7  | CLAY ABOVE "A" LINE<br>NEGLIGIBLE<br>ORGANIC CONTENT                   | 30% < W <sub>L</sub> < 50%    | CI           | INORGANIC CLAYS   | OF MEDIUM PLASTICITY, SILTY CLAYS                         |   |  |   |  |   |  |  |
| SOILS (A  | CLAY<br>N<br>ORGA  | W <sub>L</sub> < 50%          | СН           | INORGANIC CLA   | YS OF HIGH PLASTICITY, FAT CLAYS                          |   |  |   |  |   |  |  |
| FINE-GRAINED SOILS (MORE  | N S S S S S S S S S S S S S S S S S S S                                | W <sub>L</sub> < 50%          | OL           | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY   |   | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY   |  | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |  | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |  |  |
| FINE-G  | ORGANIC<br>SILTS &<br>CLAY'S<br>BELOW "A"<br>LINE                      | W <sub>L</sub> < 50%          | ОН           | OH ORGANIC CLAYS OF HIGH PLASTICITY  WHENEVER THE NATURE OF THE FINES BEEN DETERMINED, IT IS DESIGNATED BY SF IS A MIXTURE OF SAND WITH S |   |   |  |   |  |   |  |  |
|   | HIGH ORGANIC SOILS   |                               | Pt           | PEAT AND C  | OTHER HIGHLY ORGANIC SOILS                                | STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE   |  |   |  |   |  |  |
|   |  | SOIL COMPON                   | NENTS        |   | Plasticity Chart f  | or Soil Passing 425 Micron Sieve  |  |   |  |   |  |  |

60

|          |                               | SOIL COMPO   | NENTS   |                |             |  |  |  |  |  |
|----------|-------------------------------|--------------|---|----------------|-------------|--|--|--|--|--|
| FRACTION | U.S STANDARD S                | IEVE SIZE    | DEFINING RANGES OF PERCENTAGE BY WEIGHT O<br>MINOR COMPONENTS |                |             |  |  |  |  |  |
|          |                               | PASSING      | RETAINED  | PERCENT        | DESCRIPTOR  |  |  |  |  |  |
| GRAVEL   | COARSE                        | 76 mm        | 19 mm   | 35-50<br>20-35 | AND<br>Y/EY |  |  |  |  |  |
| G        | FINE                          | 19 mm        | 4.75 mm   | 10-20          | SOME        |  |  |  |  |  |
|          | COARSE                        | 4.75 mm      | 2.00 mm   | 1-10           | TRACE       |  |  |  |  |  |
| SAND     | MEDIUM                        | 2.00 mm      | 425 µm  |                |             |  |  |  |  |  |
|          | FINE                          | 425 µm       | 75 µm   |                |             |  |  |  |  |  |
|          | OR CLAY BASED ON<br>ASTICITY) | 75 µm        |   |                |             |  |  |  |  |  |
|          |                               | OVERSIZED MA | ATERIAL   |                |             |  |  |  |  |  |
|          |                               |              |   |                |             |  |  |  |  |  |



ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm

BOULDERS > 200 mm

Note 1: Soils are classified and described according to their engineering properties and behavior.

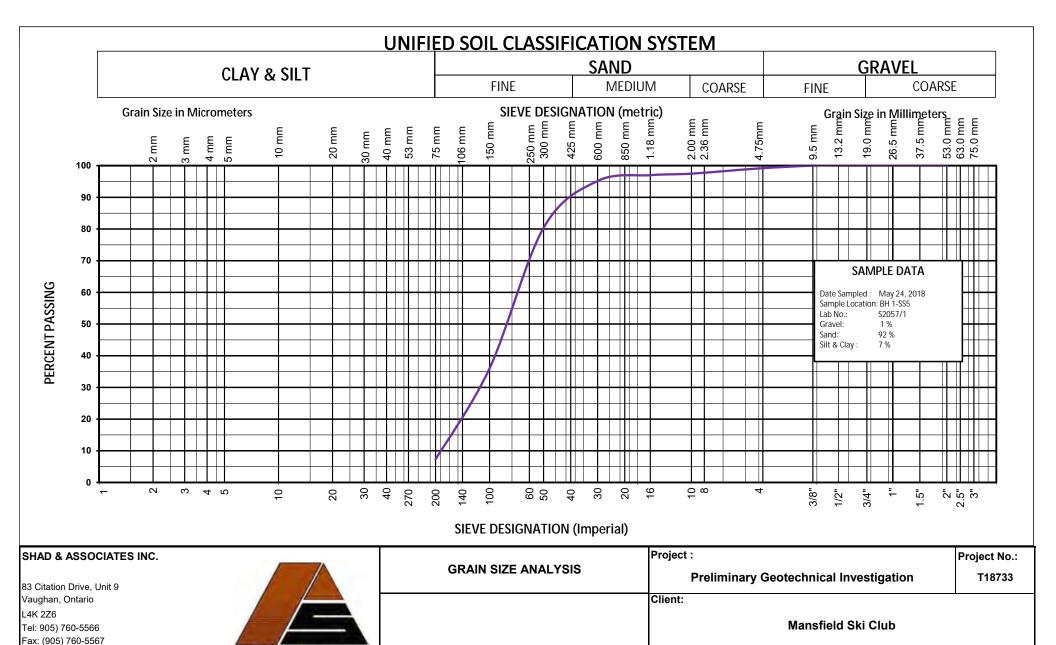
Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3<sup>rd</sup> Edition, Canadian Geotechnical Society, 1992)

NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS> 0.76 CUBIC METRE IN

VOLUME

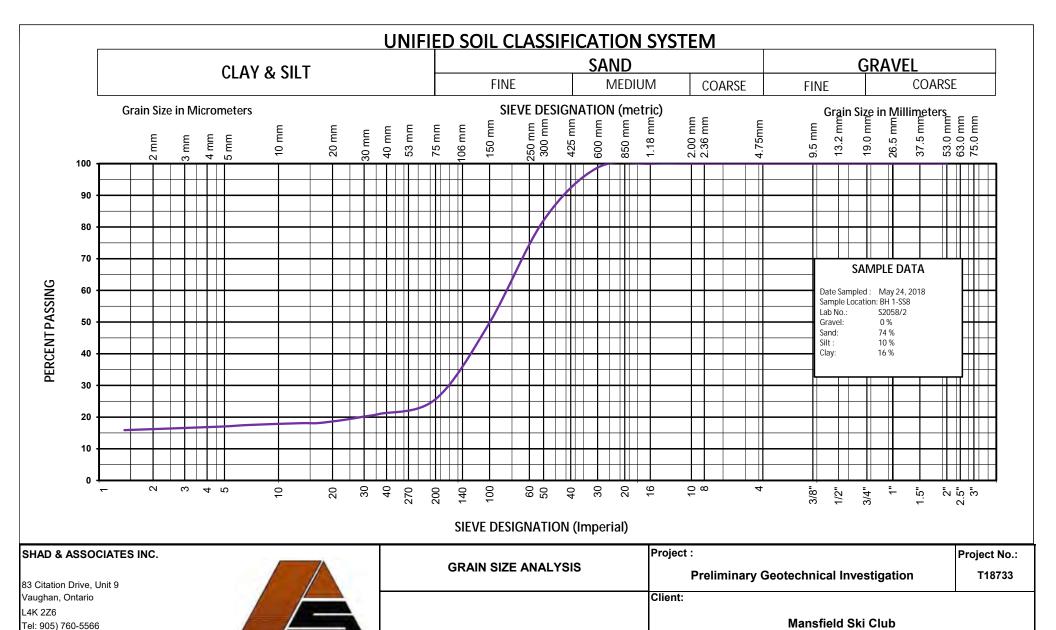
# **ENCLOSURES**

Enclosure A: Laboratory Test Results



SHAD & ASSOCIATES INC.

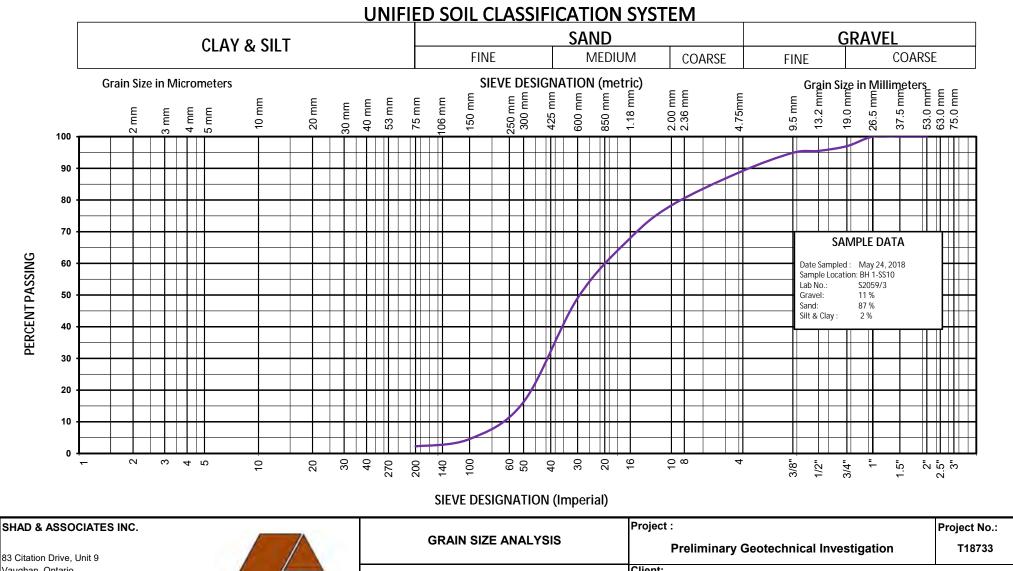
www.shadinc.ca



Fax: (905) 760-5567

www.shadinc.ca

SHAD & ASSOCIATES INC.



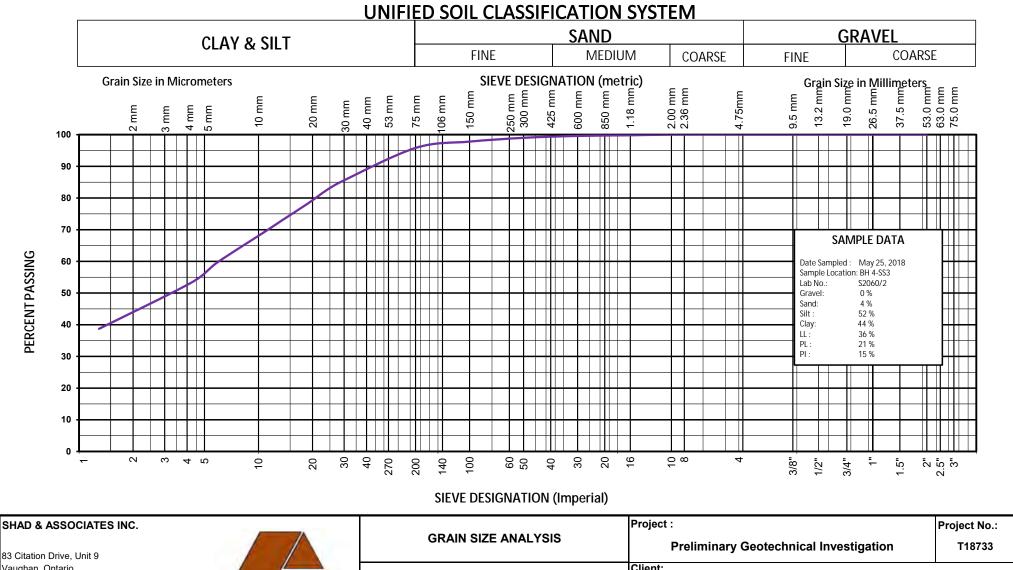
Vaughan, Ontario L4K 2Z6

Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca

| SHAD & ASSOCIATES INC. |
|------------------------|

|                     | Project :                              | Project No.: |
|---------------------|--|--------------|
| GRAIN SIZE ANALYSIS | Preliminary Geotechnical Investigation | T18733       |
|                     | Client:                                |              |

Mansfield Ski Club

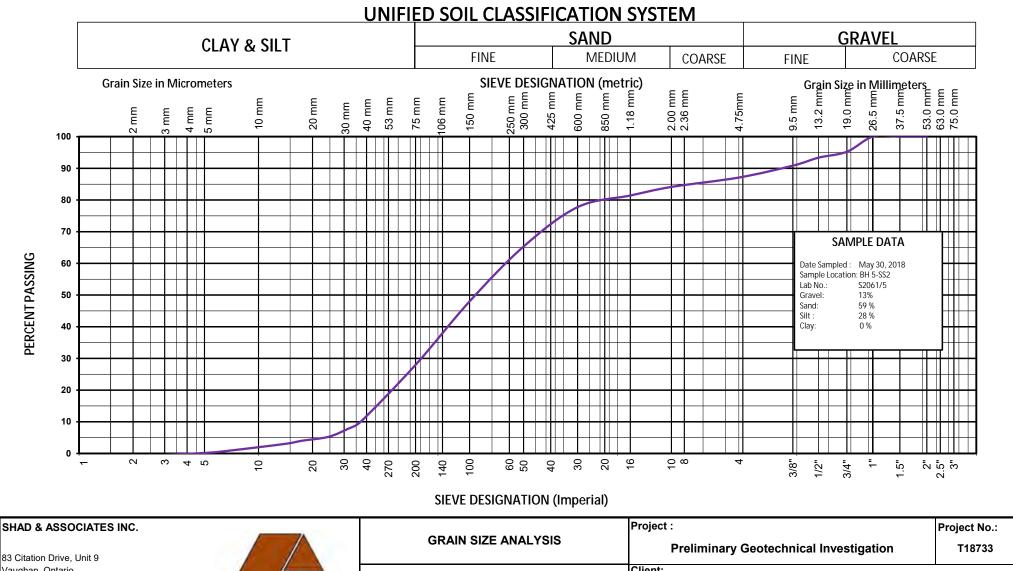


Vaughan, Ontario L4K 2Z6 Tel: 905) 760-5566 Fax: (905) 760-5567

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| GRAIN SIZE ANALYSIS | Preliminary Geotechnical Investigation | T18733 |
|---------------------|--|--------|
|                     | Client:  Mansfield Ski Club            |        |



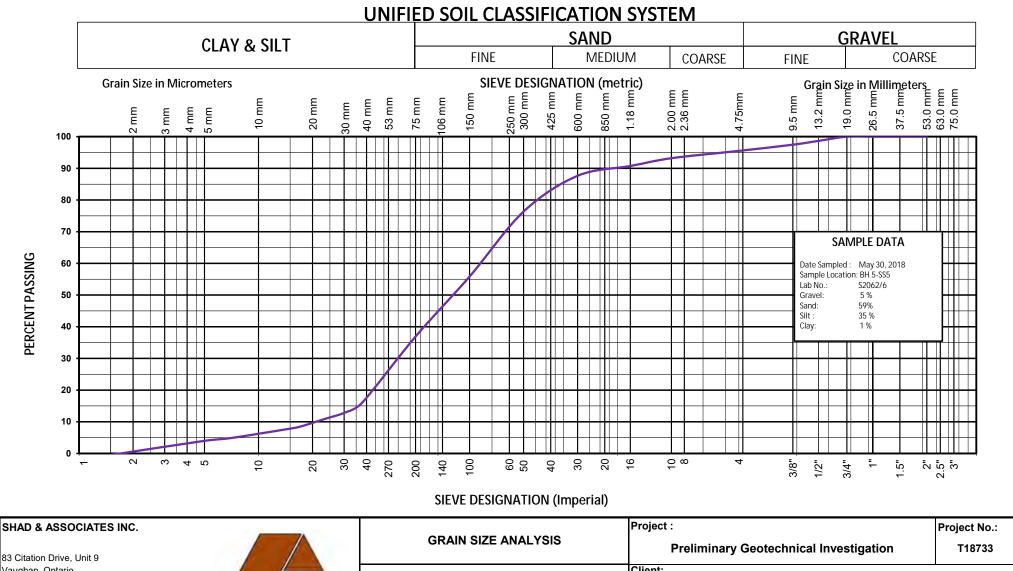
Vaughan, Ontario L4K 2Z6

Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca

| SHAD & ASSOCIATES INC. |
|------------------------|

Client:

Mansfield Ski Club



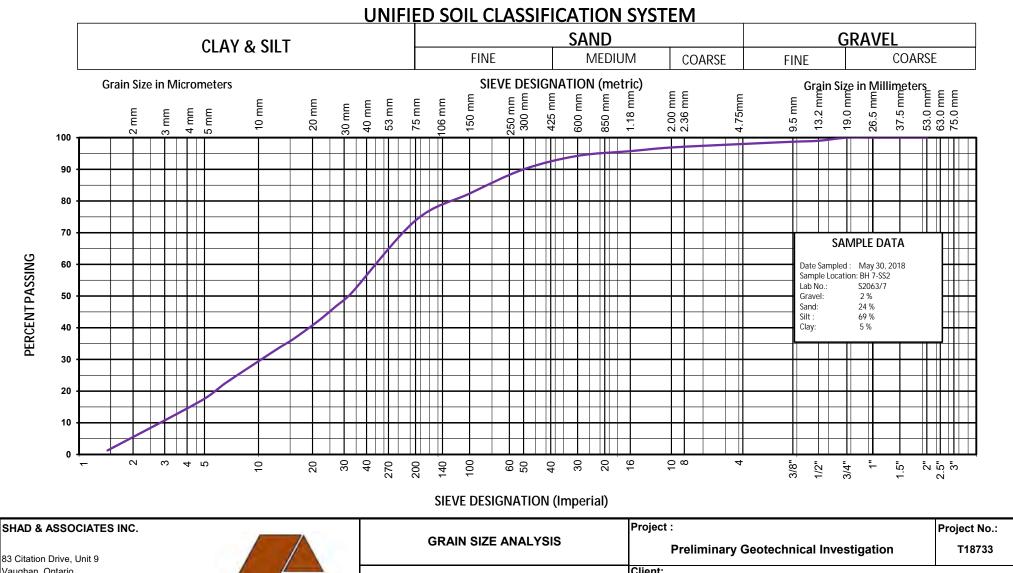
Vaughan, Ontario L4K 2Z6

Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca

| SHAD & ASSOCIATES INC. |
|------------------------|

Client:

Mansfield Ski Club

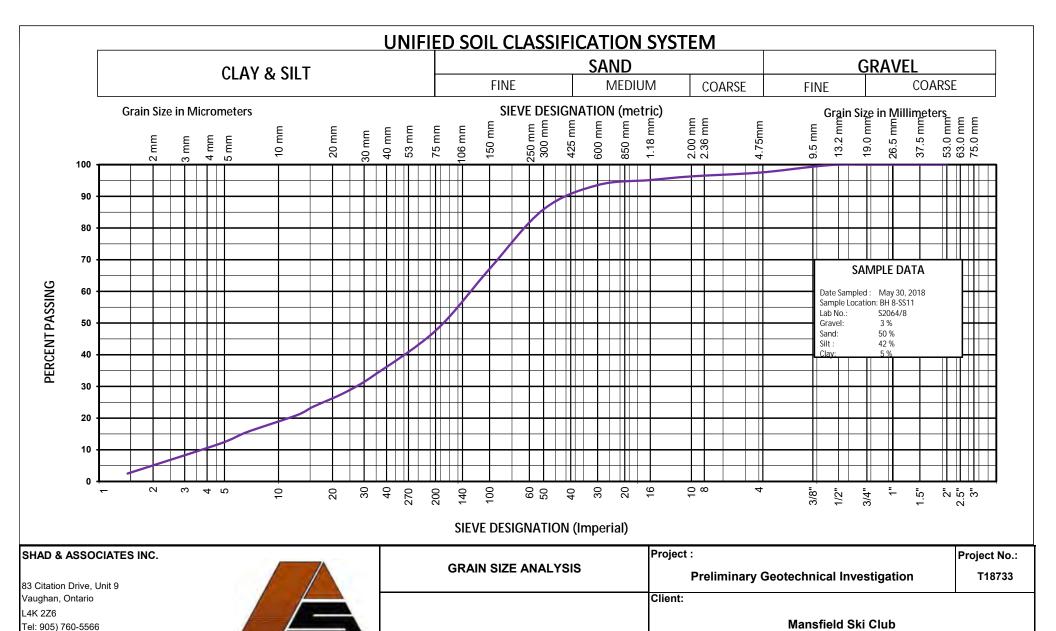


Vaughan, Ontario L4K 2Z6 Tel: 905) 760-5566 Fax: (905) 760-5567

www.shadinc.ca



| GRAIN SIZE ANALYSIS | Preliminary Geotechnical Investigation | T18733 |  |
|---------------------|--|--------|--|
|                     | Client:                                |        |  |
|                     | Mansfield Ski Club                     |        |  |



Fax: (905) 760-5567

www.shadinc.ca

SHAD & ASSOCIATES INC.

# **Enclosure B: Slope Stability Analysis Results**

Job No. T18733

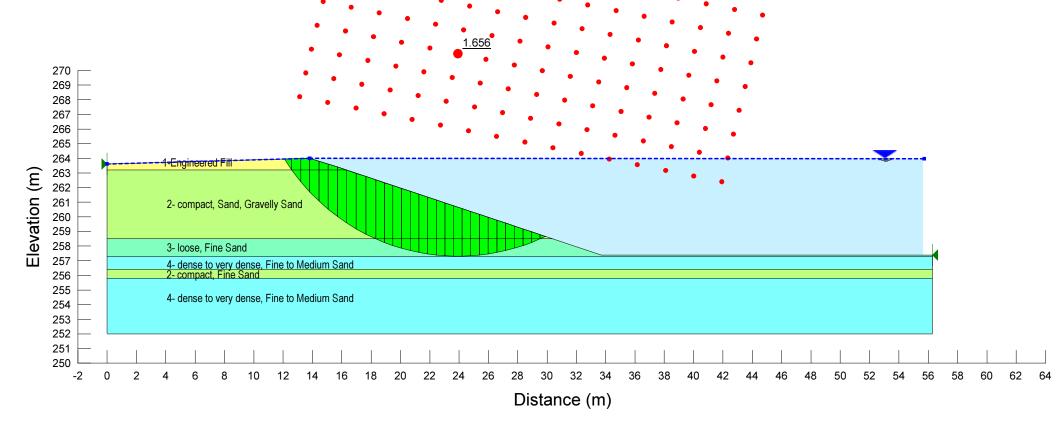
Snow Making Pond

Section A

Nearest Borehole: BH 1

Long-Term Analysis (Drained Condition)

| Soil Layer | Bulk Unit | Cohesion | Friction Angle |
|------------|-----------|----------|----------------|
| No.        | Weight    | (kPa)    | (Deg.)         |
|            | (kN/m^3)  |          |                |
| 1          | 19.0      | 0        | 30             |
| 2          | 19.0      | 0        | 30             |
| 3          | 16.5      | 0        | 20             |
| 4          | 21.0      | 0        | 32             |



Job No. T18733

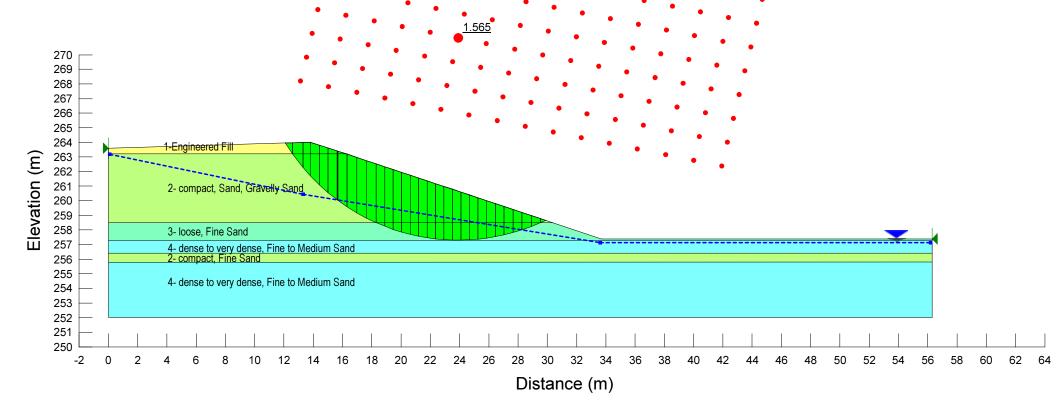
Snow Making Pond

Section A

Nearest Borehole: BH 1

During Construction (Undrained Condition)

| Soil Layer | Bulk Unit | Cohesion | Friction Angle |
|------------|-----------|----------|----------------|
| No.        | Weight    | (kPa)    | (Deg.)         |
|            | (kN/m^3)  |          |                |
| 1          | 19.0      | 0        | 30             |
| 2          | 19.0      | 0        | 30             |
| 3          | 16.5      | 10       | 10             |
| 4          | 21.0      | 0        | 32             |



Job No. T18733

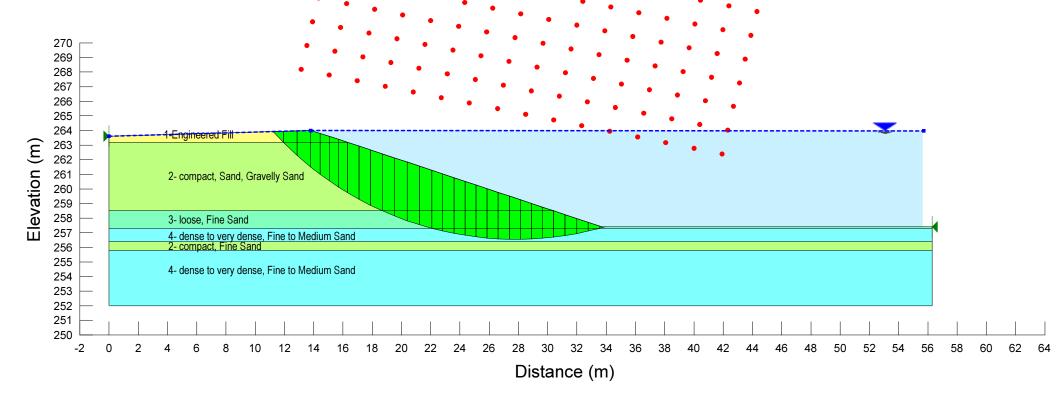
Snow Making Pond

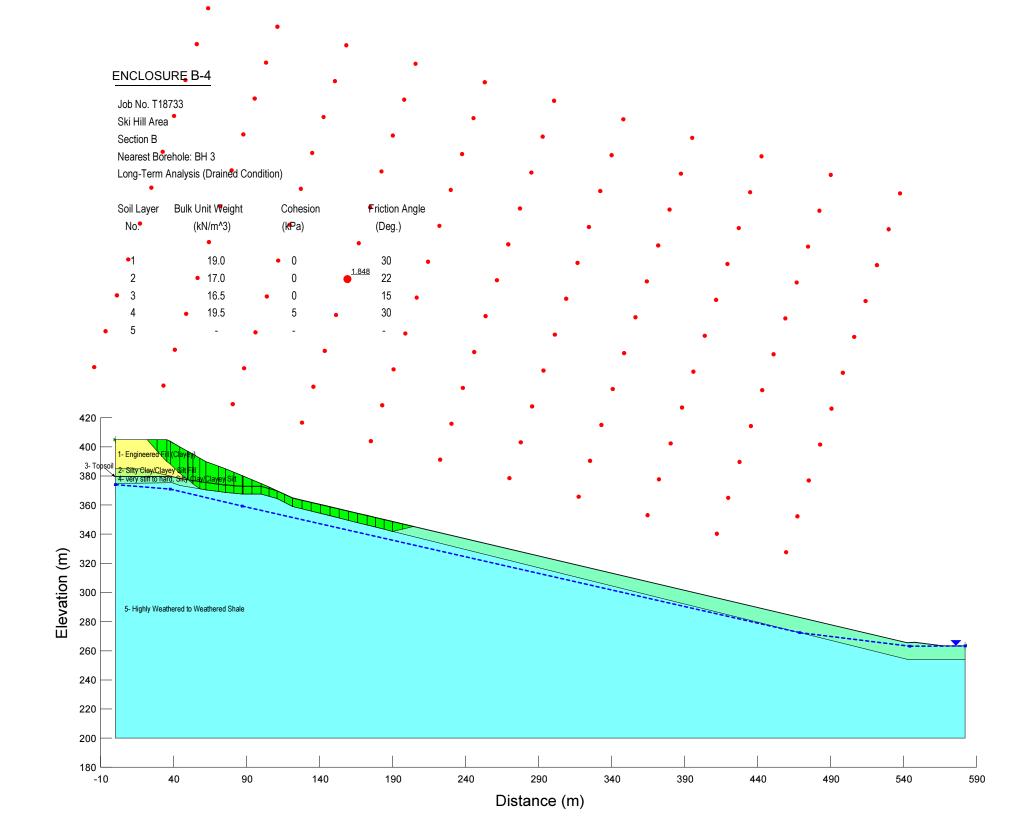
Section A

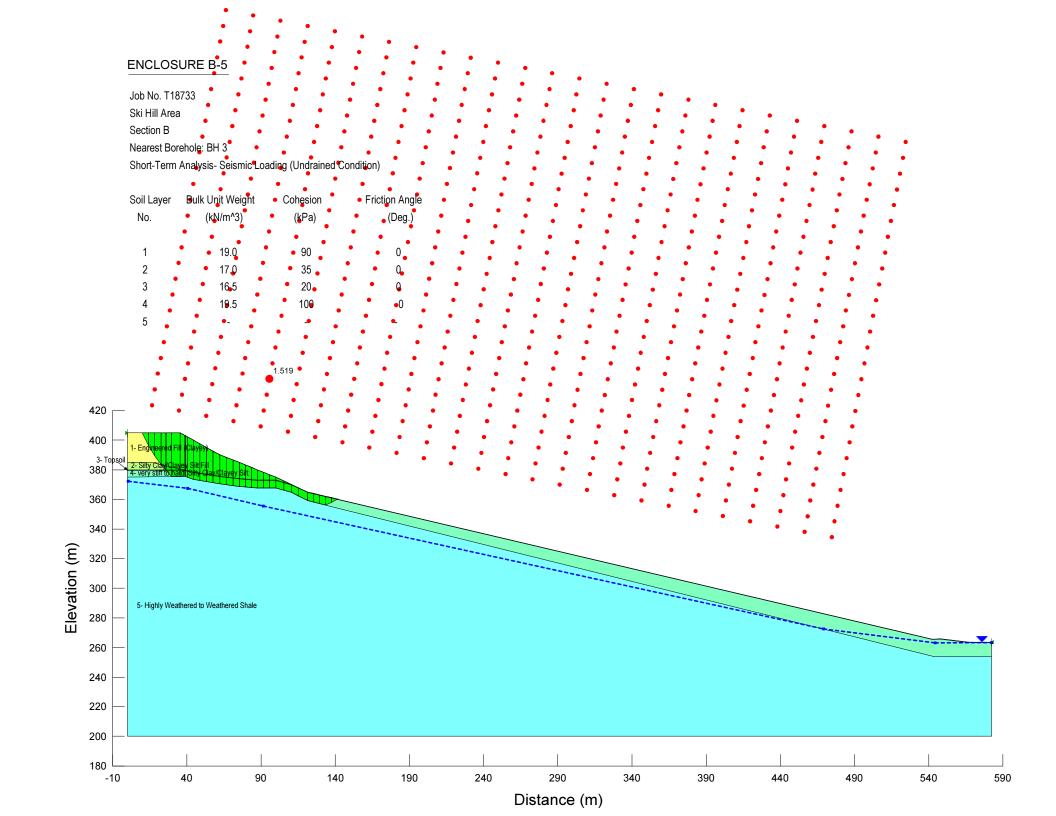
Nearest Borehole: BH 1

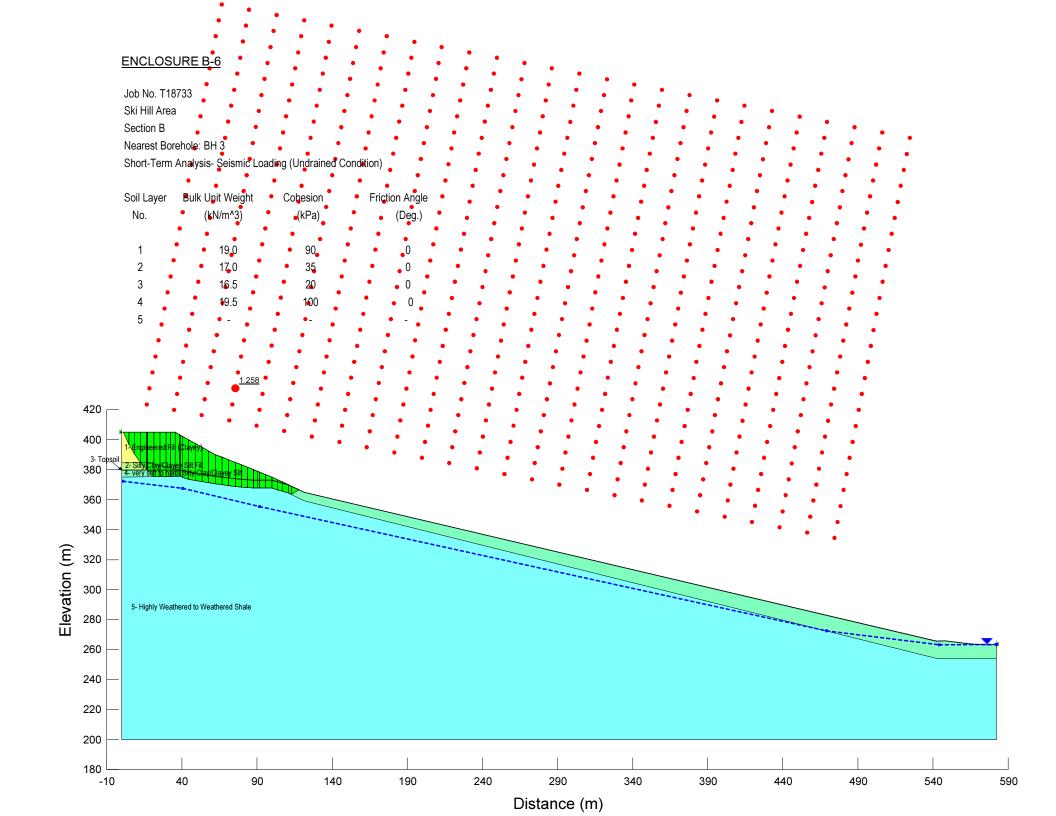
Seismic Loading (Undrained Condition)

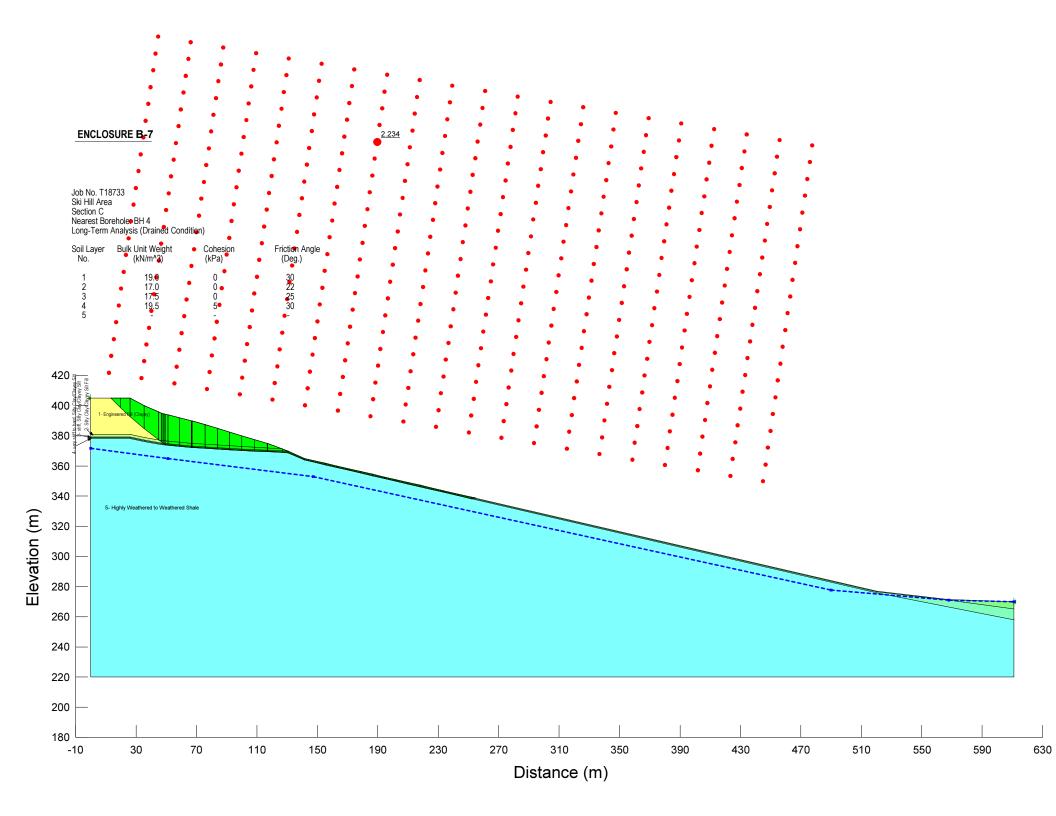
| Soil Layer | Bulk Unit | Cohesion | Friction Angle |
|------------|-----------|----------|----------------|
| No.        | Weight    | (kPa)    | (Deg.)         |
|            | (kN/m^3)  |          |                |
| 1          | 19.0      | 0        | 30             |
| 2          | 19.0      | 0        | 30             |
| 3          | 16.5      | 10       | 10             |
| 4          | 21.0      | 0        | 32             |

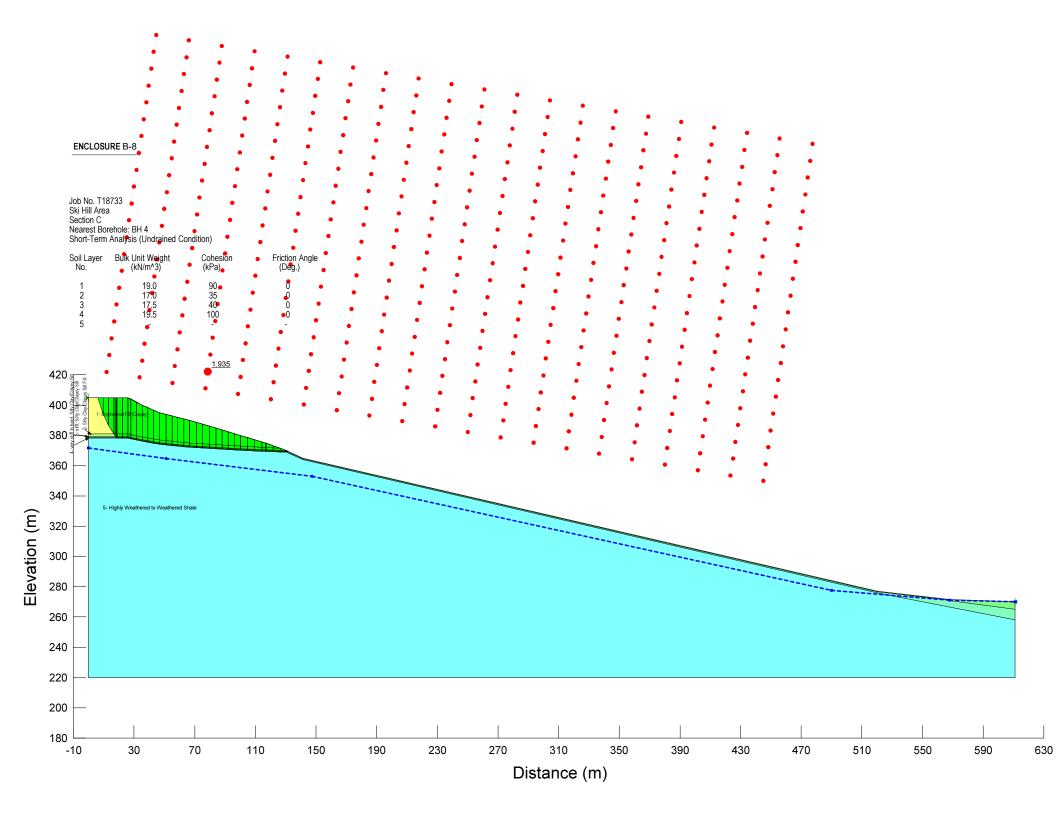


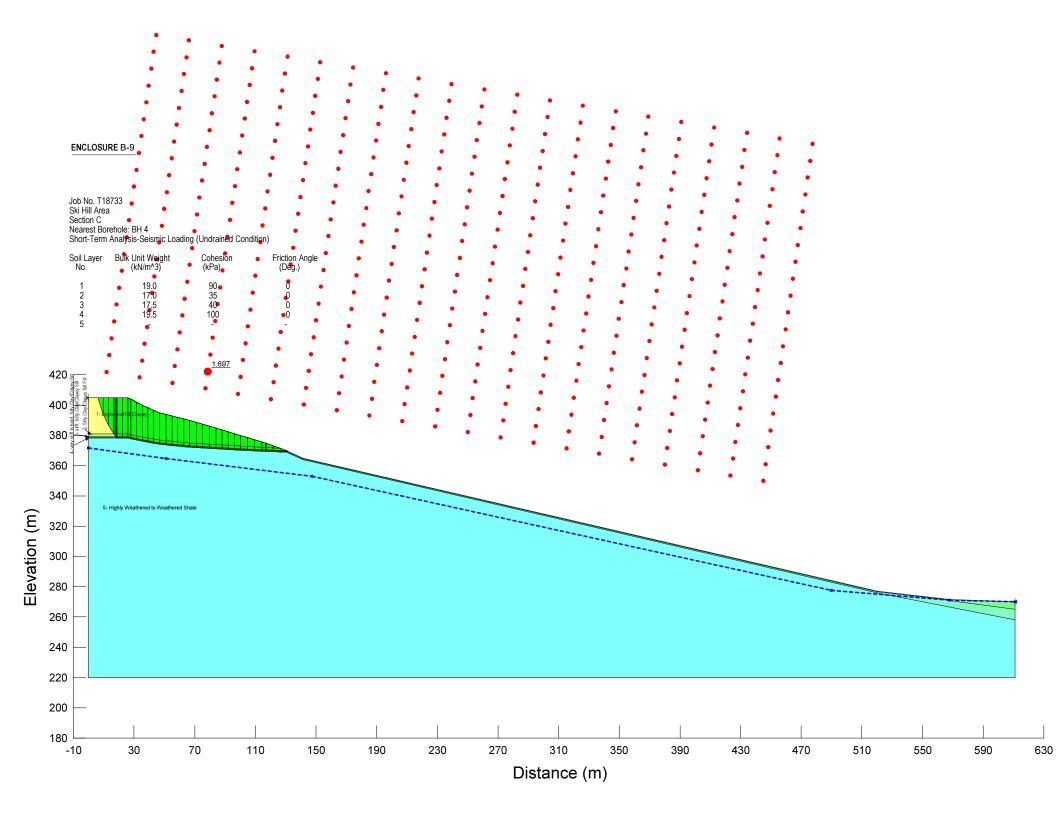










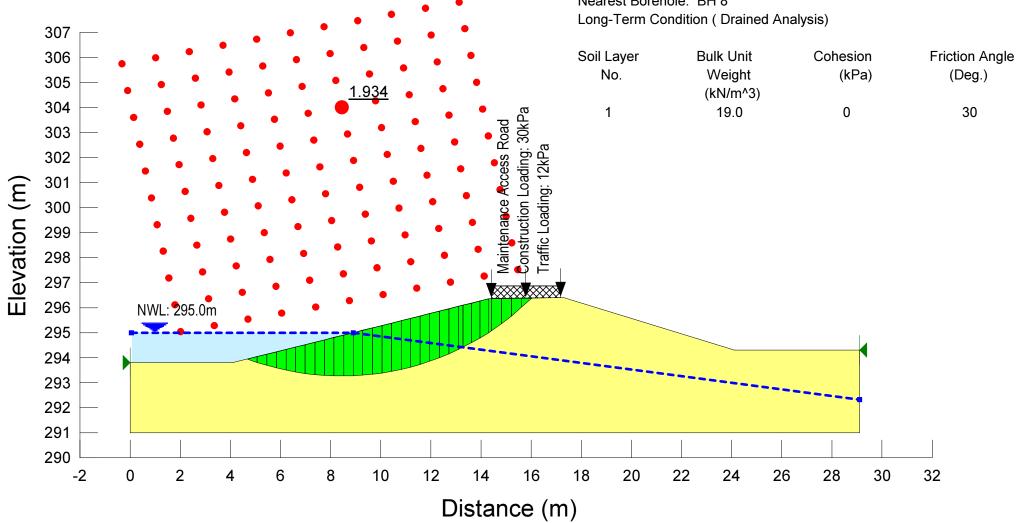


Job No. T18733

Dry Detention Basin (Pond Side)

Section D

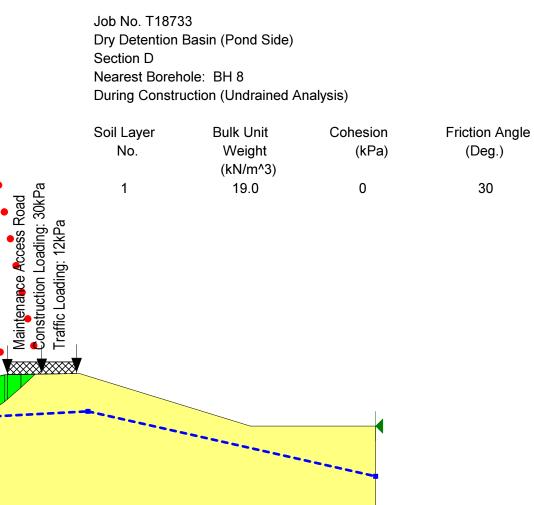
Nearest Borehole: BH 8



Distance (m)

-2

Elevation (m)

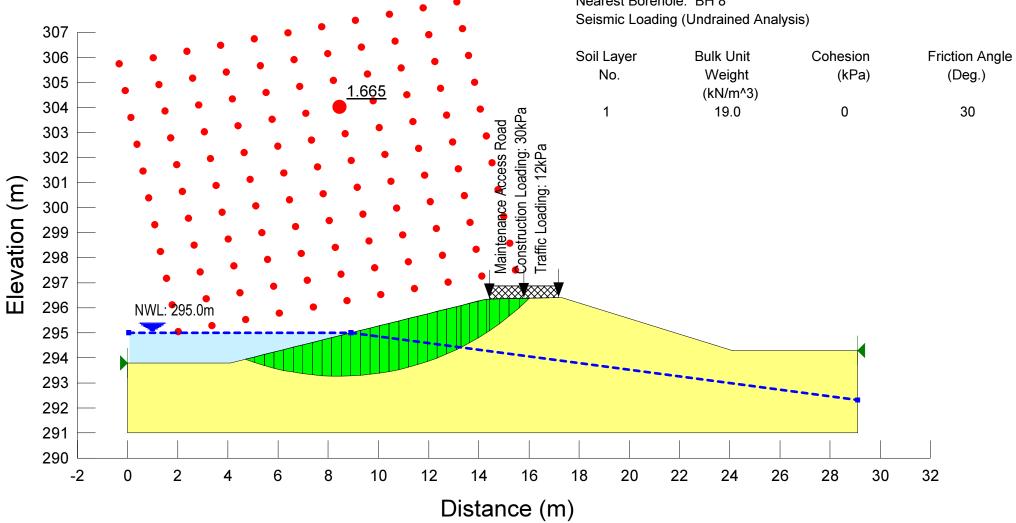


Job No. T18733

Dry Detention Basin (Pond Side)

Section D

Nearest Borehole: BH 8



# **Enclosure B-13**

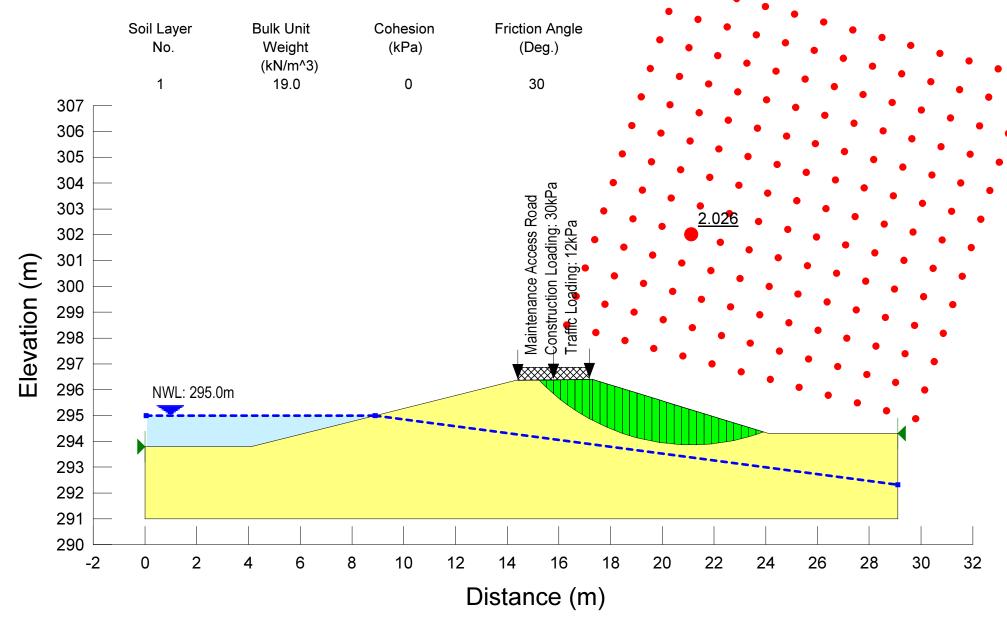
Job No. T18733

Dry Detention Basin (Outside)

Section D

Nearest Borehole: BH 8

Long-Term Analysis (Drained Analysis)



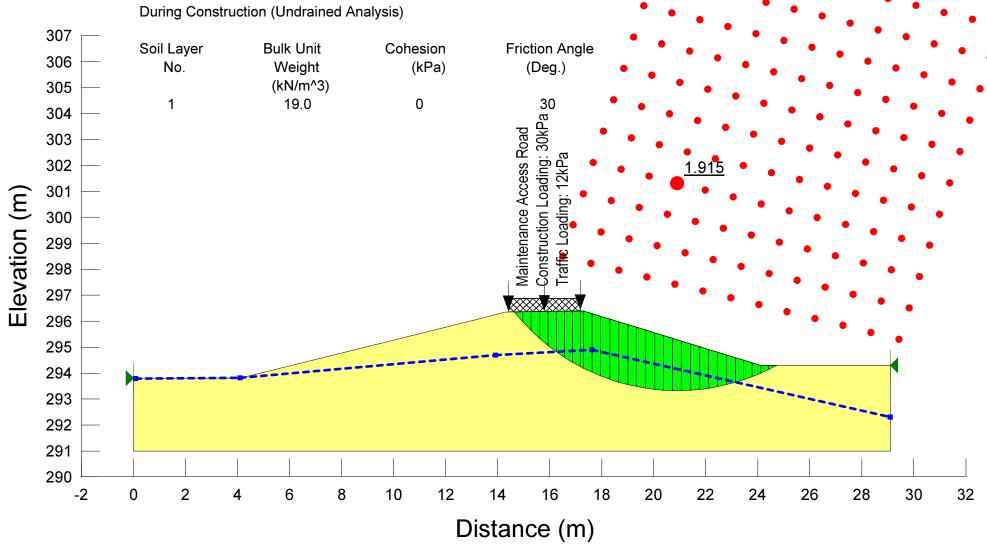
# **Enclosure B-14**

Job No. T18733

Dry Detention Basin (Outside)

Section D

Nearest Borehole: BH 8



# **Enclosure B-15**

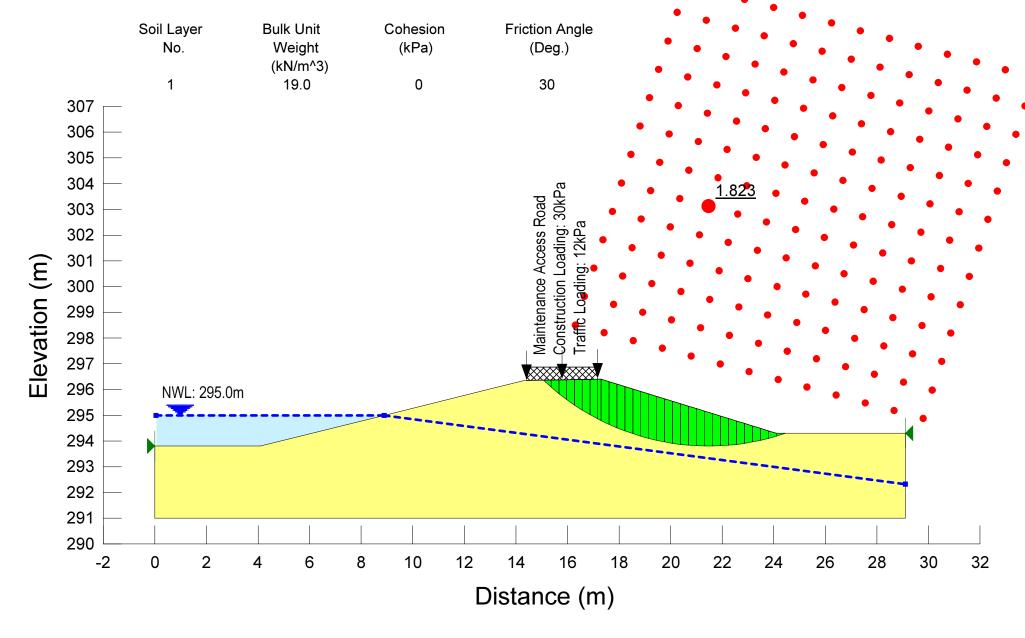
Job No. T18733

Dry Detention Basin (Outside)

Section D

Nearest Borehole: BH 8

Seismic Loading (Undrained Analysis)



# **APPENDECIES**

Appendix A: Site Specific Seismic Hazard Parameters as Per 2015 NBC of Canada

# 2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836 Western Canada English (250) 363-6500 Facsimile (250) 363-6565

June 15, 2018

Site: 44.1977 N, 80.0598 W User File Reference: Mansfield Ski Club

Requested by:,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05) Sa(0.1) Sa(0.2) Sa(0.3) Sa(0.5) Sa(1.0) Sa(2.0) Sa(5.0) Sa(10.0) PGA (g) PGV (m/s) 0.079 0.109 0.105 0.089 0.074 0.045 0.023 0.0057 0.0025 0.062 0.060

**Notes.** Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s²). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.** 

## Ground motions for other probabilities:

| Probability of exceedance per annum   | 0.010  | 0.0021 | 0.001  |
|---------------------------------------|--------|--------|--------|
| Probability of exceedance in 50 years | 40%    | 10%    | 5%     |
| Sa(0.05)                              | 0.0098 | 0.031  | 0.048  |
| Sa(0.1)                               | 0.016  | 0.045  | 0.069  |
| Sa(0.2)                               | 0.017  | 0.046  | 0.069  |
| Sa(0.3)                               | 0.016  | 0.041  | 0.060  |
| Sa(0.5)                               | 0.012  | 0.034  | 0.049  |
| Sa(1.0)                               | 0.0060 | 0.020  | 0.030  |
| Sa(2.0)                               | 0.0026 | 0.0096 | 0.015  |
| Sa(5.0)                               | 0.0006 | 0.0021 | 0.0036 |
| Sa(10.0)                              | 0.0004 | 0.0010 | 0.0015 |
| PGA                                   | 0.0086 | 0.026  | 0.039  |
| PGV                                   | 0.0072 | 0.024  | 0.038  |

#### References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no.

xxxxxx (in preparation)

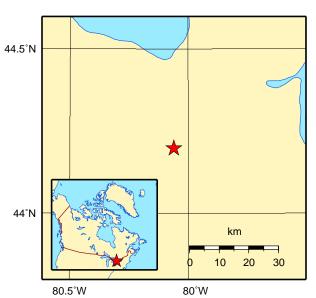
Commentary J: Design for Seismic Effects

**Geological Survey of Canada Open File 7893** Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Aussi disponible en français





March 20, 2020 **Ref. No.: T18733** 



Mansfield Ski Club

628213 Sideroad 15, Mulmur, Ontario, L9V 3M6

Attention: Mr. Finley McEwen

RE: Recommended Gravel Fire Route Pavement Thickness

Mansfield Ski Club

628213 SDRD 15, Mulmur, Ontario

Based on your information, we understand that a gravel fire route is proposed to be constructed on a portion of the gravel driveway at the above captioned site. We wish to mention that a feasibility geotechnical assessment was previously carried out at above property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. As requested, this addendum letter report is prepared to provide our recommendations for the proposed pavement thickness and its construction at the above captioned site.

#### Pavement Thickness

In accordance with the 2018 report, Boreholes 5 and 6 appear to be located close to the north end of the proposed fire route. Based on the subsurface conditions encountered at these boreholes, below some fill (generally consisting of silty sand/sandy silt fill and/or granular fill), the site was underlain by a competent and compact to very dense silty sand till. However, some topsoil was also noted interbedded within the fill at Borehole 6. The groundwater level was monitored during and upon completion of drilling and it was measured at 3.2 m and 4.3 m below existing ground surface at Boreholes 5 and 6, respectively.

Considering the subsurface information, for a trouble-free performance of the proposed pavement, we would recommend the existing topsoil and fill to be removed and the excavated subgrade to be raised up to the design grade to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the following minimum pavement structure for the proposed gravel fire route may be used:

| PAVEMENT STRUCTURE    | COMPACTION | PAVEMENT THICKNESS (mm) |
|-----------------------|------------|-------------------------|
| Granular 'A' Base     | 100%       | 150                     |
| Granular 'B' Sub-base | 100%       | 450                     |

Alternatively, the pavement thickness could be reduced to 400 mm (Granular 'A': 150 mm and Granular 'B': 250 mm) by strengthening the subgrade by including a layer of BX1200 Geogrid. The geogrid should be extended out at least 1.0 m beyond the route footprint. To ensure the longevity of the pavement, the roadbed should be well drained at all times.

Manfield Ski Club Recommended Gravel Fire Route Pavement Thickness 628213 Sideroad 15, Mulmur, Ontario Reference Number: T18733

March 20, 2020

#### - Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved by proof-rolling by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 98% Standard Proctor Maximum Dry Density, before placing the next lift. If construction of the roadfill is carried out in wet weather, the thickness of the subbase course may need to be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

#### Closure

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

OFESSION

H. SHAD

Sincerely,

Shad & Associates Inc.

Stephen Chong, P. Eng. Senior Engineer

Houshang Shad, Ph. D., P. Eng. Principal

April 22, 2020 **Ref. No.: T18733** 



Mansfield Ski Club c/o WMI & Associates Limited 119 Collier Street Barrie, Ontario L4M 1H5

Attention: Mr. Andrew Windrem

RE: Addendum Geotechnical Report

Mansfield Ski Club

628213 SDRD 15, Mulmur, Ontario

Further to your email of April 17, 2020 and our conversation, this addendum report is prepared to provide our geotechnical opinion and recommendations on the following Items:

1) Asphalt pavement structure for entrance off 15<sup>th</sup> Sideroad and fire route;

- 2) Maintenance access to the Dry Pond basin;
- 3) Sewers & watermain;
- 4) Snow Making Pond;
- 5) 2.0 m wide berm east of Dry Pond; and
- 6) Enhanced seeded grass swale along the east side of the parking lot.

The Items are discussed below. We wish to mention that a feasibility geotechnical assessment was previously carried out at the property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. This addendum report is prepared as an addendum to the 2018 report.

1) Asphalt Pavement Structure for Site Entrance off 15th Sideroad & Fire Route

Based on our conversation, we understand that the entrance will have a heavy duty use and that part of the fire route inside the property will also be asphalt paved.

Considering the subsurface information encountered at Boreholes 5, 6 and 8, for a trouble-free performance of the proposed asphalt pavement, we would recommend the existing topsoil and/or fill to be removed down to competent inorganic and undisturbed subgrade. The exposed native subgrade should then be inspected and approved by experienced geotechnical staff. Following its approval, the subgrade should be raised up to the design grades to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the minimum pavement structure provided in Table 1 may be used.

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**Table 1: Recommended Minimum Pavement Structure** 

| Pavement<br>Structure                              | Compaction              | Heavy Duty & Fire Route (mm) |
|--|-------------------------|------------------------------|
| HL-3 Asphaltic Concrete<br>HL-8 Asphaltic Concrete | 97% Marshall<br>Density | 50<br>50                     |
| Granular 'A' Base                                  | 100%                    | 150                          |
| Granular 'B' Sub-base                              | 100%                    | 350                          |

Note: HL-3 and HL-8 asphaltic Concrete to conform to OPSS 1150 & 310

To ensure the longevity of the pavement, the roadbed should be well drained at all times. We recommend that full-length perforated sub-drains of 150 mm diameter be installed along both sides of the road, below the roadbed level, to ensure effective drainage. The sub-drain should be surrounded by 20 mm size clear stone drainage zone of minimum 150 mm thickness, which should have non-woven geotextile (Terrafix 270R or approved equal) wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.

The granular materials should be compacted as per American Society for Testing and Material's Number D698. The placing, spreading and rolling of the asphalt should be in accordance with Ontario Provincial Standard Specifications Form 310, or equivalent.

Construction traffic over exposed subgrade materials should be minimized, and temporary construction hauling routes should be established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, use of geofabrics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold season.

#### 1.1 Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved, by proof-rolling, by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 95% Standard Proctor Maximum Dry Density, before placing the next lift.

The uppermost zones of the roadfill, within 1.0 m of the roadbed, should be compacted to minimum 98% Standard Proctor Maximum Dry Density. If construction of the roadfill is carried

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out in wet weather, the thickness of the sub-base course should be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

## 2) Maintenance access to the Dry Pond basin

According to the information provided to us, we understand that a 3.0 m wide gravel access road will be constructed in the pond. Based on the subsurface conditions encountered at Borehole 8 and the considerable presence of fill and topsoil, all the unsuitable material would need to be removed and the grade raised up to the design elevations using properly placed and compacted engineered fill. (For additional information on the construction of the dry pond, reference should be made to Section 4.4 of the 2018 report). Assuming this, we recommend the 3.0 m wide gravel access road to consist of 150 mm of Granular B overlain by 150 mm of Granular A. The pavement structure should be placed in maximum 150 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted to 100% of the material's Standard Proctor Maximum Dry Density.

## 3) Sewers & Watermain

According to Drawings GENN and SSOP (with a SPA 1<sup>st</sup> submission date of February 7, 2020), we understand that the depth of proposed services will be within 4.2 m of the road grade. The following discussion is based on this assumption.

#### 3.1 Trenching

Trench excavations should be carried out as per the Safety Regulations of the Province of Ontario. Considering the subsurface conditions encountered at Boreholes 5, 6 and 7, below the existing topsoil and fill, the sewer trenches will be predominantly excavated within the compact to very dense, but generally dense to very dense silty sand to sandy silt till. These deposits are classified in Section 4.3.5 of the 2018 report in accordance with the Ontario Health and Safety Regulations. Within these soils, the side slopes of excavations are expected to be temporarily stable at 1H:1V, although above the groundwater level in the dense to very dense silty sand to sandy silt till, the bottom 1.2 m of the trench walls could be excavated close to vertical. Flatter slopes may be required in surficial topsoil and fill layers and below the groundwater level in silty sand to sandy silt till. Approved trench boxes or equivalent may be used to limit the extent of the excavation, if required.

Groundwater seepage within the glacial deposits should be minor and manageable by gravity drainage and pumping from filtered sumps. However, increased seepage may occur from any perched water condition within the topsoil and fill, which may require a series of sump pumps. Increased seepage should also be expected if the excavation is extended below the groundwater level in the silty sand to sandy silt till. We recommend that once the pipe inverts are finalized and before construction, the groundwater conditions at the site to be further assessed by test pitting

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to ensure that the most suitable dewatering methodology is selected. In no case should the pipes be placed on dilated or disturbed subsoil.

Attention is called to the possible presence of cobbles and/or boulders that may be encountered during the excavation in the glacial till deposits.

Normal excavation equipment will be suitable for making trenches within soils in which the proposed underground services will be installed. The terms describing the relative density (compact, dense, very dense) of soil strata give an indication of the effort needed for excavation.

### 3.2 Bedding

The boreholes showed that the sewer pipes will be predominantly laid within a compact to very dense silty sand to sandy silt till or engineered fill which are considered to be suitable to support the pipes. The recommended minimum thickness of granular bedding for normal Class 'B' Type of bedding (i.e., compacted granular bedding material – OPSD-802) below the invert is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered.

#### 3.3 Backfill

Based on the visual and tactile examination of the soil samples, the on-site inorganic excavated soils could be re-used as backfill in service trenches. The moisture contents at the time of construction should be at or near optimum. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 95% Standard Proctor Maximum Dry Density. This value should be increased to at least 98% within 1.0 m of the road subgrade surface.

The excavated native deposits may require reconditioning (e.g., wetting or drying) prior to reuse. The on-site excavated soils should not be used in confined areas (e.g., around catchbasins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of good backfill together with an appropriate frost taper would be preferable in confined areas. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling.

We recommend that frost tapers be provided at backfilled trenches to ensure gradual transition from the frost-free materials to the frost susceptible natural soil, otherwise differential frost heaving may occur. Frost taper would not be necessary if the backfill material can be matched within the frost zone (i.e. within about 1.6 m depth below the pavement surface) with subgrade-type material.

The need for anti-seepage collars should be assessed during site servicing.

#### 4) Snow Making Pond

The design and construction of the snow making pond were discussed in Section 4.1 of the 2018

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report. The conditions were further discussed with Mr. Dan Hurley of Tatham Engineering Limited on April 20, 2020. Considering the subsurface conditions encountered at Borehole 1, below some surficial topsoil and fill, the site is predominantly underlain by wet and sandy deposit with the short-term groundwater level being measured at 0.9 m above the ground surface. Currently, the proposed pond is designed to extend to a depth of about 6 m or so below the existing grade. Considering these, from a geotechnical viewpoint, we would recommend the pond not to be lined, if allowed. For the unlined pond, the base and walls of the pond would still need to be protected against erosion and washout, perhaps through the use of riprap stones, separated from the base and walls using a suitable geofabric separator, such as Terrafix 300 or 360. However, if the pond must be lined, for an economical design, we would recommend reducing the pond depth below the existing ground surface as much as possible in attempt to reduce the uplift hydrostatic pressure. The uplift pressure would need to be counterbalanced (using weight placed over the liner) or the pressure would need to be minimized by permanent water level lowering (by using a subsurface drainage network connected to a frost-free outlet). We would also need to ensure that any manholes or associated structures (such as wet well or pumping house, etc.) are assess for the uplift condition to ensure that they do not float. The liner could be clayey or geosynthetic. We would recommend that once the pond design is known, we should review and provide additional geotechnical recommendations.

## 5) 2.0 m wide berm east of Dry Pond

Considering the existing and design grades for the proposed dry pond, we understand that following the east berm of the pond, the grade will fall from Elevation 296.40 m to the existing grades at approximately 294.3 m at a gradient of 3H:1V. This proposal was modelled for slope stability analysis and the proposed outside berm of the pond was found to be stable. Reference should be made to Section 4.4 of the 2018 report for full details. We would recommend the berm to be vegetated to minimize surface erosion and localized gulleying.

#### 6) Enhanced seeded grass swale along the east side of the parking lot

According to Drawings SP.1 (dated January 2020) and SGRS (with a SPA 1<sup>st</sup> submission date of February 7, 2020), we understand that an enhanced seeded grass swale is proposed to be constructed on the east side of the proposed parking lot. The proposed swale will have its bottom invert elevation on the north end at about El.297.08 m, falling to El.295.65 m at the south end where it meets the dry pond basin. The proposed channel will be 1 m wide at the base and 0.5 m deep, with a side slope of 3H:1V. The swale will be topsoil seeded and a 100 mm diameter perforated subdrain will be installed at about 0.2 m below the base to minimize any potential for flooding.

Boreholes 7 and 8 are drilled near the north and south ends of the proposed swale, according to these boreholes, the proposed channel would be constructed in engineered fill. Assuming, the native onsite silty sand to sandy silt soils to be used for the earthworks, the soils would have permeability values of approximately  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  cm/sec, depending on the silt content, indicating a medium to low permeability condition.

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#### Closure

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

OFESSION

H. SHAD

Sincerely,

Shad & Associates Inc.

Stephen Chong, P. Eng. Senior Engineer

Houshang Shad, Ph. D., P. Eng. Principal

cc. Mr. Finley McEwen, Manfield Ski Club

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