COLAND DEVELOPMENT CORPORATION
REPORT NUMBER: 18M-01620-00-WR1

STORMWATER MANAGEMENT REPORT
16928 HIGHWAY 12, MIDLAND, ON

FEBRUARY 12, 2020 CONFIDENTIAL

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PROJECT NO.: 18M-01620-00-WR1
DATE: FEBRUARY 12, 2020

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1 INTRODUCTION

1.1 SCOPE OF SWM REPORT

WSP Canada Group Limited (WSP) has been retained by Coland Development Corporation to prepare a stormwater management (SWM) report in support of a Site Plan Approval (SPA) Application for the proposed development in Town of Midland, Ontario.

The subject property is 5.87 ha and bounded by Highway 12 to the north, Beamish Road to the east, vacant land to the south and west. The location of the proposed development is illustrated in Figure 1.

The subject property is designated as commercial development. Due to the large scale of the property, it shall be developed in phases. Out of the 5.87 ha property, the Phase 1 development is a 1.96 ha parcel and consists of a conference centre, a five-storey hotel, and associated surface parking, leaving 3.91 ha to be developed in the future.

This SWM report shall examine impacts on water balance, water quality, and water quantity due to the proposed development, and summarize how each shall be addressed in compliance of the design criteria set by the Town of Midland.

This report presents in-depth study of SWM strategy for the Phase 1 development, with discussions on how the stormwater runoff from the future development and external drainage areas being managed under both ultimate development conditions and interim development conditions.

1.2 SWM PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- ◊ Determine site specific SWM requirements to ensure that the development project is in conformance with Town of Midland's engineering guidelines manual;
- ◊ Evaluate various stormwater management practices that meet the requirements of the Town, and recommend a preferred strategy; and
- ◊ Prepare a stormwater management report documenting the strategy along with the technical information necessary for the sizing of the proposed stormwater management facilities.

1.3 BACKGROUND DOCUMENTS

The following documents have been reviewed in preparing this SWM report:

- ◊ "Engineering Development Design Standards", Town of Midland, December 2012;
- ◊ "Official Plan for the Town of Midland", January 2017.
- ◊ "Severn Sound Source Protection Area Approved Assessment Report, Chapter 7: Town of Midland", Severn Sound Environmental Association, January 2015.
- ◊ "Stormwater Management Planning and Design Manual", MECP, March 2003;
- ◊ "Low Impact Development Stormwater Management Planning and Design Guide", CVC and TRCA, 2010;
- ◊ "Geotechnical Investigation for Proposed Hotel & Conference Centre at 16928 Highway 12, Midland, Ontario", Peto MacCallum Ltd. (PML), December 2018.

FIGURE 1.dwg - 16928 Hwy 12 Midland - Site Location X:\DIV38\2018\18M-01620-00 16928 Highway 12 Midland\CAD\FIGURES\ Feb 06, 2020 - 8:57am

0 0.1 0.25 0.5 0.75km

CLIENT	TRIPAR
TITLE	16928 HIGHWAY 12, MIDLAND, ONTARIO HOTEL AND CONFERENCE CENTRE SITE LOCATION

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Date FEBRUARY 2020	Proj. No. 18M–01620–00	
Scale AS SHOWN	Figure No. 1	Gr.No. 00

1.4 SWM DESIGN CRITERIA

The SWM criteria applicable to the subject development are set out in Town of Midland Engineering Development Design Standards (December 2012), Section 5, Office Plan for the Town of Midland (2017), and the MECP's Stormwater Management Planning and Design Manual (March 2003).

Subject property falls within WHPA Q1 & Q2 in the SGBLS Source Protection Plan (SPP). As the proposed development would meet the criteria as new major development, it is therefore subject to SPP policies LUP-12 and LUP-13. Report in s 1.4 should reflect this requirement as a design criteria.

A summary of the applicable requirements is provided below.

◊ **Source Water Protection**

Per the Severn Sound Source Protection Area Approved Assessment Report d site falls within WHPA-D, which represents wellhead protection area with characterized with medium vulnerability. Refer to Appendix G for Figure 7a Protection Areas.

The site is required to retain stormwater on-site for infiltration, to the extent p development water balance conditions.

◊ **Water Quality**

The site is required to provide an Enhance Level of water quality protection (Le an annual loading basis, and to ensure that water discharged to the municipal storm sewers is in compliance with all Town By-laws pertaining to water quality.

◊ **Water Quantity Control**

Post-development peak flow rates must be controlled to pre-development levels for the 2-year up to 100-year storm. Meanwhile, hydrologic and hydraulic analysis shall be carried out to demonstrate that the downstream infrastructure - twin culvert underneath Beamish Road have sufficient capacity to convey the 100-year pre-development peak flow rate.

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The subject property is a 5.87 ha parcel of land currently occupied by trees and vegetation. The existing site has an imperviousness of 0%. Figure 2 shows the pre-development drainage plan.

Based on the topographic survey, the grades within the property ranges between 231.15 m at the north-west corner of the site, 212.21 m at the north-east corner, 216.51 m at the south-west corner, and 212.23 m at the south-east corner. There is drop in grade of approximately 19.0 m from west to east, with a steep slope (~10%) at west and relatively flat slope (~1.0%) at east.

Runoff from the subject site and the external area to the west currently drains southeasterly as sheet flow towards an existing twin culvert underneath the Beamish Road and adjacent to the southeast corner of the property. West half of the Beamish Road right-of-way (ROW) drains southward through a roadside ditch. Above drainage joins together and across Beamish Road via the existing culvert and continue eastward along Prospect Boulevard and ultimately drain into an existing roadside ditch running on Macdonald Road approximately 200 m east of the site.

2.2 RAINFALL INFORMATION

Visual OTTHYMO 5.0 (VO5) hydrologic model is used to simulate the pre-development and post-development flow rates from the subject site, and to size and confirm the performance of the proposed SWM facilities.

The design storms with 24-hour SCS Type II distribution and Chicago distribution were developed using the rainfall Intensity – Duration – Frequency (IDF) data specified in the Town of Midland Engineering Development Design Standards and were used in the Visual OTTHYMO modeling.

The rainfall intensity for the subject site was calculated using the following equation:

$$I = \frac{A}{(B+T)^C}$$

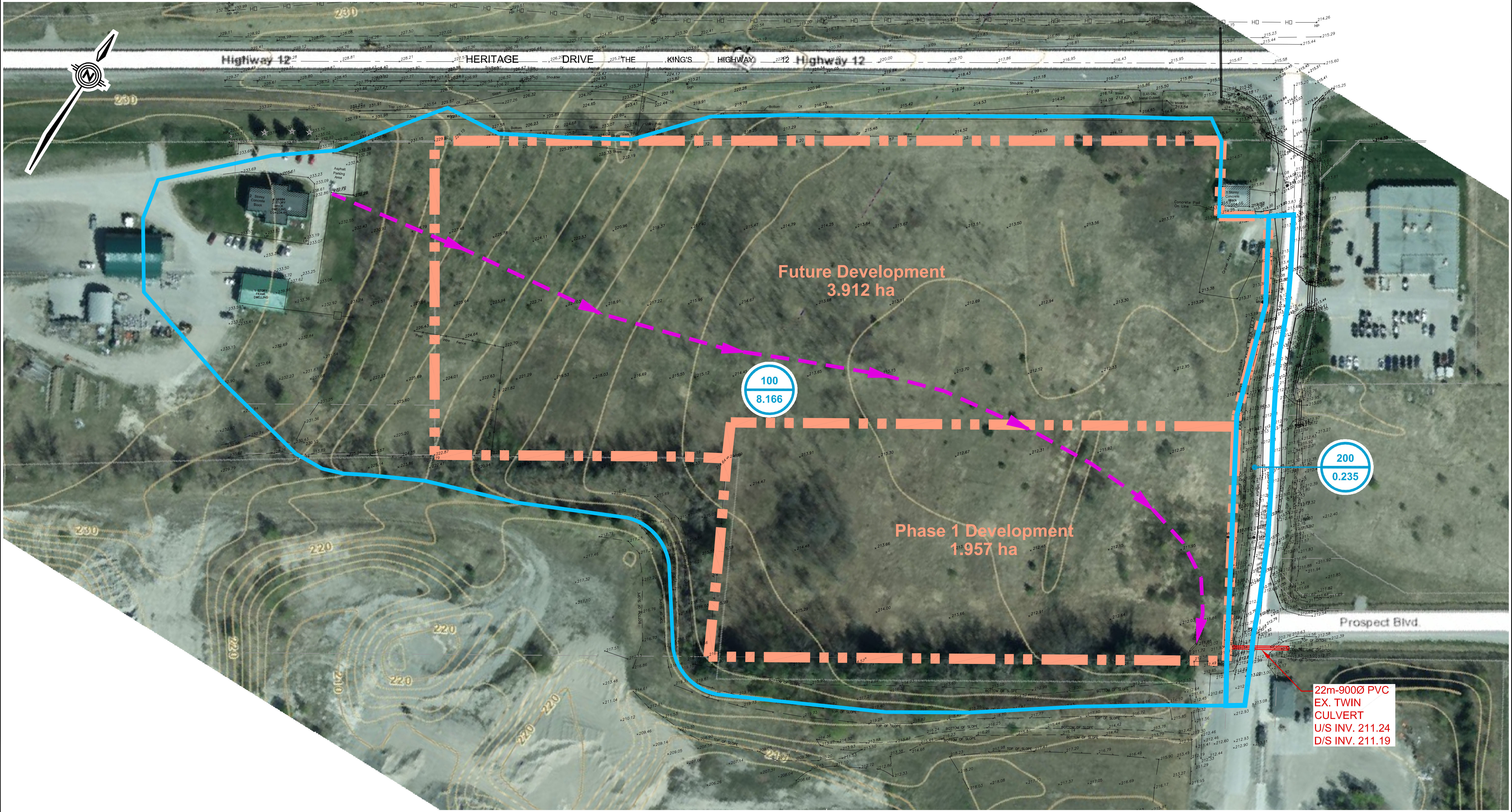
Where,

I = Rainfall Intensity (mm/hour)

T = Time of Concentration (minutes)

A, B, C = Constant Coefficient

The coefficient for A, B, and C values used in the Town of Midland are defined in Section 5.2.5 of the Town of Midland Engineering Development Design Standards and are summarized in Table 2-1.



LEGEND

- PROPERTY BOUNDARY
- SUB-CATCHMENT BOUNDARY
- SUB-CATCHMENT ID. (100)
- DRAINAGE AREA (ha) (8.166)
- FLOW PATH

0 10 25 50 75m

CLIENT	TRIPAR
TITLE	16928 HIGHWAY 12, MIDLAND, ONTARIO HOTEL AND CONFERENCE CENTRE EXISTING DRAINAGE PLAN

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FIGURE 2.dwg - 16928 Hwy 12 Midland - Existing Drainage Plan X:\DIV38\2018\18M-01620-00 16928 Highway 12 Midland\CAD\FIGURES\ Feb 13, 2020 - 10:34am

Table 2-1 Rainfall Parameters used by Town of Midland

Return Periods (Years)	A	B	C	24-hour Rainfall Amount (mm)
2	807.44	6.75	0.828	46.8
5	1135.40	7.50	0.841	59.9
10	1387.00	7.97	0.852	67.5
25	1676.20	8.30	0.858	78.1
50	1973.10	9.00	0.868	85.4
100	2193.10	9.04	0.871	92.9

2.3 PRE-DEVELOPMENT DRAINAGE PLAN

The existing site, including the external area, is represented with a single catchment (100), which is a rural basin with an imperviousness of 4.6% (< 20%) and is modelled using the NASHYD command in VO5 model. Catchment 200 represents west half right-of-way (ROW) of Beamish Road and contributes runoff to the existing twin culvert underneath Beamish Road as well. Catchment 200 has an imperviousness of 47.5% and is modelled using STANDHYD command in VO5 model.

The parameters used for hydrologic modelling, including site imperviousness, Curve Number (CN) of native soil, and Time to Peak (T_P), were estimated based on available topographic, land use, soil map, and geotechnical investigation report. A SCS CN value of 75 is assigned to site soil (silty sand) with hydrologic soil group (HSG) "B" which has an above-average infiltration and moderately low runoff potential. A typical initial abstraction (IA) of 5 mm is applied to the pervious areas. The upland method is used to obtain the Time of Concentration (T_C) and then Time to Peak (T_P) for rural catchment.

Table 2-2 presents the modelling parameters under pre-development conditions. Refer to Appendix A for detailed calculations.

Table 2-2 Pre-development Condition Catchment Parameters

Catchment	Area (ha)	IMP (%)	CN	IA (mm)	TP (hr)	Command
100	8.166	4.6	76	5.0	0.25	NASHYD
200	0.235	47.5	75	5.0	---	STANDHYD
Total	8.401					

2.4 PRE-DEVELOPMENT PEAK FLOW RATES

Visual OTTHYMO model was simulated for 24-hour SCS Type II storm for 2-year up to 100-year events, as per Town Standards. The modelling results are summarized in Table 2-3. Refer to Appendix E for detailed model output.

Table 2-3 Pre-Development Peak Flow Rates

Return Periods (Years)	Pre-Development Peak Flow Rates (m^3/s)
2	0.25
5	0.39
10	0.49
25	0.62
50	0.72
100	0.83

2.5 HYDRAULIC ANALYSIS OF EXISTING TWIN CULVERT

Under existing conditions, runoff from the subject property and external drainage area drains to the existing twin culvert (22.0 m PVC culvert at 0.23%) underneath Beamish Road. Hydraulic analysis for the existing culvert is carried out using HY-8 software to demonstrate that the culvert doesn't have any constraints on the subject development.

The results show that the existing twin culvert satisfies the MTO highway drainage standards on freeboard for culvert and ratio of the flood depth at the upstream face of the culvert to the diameter of the culvert, and can convey the 100-year pre-development peak flow rate (0.83 m^3/s) without overtopping the Beamish Road.

Refer to Section 4.4 of Appendix A and HY-8 output in Appendix C for more details.

2.6 ALLOWABLE PEAK FLOW RATES

As demonstrated in previous section, the existing twin culvert has sufficient capacity to convey the pre-development peak flow rates. Therefore, on-site quantity control shall be proposed to ensure that the pre-development peak flow rates presented in Table 2-3 not be exceeded.

3 PROPOSED CONDITIONS

3.1 GENERAL

The proposed Phase 1 development consists of a conference centre, a five-storey hotel, associated surface parking, and a second access road outside of the phase 1 boundary. The lands to be developed in the future is designated as commercial blocks.

3.2 DRAINAGE PLAN FOR ULTIMATE DEVELOPMENT CONDITIONS

Figure 3 presents the drainage plan for the ultimate development conditions with the entire property being developed. Under the ultimate conditions, the subject site and external drainage areas are delineated into eight (8) sub-catchments.

Catchment 1101 ~ 1104 represent the Phase 1 development. SWM facilities, such as Oil/Grit Separator (OGS) units and StormTech chamber systems, are proposed for Phase 1 development. Detailed discussion on water balance, quality control and quantity control for Phase 1 development are presented in Section 3.4, Section 3.5, and Section 3.6, respectively.

Catchment 1200 represents the property to be developed in the future. Details of the SWM controls for these lands shall be discussed in a separate cover at the SPA stage for the future development. However, quantity control target and required storage volume for the future development are presented in Section 3.7.

The flows from both Phase 1 development and future development shall be conveyed via storm sewer on Phase 1 land to a storm outfall located at the southeast corner of the property and discharge to roadside ditch just upstream of the twin culvert underneath Beamish Road.

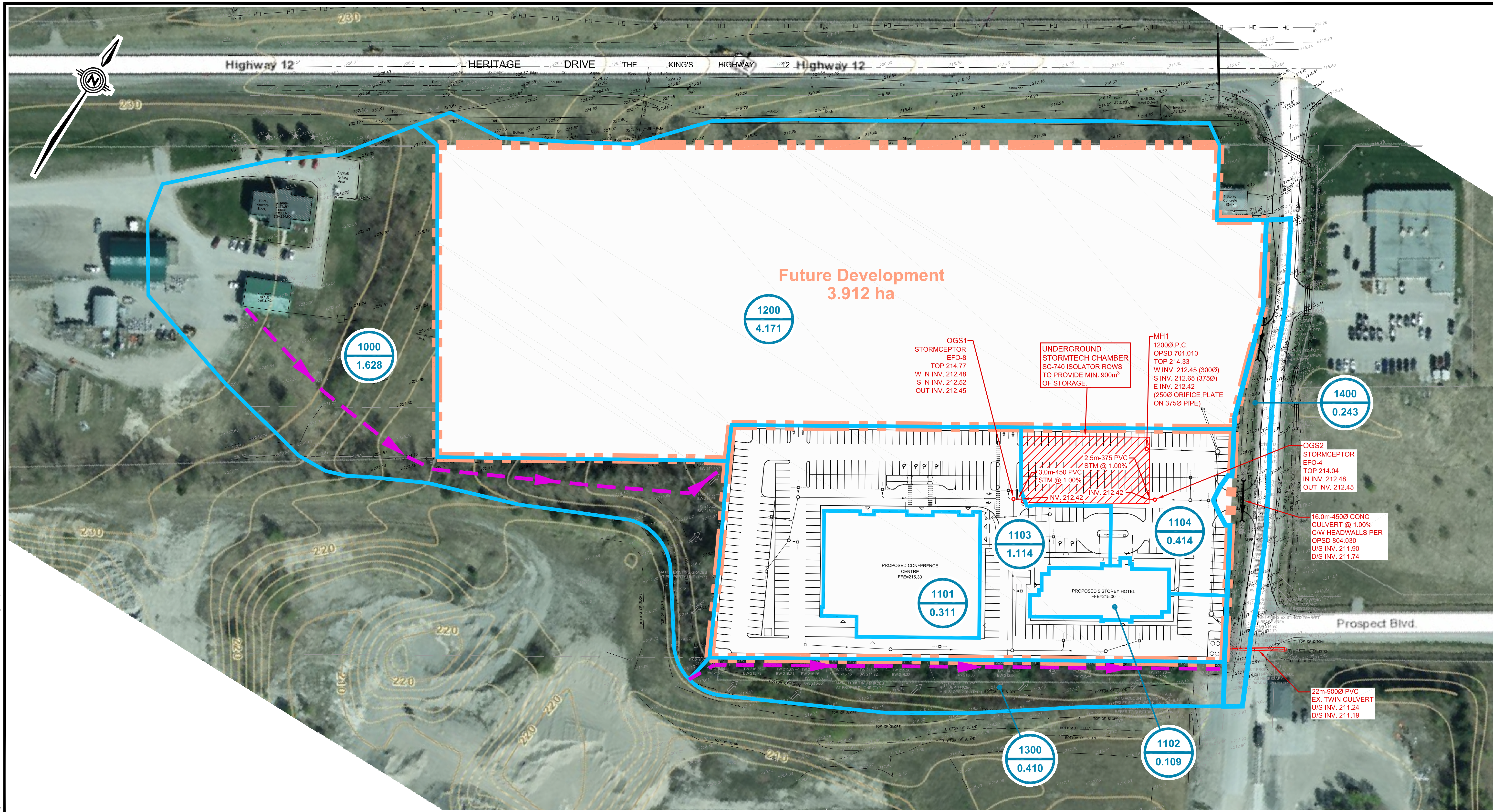
Catchment 1300 and 1400 represent the external areas and Beamish Road right-of-way (ROW), which contribute flows to the existing twin culvert underneath Beamish Road.

Please submit Full design regrading the restoration of full ditc across frontage of the property.

The imperviousness for the catchment 1101 ~ 1104 are calculated using the current site plan. A typical imperviousness value of 95% is assigned to catchment 1200. Imperviousness for the catchments 1000, 1300, and 1400 are estimated using google image.

A SCS CN value of 75 is assigned to the site soil - silty sand with HSG "B". A typical initial abstraction (IA) of 5 mm is applied to the pervious areas. The upland method is used to obtain the Time of Concentration (T_C) and then Time to Peak (T_P) for rural catchment 1300.

Table 3-1 presents the catchment parameters used in hydrologic modelling for the ultimate development conditions. Refer to Appendix A for detailed calculations.



LEGEND

PROPERTY BOUNDARY

SUB-CATCHMENT BOUNDARY

1101 — SUB-CATCHMENT ID.

0.311 — DRAINAGE AREA (ha)

FLOW PATH

0 10 25 50 75m

CLIENT

TRIPAR

TITLE

16928 HIGHWAY 12, MIDLAND, ONTARIO
HOTEL AND CONFERENCE CENTRE

PROPOSED DRAINAGE PLAN ULTIMATE CONDITIONS

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Date FEBRUARY 2020	Proj. No. 18M-01620-00
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FIGURE 3.dwg - 16928 Hwy 12 Midland - Proposed Drainage Plan Ultimate Conditions X:\DIV38\2018\18M-01620-00 16928 Highway 12 Midland\CAD\FIGURES\ Feb 13, 2020 - 12:48pm

Table 3-1 Post-development (Ultimate) Condition Catchment Parameters

Catchment	Land Use	Area (ha)	IMP (%)	CN	IA (mm)	Tp (hrs)	Command
1000	External to the West	1.628	23.1	75	5	---	STANDHYD
1101	Conference Center	0.311	100	75	5	---	STANDHYD
1102	Hotel	0.109	100	75	5	---	STANDHYD
1103	Phase 1 Parking (W)	1.114	87.2	75	5	---	STANDHYD
1104	Phase 1 Parking (E)	0.414	87.6	75	5	---	STANDHYD
1200	Future Development	4.171	95.0	75	5	---	STANDHYD
1300	External to the South	0.410	0.0	75	5	0.06	NASHYD
1400	Beamish Road ROW	0.243	51.5	75	5	---	STANDHYD
Total		8.401	69.5				

3.3 WATER BALANCE

The proposed development would increase the site imperiousness by converting pervious surface to impervious surface, resulting in less infiltration, less evaporation, and much more runoff from the site. Low Impact Development (LID) practices are proposed to enhance the infiltration and groundwater recharge.

An annual water balance analysis was conducted for both pre-development and post-development conditions to evaluate the impact on the water balance due to the proposed re-development. The water balance study is carried out for a total 2.07 ha area, includes 1.96 ha Phase 1 land and 0.11 ha area outside Phase 1 boundary, i.e. the second access road and two entrances.

3.3.1 Water Balance for Pre-Development Conditions

The study area is a 2.07 ha parcel with an imperviousness of 0%. Water balance analysis for pre-development conditions was carried out by defining the relationship for different type of surfaces and then weighted by the % of surface coverage to obtain the site wide water balance relationship.

Water balance relationship for the pervious area can be defined using the method developed by Thornthwaite and Mather in 1957 and following the example given in Section 3.2.3 in MOECP's "Stormwater Management Planning and Design Manual".

1) Per Environment and Climate Change Canada, the mean annual precipitation at adjacent gauge (Orillia TS) is 1043.2 mm.
2) For surface with pasture cover and a site soil of silty sand (HSG=B), 598.2 mm out of 1043.2 mm annual precipitation returns to the atmosphere as evapotranspiration (ET), leaving 445.0 mm as precipitation surplus;
3) Then, infiltration factors are used to determine the fraction of water surplus that infiltrates into the ground and the fraction runs off the site.

The study area has homogeneous soil and vegetation cover, with mild slope – approximately 1.1%. The infiltration factor is 0.52, by summing a factor for topography (0.17), soil (0.25), and surface cover (0.10). That is, 231.5 mm out of 445.0 mm water surplus infiltrates into the ground and 213.5 mm runs off the site. Thus, under pre-development conditions, for the study area, 22.2% of annual precipitation infiltrates into the ground, 57.3% returns to atmosphere as evapotranspiration, and 20.5% runs off the site.

The average annual infiltration would be 4,793 m^3 for 2.07 ha area. Refer to Section 5.3.3 of Appendix A for detailed calculations.

3.3.2 Water Balance for Post-Development Conditions without Mitigation Measures

Under proposed conditions, the imperviousness of the study area increases from 0.0% to 90.5%. Of the total 2.07 ha area, 1.873 ha is converted to impervious surface, and 0.198 ha is pervious area with urban lawn.

Water balance analysis for post-development conditions is carried out by defining the relationship for different type of surfaces and then weighted by the percentage of surface coverage to obtain the site wide water balance relationship.

It is assumed that the impervious area will accept 1 mm rainfall for subsequent evaporation prior to runoff generation due to the shallow depressions. Capturing 1 mm rainfall corresponds to a 12.5% of annual precipitation as per Figure 1a of City of Toronto's Wet Weather Flow Management Guidelines (WWFMGs). The remaining 87.5% of annual precipitation will leave the site as runoff. Thus, out of 1043.2 mm annual precipitation, 130.4 mm returns to atmosphere as evaporation (ET), 912.8 mm runs off, and none infiltrates.

The water balance for pervious area can be carried out following the procedure illustrated in above Section. However, the annual evapotranspiration for the landscaped area shall be 582.6 mm out of total 1043.2 mm annual precipitation. Meanwhile, the infiltration factor for the pervious area is 0.48, by summing a factor for topography (0.13 for a 2.0% slope), soil (0.25), and surface cover (0.10). That is, 222.5 mm out of 460.6 mm water surplus infiltrates to subsurface and 238.1 mm runs off. Thus, for the pervious area, 21.3% of annual precipitation infiltrates into the ground, 55.9% returns to atmosphere as evapotranspiration, and 22.8% runs off the site.

Then, above relationships for impervious and pervious area are weighted with corresponding % of land use coverage to obtain the site-wide water balance relationship. Under post-development conditions without mitigation measures, of the total average annual rainfall, infiltration accounts for approximately 2.0%, evapotranspiration (ET) accounts for approximately 16.6%, and there is approximately 81.3% runoff.

Table 3.2 presents a comparison of site wide water balance results between pre-development conditions and post-development conditions without mitigation measures. Without any mitigation measures, the proposed development would result in reductions in ET and infiltration, and increase in surface runoff.

Table 3.2 Water Balance – Pre-development vs Post-development w/o Mitigation Measures

Hydrologic Cycle Components	Pre-Development Conditions			Post-Development Conditions w/o Mitigation Measures			Change	
	mm	%	m^3	mm	%	m^3	m^3	%
Infiltration	231.5	22.2%	4,793	21.2	2.0%	440	-4,353	-90.8
ET	598.2	57.3%	12,383	173.6	16.6%	3,593	-8,790	-71.0
Runoff	213.5	20.5%	4,420	848.4	81.3%	17,563	13,143	297.4
Precipitation	1,043.2	100.0%	21,596	1,043.2	100.0%	21,596	0	0.0

The annual infiltration volume for 2.07 ha area is 440 m^3 and there is 4,353 m^3 infiltration deficits, which should be mitigated with on-site Low Impact Development (LID) measures.

3.3.3 Feasibility and Configuration of Infiltration Facilities

It is proposed to temporarily store the site runoff within the voids of the clear stone foundation and infiltrate via the bottom of the proposed chamber system. The infiltration facility, the clear stone foundation of the proposed StormTech SC740 chamber system, should satisfy the minimum infiltration rate, groundwater table depth, and bedrock depth as per 2003 MECP's SWMPDM.

Section 4.5.6 of 2003 MECP's SWMPDM provides guidance on the design of the infiltration facilities. The information contained in the Geotechnical Investigation Report by PML (December 2018) (hereafter PML's Geo-Report) is used in evaluation of the feasibility, design, and configuration of the infiltration facilities.

Infiltration Rate of Underlain Soil

Generally, the site soil should have an infiltration rate greater than 15 mm/hr (coarse than loam) to be suitable for infiltration based practices, as per 2003 MECP's SWMPDM.

The PML's Geo- Report indicated that the site subsurface profile comprised surficial topsoil or fill, overlying thin granular soil layers over a silty clay unit, overlying deposits of till and silty sand / sand. In-situ tests in seven test pits give an infiltration rate ranging from 25 mm/hr to 103 mm/hr, which is greater than 15 mm/hr and suitable for infiltration facilities.

Design infiltration rate is obtained by applying a safety factor on the in-situ infiltration rate, as per CVC and TRCA's Low Impact Development Stormwater Management Planning and Design Guide. The factored infiltration rate adjacent to the proposed chamber system is 17 mm/hr. Refer to Appendix F for details. The factored infiltration rate shall be used to design and configure the infiltration facility.

Groundwater Table Depth

The seasonally high groundwater table depth should be > 1.0 m below the bottom of the infiltration facility, as per 2003 MECP's SWMPDM.

The groundwater elevation in vicinity of the chamber system are 209.20 m. Refer to borehole log for BH #111 contained in Appendix F. Therefore, the bottom elevations of the clear stone foundation of the chamber system (212.27 m) will meet the minimum 1.0 m separation from the bottom of the infiltration facility to the seasonally high groundwater table.

Bedrock Depth

The depth to bedrock should be greater or equal to 1.0 m below the bottom of the infiltration facility to ensure adequate drainage/hydraulic potential, as per 2003 MECP's SWMPDM.

The bedrock was not encountered during the investigation at all boreholes and test pits. The bottom elevation of the BH #111 is used to evaluate the bedrock depth and the infiltration facility satisfies the minimum requirement for bedrock depth. Therefore, the proposed infiltration facility satisfies all requirements on minimum infiltration rate, groundwater table depth, and bedrock depth.

Pre-treatment

Rooftops of the conference centre (catchment 1101) and the hotel (catchment 1102) are not prone to sediment generation. Runoff from these areas are considered clean and can be directed to the chamber system without pre-treatment. The surface runoff from catchment 1103 and 1104 shall be treated by oil / grit separator (OGS) units. All runoff entering the chamber system shall be treated by Isolator Rows build into the ADS StormTech SC-740 chamber system prior to infiltration. Thus, there is no threats to the groundwater quality.

Storage Configuration

The storage depth of the infiltration facility shall be sized to ensure a drawdown time of 48 hours or less, based on the design infiltration rate. The chamber system shall have a clear stone foundation with depth of 0.15 m, which shall have a drawdown time of 8.9 hours.

Table 3.3 presents the infiltration volume provided within the chamber system. With a 0.152 m depth foundation filled with clear stone with typical void ratio of 0.40, the available infiltration volume would be 84.6 m^3.

Table 3-3 Available Infiltration Volume

Infiltration Facility	Footprint (m^2)	Depth (m)	Void Ratio	Storage Volume (m^3)
Chamber System	1387	0.152	0.40	84.6

As shown in Section 3.3.2, the pervious area can retain 77.2% of annual precipitation for infiltration and evapotranspiration, which is equivalent to rainfall volume from event of 12.4 mm or less within 24 hours. Therefore, all pervious areas are considered self-mitigated in terms of infiltration and groundwater recharge.

Along with 1 mm depression storage, the infiltration facility would retain runoff from a storm event with daily volume of 5.82 mm falling on impervious surface of catchment 1101 ~ 1104. This is equivalent to 53.0% of annual precipitation, as per Figure 1a of City of Toronto's Wet Weather Flow Management Guidelines (WWFMGs). Refer to Appendix A for detailed calculations. Table 3.4 presents the retention capacity of the infiltration facilities.

Table 3.4 Water Balance Performance of Underground Chamber System

Catchment / Infiltration Facility	Surface Type	Area (ha)	Rainfall Depth (mm)	Initial Abstraction (mm)	Runoff Depth (mm)	Retention Volume (m^3)
Basin 1101 ~ 1104 / Chamber System	Impervious Area	1.755	5.82	1.0	4.82	84.6
	Pervious Area	0.194	5.82	12.4	0.0	0.0
	Total	1.949				84.6

3.3.4 Water Balance for Post-Development Conditions with Mitigation Measures

Water balance analysis for post-development conditions was carried out by defining the relationship for different type of surfaces and LID practices, and then weighted by the % of surface coverage to obtain the site wide water balance relationship.

The water balance relationships for drainage to the proposed LID measures (underground chamber system) have been established in Section 5.3.5.5 of Appendix A. The water balance relationship for impervious and pervious area without LID practices shall be carried out following the procedure illustrated in Section 5.3.4.2 and 5.3.4.3 of Appendix A.

The site wide water balance relationship for the post-development conditions is determined by weighting the relationship for various surface types with corresponding % of land use coverage. Under post-development conditions with mitigation measures, of the total average annual rainfall, infiltration accounts for approximately 36.4%, evapotranspiration (ET) accounts for approximately 16.6%, and there is approximately 47.0% runoff. The annual infiltration volume for 2.07 ha area is 7,853 m^3.

3.3.5 Development Impacts on Water Balance

A summary of the water balance analysis results, both pre-development and post-development, have been shown in Table 3-5. Under the post-development conditions with the proposed infiltration measure, the annual infiltration volume within the study area shall increase by 3,060 m^3 or 63.8%, compared with the annual infiltration volume under pre-development conditions. It has been demonstrated that the subject development will enhance the groundwater recharge and satisfy the source water protection design criteria.

Table 3-5 Comparison of Water Balance under Various Scenario

Hydrologic Cycle Components	Pre-Development Condition Volumes (m^3)	Post-Development Conditions Volumes (m^3)	Change	
			(m^3)	(%)
Infiltration	4,793	7,853	3,060	63.8
Evapotranspiration	12,383	3,593	-8,790	-71.0
Runoff	4,420	10,150	5,730	129.6
Precipitation	21,596	21,596	0	0

3.4 WATER QUALITY

The subject site is required to provide an Enhance Level of Protection or 80% TSS removal on a long-term loading basis, as per MECP manual. This shall be addressed through treatment train approach with combination of OGS units and Isolator Rows built in the StormTech chamber system. The infiltration volume available within the clear stone foundation of the chamber system provides additional water quality treatment benefit.

Rooftops of the conference centre (catchment 1101) and the hotel (catchment 1102) are not prone to sediment generation. Runoff from these areas are relatively clean and can be directed to the chamber system without pre-treatment.

Two Stormceptor units (model: EFO8 and EFO4) are proposed to treat runoff from catchments 1003 and 1004, respectively. The OGS units shall be installed at upstream of the inlets to the chamber system as pre-treatment devices. Based on the historic storm data, the selected units can provide minimum 60% TSS removal as per the sizing calculation provided by the product supplier. However, the recognized TSS removal efficiency of an OGS unit is 50%, as per NJDEP. Refer to Appendix D for OGS sizing reports.

All runoff from catchment 1101 ~ 1104 shall be treated by Isolator Rows build into the ADS StormTech SC-740 chamber system prior to infiltration. The Isolator Rows are wrapped entirely in geotextile to ensure that water entering the system be filtered through the cloth. The Isolator Rows will provide 80% TSS removal. Refer to Appendix E for more details.

The overall TSS removal efficiency of the Phase 1 development is estimated by analysing the site annual TSS loading for each drainage catchment and removal efficiency of the proposed best management practices (BMPs). A TSS removal efficiency of 81.8% has been achieved and the subject development satisfies the required 80% TSS removal.

3.5 WATER QUANTITY

ADS StormTech SC-740 chamber system with total 900 m^3 storage volume is proposed to address water balance and water quantity control. A 250 mm diameter orifice plate with invert of 212.42 m is proposed to control the release rate from the underground chamber system. Refer to Appendix E for the cumulative storage volume spreadsheet, general cross-sections, and details for the StormTech SC-740 chamber system.

During a storm event, runoff will fill the 84.6 m^3 volume available within the 0.152 m clear stone foundation for subsequent infiltration through the bottom of the system, and then release at the controlled flow rate of the outlet control device.

3.5.1 OPERATION PERFORMANCE OF STORMTECH CHAMBER SYSTEM

The Visual OTTHYMO (VO) model is simulated for 24-hour SCS Type II distribution storm and Chicago storm to determine the operation performance of the underground chamber system with the proposed outlet structure. The modelling results are summarized in Table 3-6 and Table 3-7. Detailed VO model output is included in Appendix B.

Table 3-6 Operation Performance of StormTech Chamber System (24-hour SCS Storm)

Return Periods (Years)	Outflow Rate (m^3/s)	Utilized Storage (m^3)	Water Elevation (m)
2	0.057	413	212.71
5	0.072	517	212.82
10	0.080	577	212.88
25	0.090	661	212.97
50	0.097	719	213.17
100	0.105	779	213.13

Table 3-7 Operation Performance of StormTech Chamber System (24- hour Chicago Storm)

Return Periods (Years)	Outflow Rate (m^3/s)	Utilized Storage (m^3)	Water Elevation (m)
2	0.058	416	212.72
5	0.076	544	212.84
10	0.086	627	212.93
25	0.100	737	213.06
50	0.111	821	213.19
100	0.122	898	213.33

3.5.2 QUANTITY CONTROL FOR FUTURE DEVELOPMENT

Quantity control shall be provided for the future development lands to ensure that the total allowable flow rates at the existing twin culvert be satisfied. Visual OTTHYMO model was simulated to determine the target flow rates and required storage volume for the future development, as shown in Table 3-8. The VO model output is included in Appendix B.

Table 3-8 Target Flow Rates and Required Storage for Future Development

Return Periods (Years)	Target Flow Rate (m^3/s)	Required Storage (m^3)
2	0.180	870
5	0.300	1120
10	0.375	1280
25	0.495	1485
50	0.575	1645
100	0.665	1815

3.5.3 POST-DEVELOPMENT (ULTIMATE CONDITIONS) PEAK FLOW RATES

A comparison of the pre- and post-development peak flow rates to the existing twin culvert is presented in Table 3-9. It shows that, with the proposed quantity controls, the peak flows at existing twin culvert are controlled to pre-development levels for 2-year up to 100-year events. Refer to Appendix B for detailed hydrologic modelling output.

Table 3-9 Comparison of Pre- and Post-Development (Ultimate Conditions) Peak Flow Rates

Return Periods (Years)	Pre-development Peak Flow Rates (m^3/s)	Post-development Peak Flow Rates (m^3/s)	
		24 Hour SCS	24 Hour Chicago
2	0.249	0.228	0.249
5	0.395	0.335	0.394
10	0.487	0.407	0.486
25	0.625	0.510	0.622
50	0.724	0.591	0.720
100	0.830	0.669	0.830

3.6 SWM FOR INTERIM DEVELOPMENT CONDITIONS

3.6.1 DRAINAGE PLAN UNDER INTERIM DEVELOPMENT CONDITIONS

Figure 4 presents the drainage plan for the interim development conditions with Phase 1 land being developed. Under the interim conditions, the subject site and external drainage areas are delineated into seven (7) sub-catchments. catchments 1101 ~ 1104 represent the Phase 1 development, for which the SWM strategy has been discussed in previous sections. Catchments 1200, 1300, and 1400 represent the future development, external areas and Beamish Road right-of-way (ROW).

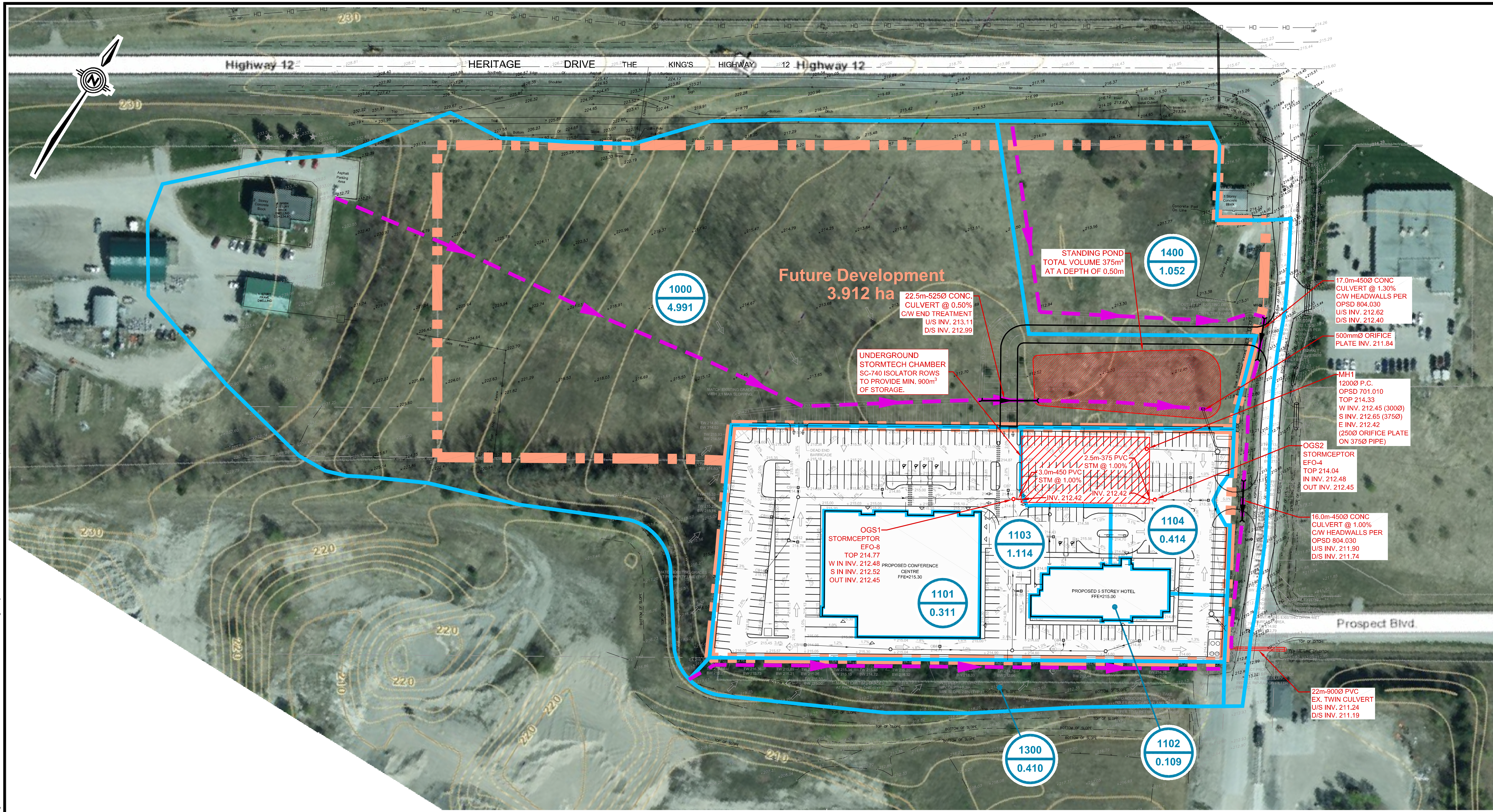
Runoff from catchment 1200 shall be captured by a Ditch Inlet Catch Basin (DICB), controlled by orifice plate, and then conveyed via storm sewers on Phase 1 lands to storm outfall located at the southeast corner of the site and discharges into the roadside ditch just upstream of the existing twin culvert.

A SCS CN value of 75 is assigned to site soil - silty sand with HSG "B". A typical initial abstraction (IA) of 5 mm is applied to the pervious areas. The upland method is used to obtain the Time of Concentration (T_C) and then Time to Peak (T_P) for rural catchment 1200, 1300, and 1400.

Table 3-10 presents the catchment parameters used in hydrologic modelling for the interim development conditions. Refer to Appendix A for detailed calculations.

Table 3-10 Post-development (Ultimate) Condition Catchment Parameters

Catchment	Land Use	Area (ha)	IMP (%)	CN	IA (mm)	Tp (hrs)	Command
1101	Conference Center	0.311	100	75	5	---	STANDHYD
1102	Hotel	0.109	100	75	5	---	STANDHYD
1103	Phase 1 Parking (W)	1.114	87.2	75	5	---	STANDHYD
1104	Phase 1 Parking (E)	0.414	87.6	75	5	---	STANDHYD
1200	Future Dev. & External	4.991	7.5	76	5	0.15	NASHYD
1300	External to the South	0.410	0.0	75	5	0.06	NASHYD
1400	Future Dev. & ROW	1.052	16.0	75	5	0.28	NASHYD
Total		8.401	27.4				



LEGEND

PROPERTY BOUNDARY

SUB-CATCHMENT BOUNDARY

1101 — SUB-CATCHMENT ID.

0.311 — DRAINAGE AREA (ha)

FLOW PATH

0 10 25 50 75m

CLIENT
TRIPAR

TITLE
16928 HIGHWAY 12, MIDLAND, ONTARIO
HOTEL AND CONFERENCE CENTRE

PROPOSED DRAINAGE PLAN INTERIM CONDITIONS

wsp

Checked: J.Z.	Drawn: AutoCAD/B.K.B.
Date: FEBRUARY 2020	Proj. No.: 18M-01620-00
Scale: AS SHOWN	Figure No.: 4 — Gr.No.: 00

FIGURE 4.dwg - 16928 Hwy 12 Midland - Proposed Drainage Plan Interim Conditions X:\DIV38\2018\18M-01620-00 16928 Highway 12 Midland\CAD\FIGURES\ Feb 13, 2020 - 1:31pm

3.6.2 QUANTITY CONTROL UNDER INTERIM DEVELOPMENT CONDITIONS

Quantity control shall be proposed for runoff from catchment 1200 to ensure that the target flow rates at the existing twin culvert are achieved under interim development conditions. There are total 375 m^3 surface storage available on the open space north of Phase 1 lands with a ponding depth of 0.50 m. A 500 mm orifice plate is proposed at the DICB to control the runoff from catchment 1200.

Table 3.11 presents a comparison between the pre- and post-development (interim conditions) peak flow rates at the existing twin culvert underneath Beamish Road. It shows that, under the interim development conditions, the peak flow rates are controlled to a level less than pre-development conditions for 2-year up to 100-year events.

Table 3-11 Comparison of Pre- and Post-Development (Interim Conditions) Peak Flow Rates

Return Periods (Years)	Pre-development Peak Flow Rates (m^3/s)	Post-development Peak Flow Rates (m^3/s)	
		24 Hour SCS	24 Hour Chicago
2	0.249	0.239	0.227
5	0.395	0.359	0.361
10	0.487	0.433	0.454
25	0.625	0.542	0.584
50	0.724	0.620	0.689
100	0.830	0.703	0.795

3.7 OTHER DESIGN CONSIDERATIONS

Ditch Inlet Catch Basin (DICB) is proposed to capture runoff from catchment 1200 under interim development conditions. Three culverts are proposed to convey the flow from upstream drainage area to the downstream drainage system under interim and ultimate development conditions.

3.7.1 DITCH INLET CATCH BASIN (DICB)

A 1200 x 600 mm precast concrete ditch inlet (OPSD 705.040) with 1200 X 600 mm grate (OPSD 403.010) is proposed to capture the 100-year flow rate from future development and external areas (Catchment 1200). The grating of DICB has a conveyance capacity greater than the flow rate of the 500 mm orifice plate, and the latter functions as quantity control device. Refer to Section 6.1 of Appendix A for detailed calculations.

The site storm sewer shall be designed to convey total flows from both catchment 1200 (future development and external area) and Phase 1 Development to the storm outfall located at the southeast corner of the property just upstream the existing twin culvert underneath the Beamish Road.

3.7.2 CONVEYANCE CULVERTS

Total three culverts are proposed to convey the flows from the upstream to downstream drainage system.

1) Two culverts are proposed at the site's two access entrances, to convey flows from upstream to downstream reach of the roadside ditch along Beamish Road. These two culverts are 450 mm diameter concrete culverts.
2) A 525 mm concrete culvert crossing the north access road is proposed to convey the flows from catchment 1200 (future development and external areas).

Hydraulic analysis has been carried out for these culverts using HY-8 software. Section 6 of Appendix A provides design details of the culverts and Appendix C includes the HY-8 culvert analysis reports.

4 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION PERIOD

During construction, there is potential for short-term sediment wash-off from the site. To protect the downstream receiving sewer system and other natural features, on-site sediment control measures are necessary during construction.

As sediment and erosion control strategies focus on minimizing adverse environmental impacts by restricting the mobilization and transport of sediment, the following general practices will be observed:

◊ Sediment and erosion control works, as shown on the project's erosion and sedimentation control plans which will be provided during the detailed design stage, must be in place prior to the commencement of construction, and not removed until the end of the construction period, when the site has been stabilized.

◊ Construction phasing must be scheduled to minimize the extent and period to which disturbed soils are exposed to weathering. As such, all disturbed areas must be stabilized as quickly as possible. Stabilization of disturbed areas may be accomplished by sodding, seeding, mulching, hydro-seeding, planting, or covering of constructed slopes with appropriate material such as geotextile or jute mesh.

◊ Access to the construction site must be minimized.

◊ A continuous siltation fence must be constructed along the perimeter of the proposed development. The silt fence must be in place prior to the commencement of construction, and must be removed at the end of the construction period.

5 CONCLUSIONS

A stormwater management plan has been prepared in support of the Site Plan Approval Application for the proposed Phase 1 Development at 16928 Highway12 in the Town of Midland, ON.

The key components of the SWM plan are summarized below.

- **Water Balance**

  Runoff from majority of the Phase 1 development shall be directed to an underground chamber system and retained within the 0.15 m clear stone foundation for subsequent infiltration.

- **Water Quality**

  Treatment Train Approach consisting of two Stormceptor units (Model: EFO8 and EFO4) and Isolator Rows incorporated in the underground chamber system is proposed to achieve an Enhance Level of Protection or 80% TSS removal.

- **Water Quantity**

  An ADS StormTech SC-740 chamber system with total 900 m^3 storage volume is proposed to detain storm runoff from the Phase 1 Development. A 250 mm orifice plate is proposed to control the release rate from the underground chamber system.

  Under ultimate development conditions, approximately 1815 m^3 storage volume is required to control the peak flow rate from the future development and the external drainage area to the west.

  Under interim development conditions, there are total 375 m^3 surface storage available on the open space north of Phase 1 lands with a ponding depth of 0.50 m. A 500 mm orifice plate is proposed at the DICB to control the runoff from future development lands and the external drainage area to the west.

  With above on-site quantity controls, the post-development peak flow rates at the existing twin culvert underneath the Beamish Road are controlled to pre-development levels for 2-year up to 100-year storm events for both ultimate and interim scenarios.

All SWM related impacts due to the proposed development have been addressed with the SWM strategies described above to the satisfaction of Town of Midland’s Engineering Development Design Standards.

Respectively Submitted

WSP

APPENDIX

A

STORMWATER MANAGEMENT CALCULATIONS

1 Background Information

1. Engineering Development Design Standards, Town of Midland, Revised December 2013
2. Stormwater Management Planning and Design Manual (MECP, 2003).

2 SWM Design Criteria

2.1 Water Balance:

Retain stormwater on-site, to the extent practicable, to match pre-development conditions.

2.2 Water Quality:

Provide an Enhanced level (80% TSS Removal) of Stormwater Quality Control per MECP guidelines.

2.3 Quantity Control:

Control the post-development runoff to pre-development levels for 2-year up to 100-year events.

3 Hydrologic Modelling

3.1 Hydrologic Analysis

Visual OTTHYMO 5.0 hydrologic model (VO5) is used to simulate the pre-development and post-development flow rates from the subject site, and to size and confirm the performance of the proposed underground Chamber.

3.2 Meteorological Data

Source: Town of Midland's Engineering Development Design Standards, 2012

Return Period (Years)	A	B	C	24 hour Rainfall Amount (mm)
2	807.44	6.75	0.828	46.8
5	1135.40	7.50	0.841	59.9
10	1387.00	7.97	0.852	67.5
25	1676.20	8.30	0.858	78.1
50	1973.10	9.00	0.868	85.4
100	2193.10	9.04	0.871	92.9

4. Pre-Development Conditions

4.1 Pre-Development Area Breakdown

The subject site and its external drainage area are delineated into two subcatchments under existing conditions.
Area breakdown was carried out as, shown in the following table.

Catchment	Land Use	Area (ha)	RC	IMP (%)
100, Subject Site & External Drainage	Impervious Area (Building & Parking)	0.376	0.900	4.6
	Pervious Areas (Grass with Sparse Trees)	7.790	0.250	
	Total	8.166	0.280	
200, Beamish Roadway ROW	Impervious Area (Road Pavement)	0.112	0.900	47.5
	Pervious Areas (Roadside Ditch)	0.123	0.250	
	Total	0.235	0.559	
Total		**8.401**		

4.2 Pre-Development Hydrologic Parameters

The subject site and its external drainage area are delineated into two subcatchments under existing conditions.
The catchment parameters are presented in the following table.

Catchment ID	Area (ha)	TIMP (%)	CN	IA (mm)	Tp (hrs)	Commend
100	8.166	4.6	76	5.0	0.25	NasHyd
200	0.235	47.5	75	5.0	---	StandHyd

4.2.1 Modified Curve Number (Paul Wisner & Associates, 1982)

Site Location: Midland, ON

Subwatershed: Wye Marsh (South)

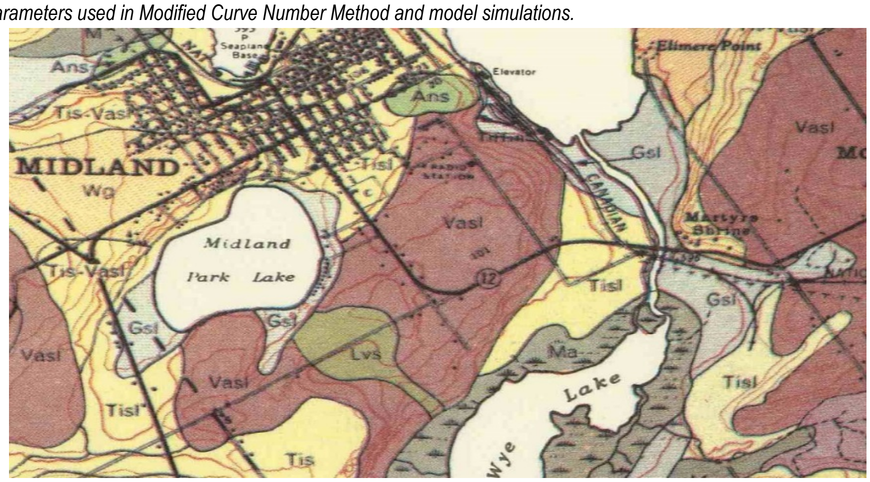
Soil Symbol	Soil Series	Soil Type	Landuse or Cover	Hydrologic Conditions	HSG	CN
Lvs	Lovering*	Silty Sand**	Lawn	Good	B	74
Vasl	Vasey*	Sandy Loam**	Lawn	Good	B	74

* *Based on the Soil Survey Report #29 - Soil Map of Simcoe County (National Soil DataBase, NSDB)*

** *Based on the Geotechnical Report*

Step	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Parameter	IA* (mm)	CN (II)	CN (III)	P (mm)	S (mm)	IA (mm)	Q (mm)	S* (mm)	CN* (III)	CN* (II)
100	5	74	87.5	92.9	36.4	5.5	61.7	37.2	87	75

** Parameters with * will be parameters used in Modified Curve Number Method and model simulations.*



(1). Select an appropriate IA for catchments being modelled (1.0 ~5.0 mm). Here IA=5 mm.

(2). Determine the SCS CN (AMC II Conditions) value from soils maps and/or calculations.

(3). Convert the CN (AMC II Conditions) to a CN (AMC III Conditions).

CN (II)	Factor (II >>> III)	CN (III)
70	1.21	84.7
80	1.14	91.2
74	1.18	87.5

(4). Determine the largest precipitation volume, P, for a rainfall event that would represent AMC III soil moisture conditions, say 100 year event.

(5). Calculate the soil storage S, based on the SCS Method using CN (III). S=25400/CN-255

(6). Calculate the IA based on the SCS method, where IA=0.2S.

(7). Determine the runoff volume, Q, based on the familiar: $Q=(P-IA)^2/(P-IA+S)$.

(8). Calculate S using the above equation with IA* = 5 mm. $S=(P-IA^*)^2/Q-P+IA^*$.*

(9). Calculate CN (III) using CN*=25400/(S*+254).*

(10). Convert CN for AMC II conditions from AMC III conditions.*

4.2.2 Weighted CN for Catchment 100

Land Use	IMP (%)	CN	
Impervious Area	4.6	92.0	*Refer to MTO Manual*
Pervious Area	95.4	74.8	*Refer to above calculations*
Total	100.0	75.6	

4.2.3 Time to Peak (tp) Estimation for Rural Catchment (100)

Time of concentration (tc) was calculated using Upland Method, then time to peak (tp) was determined using Equation tp=2/3*Tc. With Upland Method, the average overland flow velocity is determined for a catchment based on the catchment slope and ground type. Once the velocity has been determined, then the time of concentration is determined by dividing the catchment length by the overland flow velocity.

The velocity can be either read from a figure for Velocity vs. Slope or calculated from the following equation:

$$V = K\sqrt{S}$$

Where, V is average velocity;
S is slope in percentage (%); and
K (m/s) is an intercept Coefficient
2.1 for overland flow, pasture;
4.6 for grassed waterway.

Catchment	Flow Pattern & Ground Cover	L (m)	EL_1 (m)	EL_2 (m)	Sw	K	V (m/s)	Tc (min)	Tp hr)
100	Overland, Pasture	172	232.70	214.45	10.6%	2.1	0.68	4.2	0.05
	Overland, Pasture	248	214.45	211.70	1.1%	2.1	0.22	18.6	0.21
	Total							22.8	0.25

4.3 Pre-Development Peak Flow Rates

Visual OTTHYMO (VO) model is simulated for 2- to 100-year 24 hour SCS Type II distribution storm to determine the hydrographs for undeveloped watershed, as per Town Standards.

Rainfall Event (Years)	Pre-Development Peak Flow Rate (m^3/s)
2	0.25
5	0.39
10	0.49
25	0.62
50	0.72
100	0.83

4.4 Downstream Infrastructure Capacity

Under existing conditions, runoff from the subject property and external drainage area drains to the existing twin culverts underneath Beamish Road. Roadside ditch along the Beamish Road only conveys the runoff from the Right-of-Way (ROW).

Under proposed conditions, runoff from the subject development and its external drainage area shall be controlled and released at the outfall located at the southeast corner. Therefore, the on-site control should ensure the overall peak flow rates shall not exceed the conveyance capacity of the existing twin culvert underneath the Beamish Road.

4.4.1 Characteristics of Existing Twin Culvert underneath Beamish Road

Location	Number of Barrels	Material & Shape	Dia. (mm)	U/S Inv. (m)	D/S Inv. (m)	Length (m)	Slope (%)	Edge of Pavement (m)
Beamish Road	2	PVC, Circular	900	211.24	211.19	22.0	0.23	212.82

4.4.2 Design Criteria for Culvert Crossing (Design Flows, Freeboard, etc.).

Road	FRC *	Total Span	Design Event (25-year)			Check Flow (100-year)	
			Flow (m^3/s)	Free\board	HW/D	Flow (m^3/s)	Freeboard
Beamish Road	Collector	< 6.0	0.62	>= 1.0 m	<= 1.5	0.83	No Overtopping

FRC - Functional Road Classification.

4.4.2 Hydraulic Analysis of Existing Twin Culvert underneath Beamish Road

Hydraulic analysis of the existing twin culverts are carried out using Hy-8 software. Refer to Appendix C for HY-8 Output.

Storm Event	Flow (m^3/s)	WSE (m)	Freeboard (m)	HW (m)	D (m)	HW/D
25	0.62	211.76	1.06	0.52	0.90	0.58
100	0.83	211.84	0.98	---	---	---

It shows that the existing twin culvert satisfies MTO highway drainage standards on freeboard for culvert and ratio of the flood depth at the upstream face of the culvert to the diameter of the culvert.
The existing twin culvert is capable to convey the existing 100-year peak flow rate without overtopping.

4.5 Allowable Peak Flow Rates

The downstream culvert has sufficient capacity to convey the existing flow rates from the site and its external areas..

Therefore, the pre-development peak flow rates shall be used as the target flow rates for the proposed development.

5 Proposed Development and SWM Plan

5.1 Drainage Plan under Ultimate Development Conditions

Refer to Figure 3.

The subject site and its external drainage area are delineated into eight (8) sub-catchments , of which:

1. Catchment 1101 ~ 1104 represents the Phase 1 Development, Catchment 1200 represents the future development. catchment 1000, 1300, and 1400 represent external drainage from adjacent properties and Beamish Road ROW.
2. On-site SWM controls shall be provided for current development (1101 ~ 1104) and future development (1200). The total controlled flow shall be conveyed via storm sewer on Phase 1 land to the southeast corner the property and discharge to roadside ditch just upstream of the twin culvert underneath Beamish Road.
3. Runoff from external catchment 1000 shall be captured by a DICB and conveyed to catchment 1200 for quantity control.

Catchment ID	Area (ha)	TIMP (%)	CN	IA (mm)	Tp (hrs)	Commend	Notes
1000	1.628	23.1	75	5.0	---	StandHyd	External Area
1101	0.311	100.0	75	5.0	---	StandHyd	Phase 1 Development
1102	0.109	100.0	75	5.0	---	StandHyd	Phase 1 Development
1103	1.114	87.2	75	5.0	---	StandHyd	Phase 1 Development
1104	0.414	87.6	75	5.0	---	StandHyd	Phase 1 Development
1200	4.171	95.0	75	5.0	---	StandHyd	Future Development
1300	0.410	0.0	75	5.0	0.06	NasHyd	External Area
1400	0.243	51.5	75	5.0	---	StandHyd	Beamish Roadway ROW
Total	8.401	69.5					

5.1.1 Imperviousness

1. Impervious areas for catchment 1103 and 1104 are measured using current site plan.
2. A typical imperviousness value of 95% is assumed for Catchment 1200.
3. Impervious areas for catchment 1000 and 1400 are estimated using site plan and google image.

5.1.2 CN and IA for pervious area

A CN value of 75 and a IA value of 5 mm are assigned to pervious area.

5.1.3 Time to Peak (tp) Estimation for Rural Catchment

Time of concentration (tc) was calculated using Upland Method, then time to peak (tp) was determined using Equation tp=2/3*Tc. Refer to Section 4.2.3.

Catchment	Flow Pattern & Ground Cover	L (m)	EL_1 (m)	EL_2 (m)	Sw	K	V (m/s)	Tc* (min)	Tp hr)
1300	Overland, Pasture	218	216.80	212.50	2.0%	4.6	0.65	5.6	0.06

5.2 SWM Strategies for Ultimate Development Conditions

5.2.1 SWM Strategies for Phase 1 Development

1. Storage available within the voids of clear stone foundation of StormTech chamber system shall be utilized to enhance infiltration and groundwater recharge to address source water protection. Refer to Section 5.3 in this Appendix for details.
2. OGS units and Isolator Rows built into the StormTech chamber systems shall be used for water quality treatment. Refer to Section 5.4 in this appendix for detailed analysis.
3. StormTech Chamber system is proposed to control runoff from catchment 1101 ~ 1104. Refer to Section 5.5 in this appendix for detailed analysis.

5.2.2 SWM Strategies for Future Development

SWM controls shall be provided for runoff from future development (catchment 1200) and external area to the west (catchment 1000). Quantity control target for the future development is set such way that the total allowable flows at the twin culvert and required storage volume are satisfied and required volume is estimated.
Details on the SWM for future development shall not be covered in this SWM report.

5.3 Water Balance

5.3.1 Background Information

1. Engineering Development Design Standards, Town of Midland, Revised December 2013
2. Stormwater Management Planning and Design Manual, Ministry of Environment, Conservation and Parks (MECP, 2003).
3. Low Impact Development (LID) Stormwater Management (SWM) Planning and Design Guide (CVC & TRCA, 2010).
4. Geotechnical Investigation Report (PML, December 2018)

5.3.2 Water Balance Design Criteria

The proposed development should demonstrate that infiltration amount be maintained to the extent practicable, to achieve the same level of annual volume of infiltration under pre-development conditions .

The water balance study area includes 1.96 ha Phase 1 land and 0.11 ha area for second access road and two entrances which is outside of Phase 1 boundary.

5.3.3 Pre-Development Site Wide Water Balance Analysis

Section 3.2.3 of Stormwater Management Planning & Design Manual (SWMPDM, MECP, 2003) gives a water balance example for pervious area which is for a basin in Southern Ontario with a latitude of 45° .

The MECP's SWMPD Manual offers a method to estimate the infiltration on the site, based on a local infiltration factor "i", which is applied to the available water surplus to determine the groundwater recharge for a given area with pervious cover.
The methodology considers factors such as the soil type, topography, and vegetation to arrive at the infiltration factor that is then applied against the water surplus to provide an estimate of the amount of water infiltrating into the ground. The remaining water surplus is considered runoff.

According to Canadian Climate Normals Station Data, the mean annual precipitation for adjacent station (Orillia) is

1043.2 mm

Under existing conditions, the study is pervious with pasture and shrubs.

Area = 1.96 + 0.11 = 2.07 ha

Underlying the topsoil in almost all boreholes and test pits, upper thin layers of silty sand/sand and silt/sandy silt/sand were present extending to 0.7 to 2.9 m. The hydrologic soil group (HSG) is B.

Average Annual Precipitation	1043.2	mm, or	21,596	m^3
Annual Evapotranspiration	598.2	mm, or	12,383	m^3

Same ratio of 539/940 is applied to estimate the annual evapotranspiration.

Available Water Surplus (or excess of precipitation over evapotranspiration)

	445.0	mm, or	9,213	m^3

Then, infiltration factors are used to determine the fraction of water surplus that infiltrates into the ground and the fraction that runs off the site. Infiltration factor is determined by summing a factor for topography, soil, and cover.

Table 3.1: Hydrologic Cycle Component Values

**This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

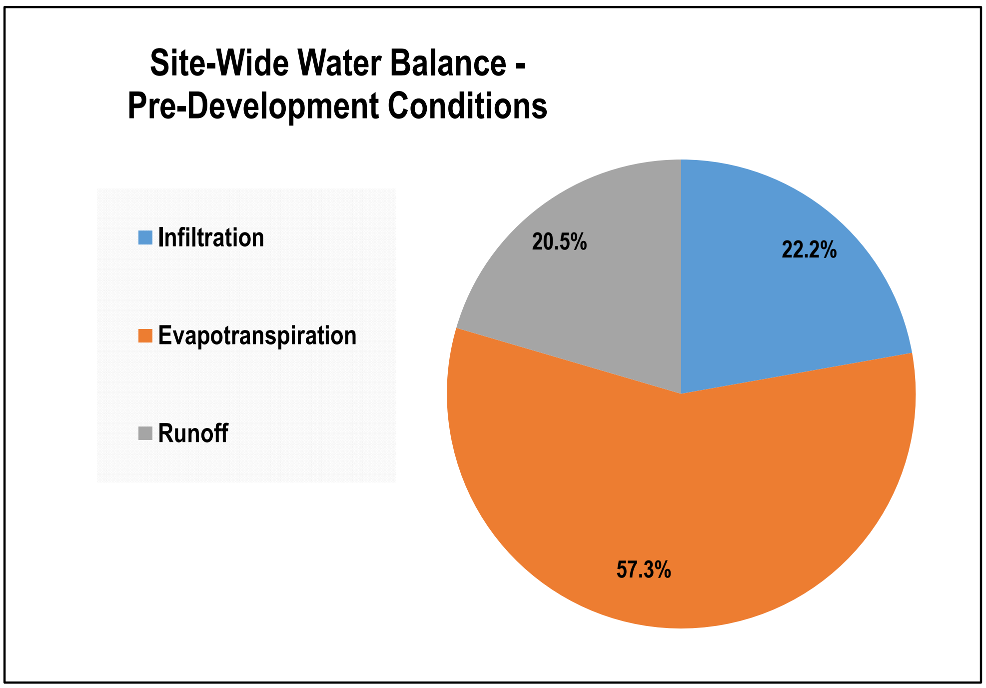
Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

SWM Planning & Design Manual -3-4- *Environmental Design Criteria*

Topography Factor	0.17	for slope = 1.1% or 11 m/km
Soil Factor	0.25	for Silty Sand or Sandy Silt
Cover	0.10	for Pasture and Shrubs
Therefore, the total infiltration factor is	0.52	

Therefore, the annual infiltration amount is	231.5	mm, or	4,793	m^3
and the annual runoff amount is	213.5	mm, or	4,420	m^3

	(%)	(mm)	(m^3)	*Comments/Assumptions:*
Infiltration	22.2%	231.5	4,793	...
Evapotranspiration	57.3%	598.2	12,383	...
Runoff	20.5%	213.5	4,420	...
Precipitation	100.0%	1,043.2	21,596	



5.3.4 Post-development Site Wide Water Balance Analysis _ without Mitigation Measures

Water balance analysis for post-development conditions without mitigation measures is carried out to evaluate the impacts due to the proposed development.

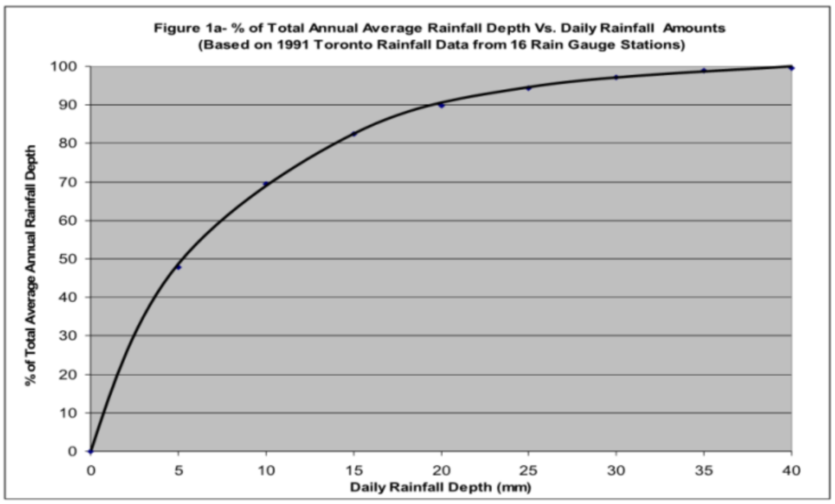
5.3.4.1 Area Breakdown

The study area is breakdown to areas in terms of soil, slopes, land uses.

Area #	*Description*	*Area (ha)*	*Coverage (%)*	*Soil*	*Cover*	*Slope*
1	Impervious Surface *	1.873	90.5	Hard Surface with 1 mm depression storage		
2	Pervious Surface	0.198	9.5	Silty Sand	Urban Lawn	2.0%
Total		2.070	100.0			

5.3.4.2 Water Balance Relationship for Impervious Surface

It is assumed that the impervious area will accept 1 mm rainfall prior to runoff generation due to the shallow depressions.
Figure 1a in City of Toronto WWFMGs presents the relationship of the % of the total annual rainfall depth vs. the daily rainfall amounts.



	(%)	(mm)	(m^3)	*Comments/Assumptions:*
Infiltration	0.0	0.0	0	*...*
Evapotranspiration	12.5	130.4	2,442	*1 mm depression.*
Runoff	87.5	912.8	17,093	*...*
Precipitation	100.0	1043.2	19,534	

5.3.4.3 Water Balance Relationship for Pervious Surface

Average Annual Precipitation	1043.2	mm, or	2,062	m^3
Annual Evapotranspiration	582.6	mm, or	1,152	m^3
Available Water Surplus (or excess of precipitation over evapotranspiration)				
	460.6	mm, or	910	m^3

Then, infiltration factors are used to determine the fraction of water surplus that infiltrates into the ground and the fraction that runs off the site. Infiltration Factor is determined by summing a factor for topography, soil, and cover.

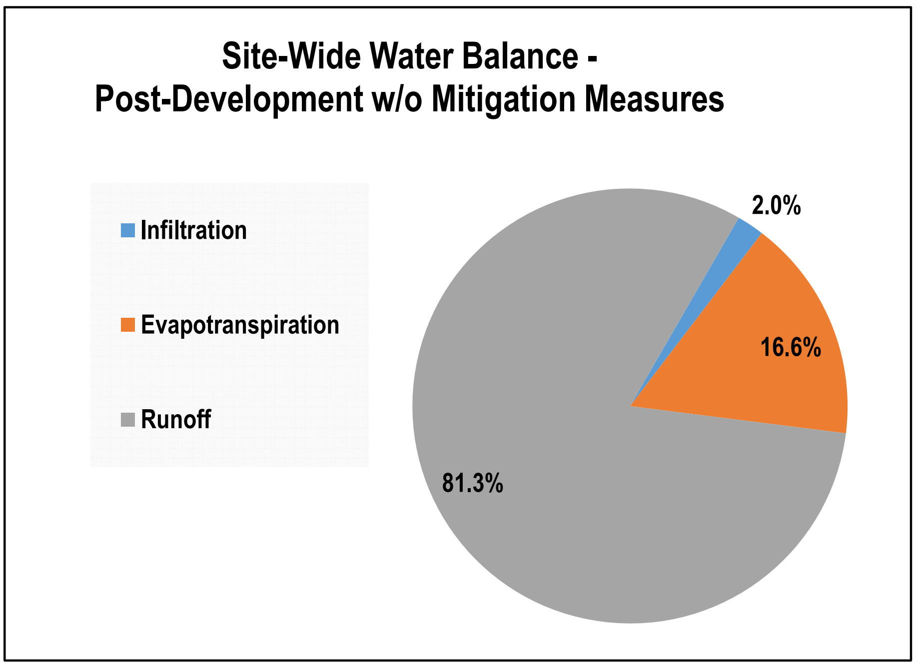
Topography Factor	0.13	for slope = 2.0% or 20 m/km
Soil Factor	0.25	for Silty Sand or Sandy Silt
Cover	0.10	for cultivated land (urban lawn)
Therefore, the total infiltration factor is	0.48	

Therefore, the annual infiltration amount is 222.5 mm, or 440 m^3
and the annual runoff amount is 238.1 mm, or 471 m^3

	(%)	(mm)	(m^3)	*Comments/Assumptions:*
Infiltration	21.3	222.5	440	...
Evapotranspiration	55.9	582.6	1,152	...
Runoff	22.8	238.1	471	...
Precipitation	100.0	1043.2	2,062	

5.3.4.4 Site Wide Water Balance Relationship _ Proposed Conditions without Mitigation Measures

Hydrologic Cycle Components	Impervious Surface	Pervious Surface	Site-Wide		
			mm	%	m^3
% Land-Use Coverage	90.5%	9.5%	100.0%		
Infiltration	0.0	222.5	21.2	2.0%	440
Evapotranspiration	130.4	582.6	173.6	16.6%	3,593
Runoff	912.8	238.1	848.4	81.3%	17,563
Precipitation	1043.2	1043.2	1,043.2	100.0%	21,596



5.3.4.5 Impacts on Water Balance _ Proposed Conditions without Mitigation Measures

Hydrologic Cycle Components	Pre-development Conditions (m^3)	Ultimate Condition without Mitigation (m^3)	Changes	
			m^3	%
Infiltration	4,793	440	-4,353	-90.8
Evapotranspiration	12,383	3,593	-8,790	-71.0
Runoff	4,420	17,563	13,143	297.4
Precipitation	21,596	21,596	0	0.0

5.3.5 Post-development Site Wide Water Balance Analysis _ with Mitigation Measures

As demonstrated in above sections, the proposed development shall reduce infiltration and evapotranspiration and increase site runoff. Therefore, LID measures shall be incorporated into the site plan to enhance groundwater recharge.

5.3.5.1 Water Balance Strategies

Runoff from catchment 1101 ~ 1104 shall be directed to underground chamber system.

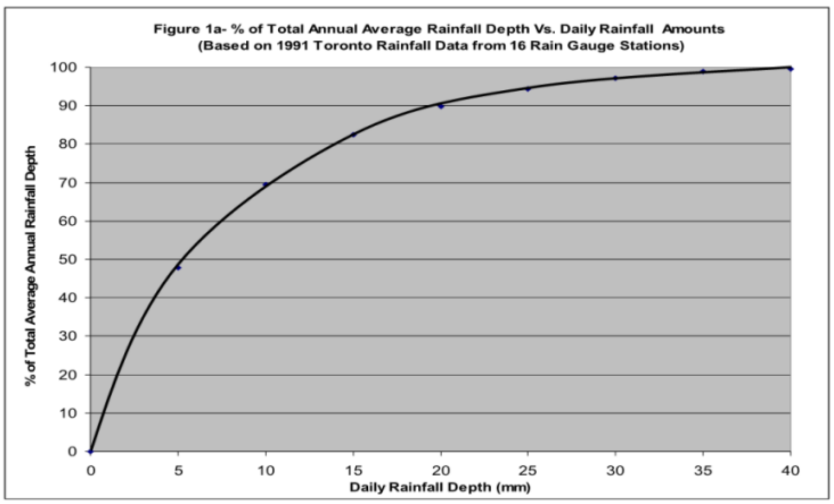
The void storage within 0.15 m clear stone foundation of the ADS StormTech SC-740 chamber systems shall enhance groundwater recharge and source water protection.

5.3.5.2 Water Balance Analysis Assumption

The following assumptions are applied in the analysis.

1) All impervious area shall accept 1 mm rainfall prior to runoff generation due to shallow depressions.
2) Water balance analysis for pervious areas shall follow the method used in the analysis for pre-development pervious area.

Figure 1a in City of Toronto WWFMGs presents the relationship of the % of the total annual rainfall depth vs. the daily rainfall amounts. This relationship will be used to conduct the water balance analysis for the subject site from an annual basis.



5.3.5.3 Area Breakdown

The Phase 1 development area is breakdown to areas in terms of soil, slopes, land uses and LID measures.

Area #	***Description***	***Area (ha)***	***coverage (%)***
1	Impervious Area to Underground Chamber System	1.755	84.8
2	Impervious area w/o LID (second access and two entrances)	0.118	5.7
3	All Pervious Area _ Self-Mitigated	0.198	9.5
Total		2.070	100.0

5.3.5.4 Feasibility and Configuration of Infiltration Facilities

Geotechnical Investigation Report prepared by PML (December 2018) shall be used to evaluate the feasibility of the Infiltration Facilities in terms of infiltration rate of native soil, water table depth, bedrock depth, etc.

5.3.5.4.1 Infiltration Rate of Native Soil

The site subsurface profile is generally characterized by topsoil, overlying thin granular soil layers over a silty clay unit, overlying deposits of till and silty sand/sand. In-situ tests in seven test pits give an infiltration rate ranging from 25 mm/hr to 103 mm/hr which is greater than 15 mm/hr for most part of the site and suitable for infiltration trenches

The proposed chamber system is adjacent to TP 106. Information for TP 106 hall be used to evaluate the infiltration rate of native soil adjacent the proposed Infiltration Facility.

Description	Infiltration Facility
BH Logs	TP 106
Material	Sandy Silt
Infiltration Rate (P) (mm/hr)	73, 43
Safety Factor	2.50
Design Infiltration Rate (mm/hr)	17.0

5.3.5.4.2 Groundwater Table Depth

The proposed three chamber system is adjacent to BH 111. Information for BH 111 shall be used to evaluate the groundwater table depth adjacent the proposed Infiltration Facility.
The depth from bottom of Infiltration Facility to the seasonal high groundwater table is calculated as follows. It shows that the proposed Infiltration Facility satisfies the minimum 1 m requirement.

Description	Infiltration Facility
Bottom of Infiltration Facilities (m)	2.12.E+02
BH Logs	BH 111
Groundwater Elevation (m)	209.20
Groundwater Depth	3.07

5.3.5.4.3 Bedrock Depth

Bedrock was not encountered in the geotechnical investigation.

5.3.5.4.4 Maximum Allowable Storage Depth

Equation 4.2 in 2003 MECP's SWMPDM is used to calculate the allowable depth of the Infiltration system.

$$d = \frac{PT}{1000}$$

Equation 4.2 in 2003 MECP SWMPDM

Description	Allowable	Provided
Depth of Infiltration Storage (m)	0.41	0.15
Infiltration Rate (mm/hr)	17.0	17.0
Drawdown Time (hrs)	24.0	8.9

5.3.5.4.5 Configuration of Infiltration Facilities

The available infiltration volume is calculated as follows.

Footprint of Infiltration Facility	1387	m^2
Depth of Infiltration Volume	0.152	m
Void Ratio of storage media for clear stone	0.40	
Infiltration Volume	84.6	m^3

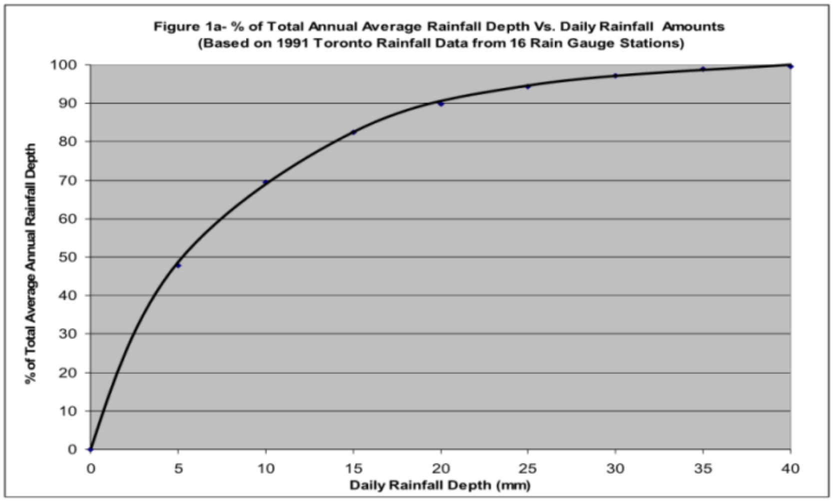
Storage System	Footprint (m^2)	Depth of Stone Base (m)	Void Ratio	Infiltration Volume (m^3)
SC-740	1387	0.152	0.40	84.6

5.3.5.4.6 Retention Capacity of Infiltration Facility

The water balance for the pervious area has been carried out in Section 5.3.4.3 in Page 8 of this Appendix .

Of the total average annual precipitation, 21.3% of annual precipitation infiltrates into the ground, 55.9% returns to atmosphere as evapotranspiration, and 22.8% runs off the site.

The total infiltration and evapotranspiration amount is 77.2% of annual precipitation which is equivalent to rainfall volume from event of 12.4 mm or less within 24 hours. 12.4 mm



Catch-ment	Surface	Area (ha)	Rainfall Depth (mm)	Infiltration & ET (mm)	Runoff Depth (mm)	Retention Volume (m³)	Equivalent Precipitation on Imper. Area
1101 ~ 1104	Impervious	1.755	5.82	1.00	4.82	84.6	53.0%
	Pervious	0.194	5.82	12.40	0.00	0.0	
	Total	1.949				84.6	

5.3.5.5 Water Balance Relationship for various land use

5.3.5.5.1 Area #1 _ Impervious Area to Underground Chamber System

Refer to Section 5.3.5.4.6

	(%)	(mm)	(m³)	Comments/Assumptions:
Infiltration	40.5	422.5	7,413	
Evapotranspiration	12.5	130.4	2,288	*1 mm depression*
Runoff	47.0	490.3	8,603	...
Precipitation	100.0	1043.2	18,304	

Total 53%

5.3.5.5.2 Area #2 _ Impervious area w/o LID (second access and two entrances).

Refer to Section 5.3.4.2

	(%)	(mm)	(m³)	Comments/Assumptions:
Infiltration	0.0	0.0	0	...
Evapotranspiration	12.5	130.4	154	*1 mm depression*
Runoff	87.5	912.8	1,077	...
Precipitation	100.0	1043.2	1,230	

5.3.5.5.3 Area #3 _ Site Pervious, Self-Mitigated

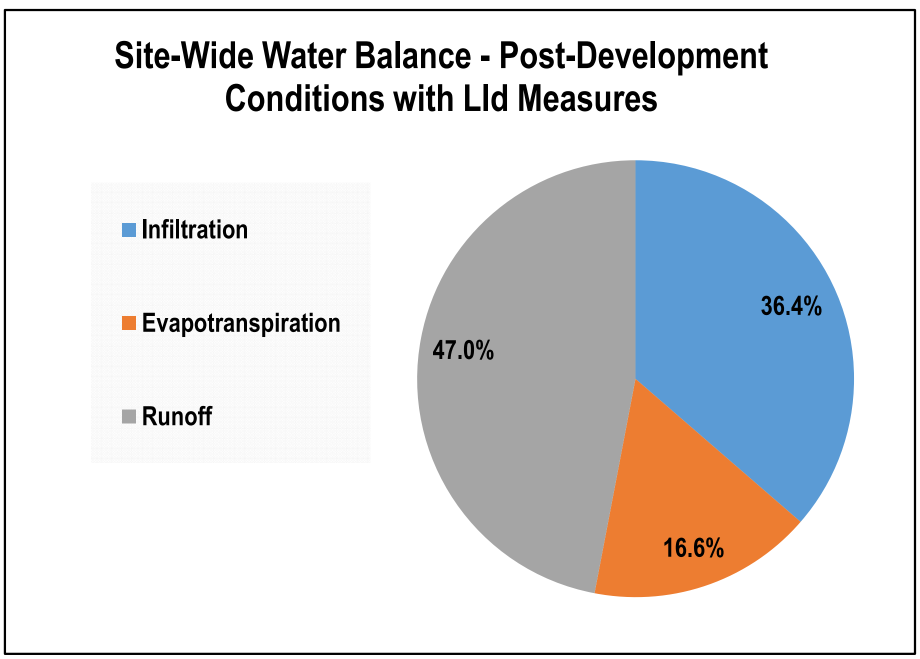
Refer to Section 5.3.4.3

	(%)	(mm)	(m^3)	Comments/Assumptions:
Infiltration	21.3	222.5	440	...
Evapotranspiration	55.9	582.6	1,152	...
Runoff	22.8	238.1	471	...
Precipitation	100.0	1043.2	2,062	

5.3.5.6 Post-Development Condition Site wide Water Balance Relationship

Hydrologic Cycle Components	Area #1 Impervious Area to Underground Chamber	Area #2 Impervious Area without LID	Area #3 Site Pervious Self-Mitigated
% Land-Use Coverage	84.8%	5.7%	9.5%
Infiltration	422.5	0.0	222.5
Evapotranspiration	130.4	130.4	582.6
Runoff	490.3	912.8	238.1
Precipitation	1043.2	1043.2	1043.2

Hydrologic Cycle Components	Post-Development Condition Water Balance Relationship with Mitigation Measures		
	mm	%	m^3
% Land-Use Coverage	100.0%		
Infiltration	379.3	36.4%	7,853
Evapotranspiration	173.6	16.6%	3,593
Runoff	490.3	47.0%	10,150
Precipitation	1,043.2	100.0%	21,596



5.3.5.7 Pre-Development Condition vs Post-Development Conditions Water Balance

Hydrologic Cycle Components	Pre-development Conditions (m^3)	Post-Development Conditions (m^3)	Changes	
			m^3	%
Infiltration	4,793	7,853	3,060	63.8
Evapotranspiration	12,383	3,593	-8,790	-71.0
Runoff	4,420	10,150	5,730	129.6
Precipitation	21,596	21,596	0	0.0

5.4 Water Quality

5.4.1. Water Quality Design Criteria

Require long-term average removal of 80% TSS on an annual loading basis from all runoff leaving the site.

5.4.2. Water Quality Strategies

Treatment train approach consisting of OGS unit and Isolator Row built in the StormTech Chamber systems are proposed to satisfy water quality design criteria. OGS units functions as pre-treatment devices for the Isolator Rows within StormTech chamber systems. Infiltration storage volume within StormTech chamber systems also provides quality treatment benefits.

5.4.3 OGS Unit Sizing

OGS units are sized to provide minimum 60% TSS removal. However, as per NJDEP, a 50% TSS removal efficiency is used to calculate overall TSS removal of treatment train approach.
Refer to Appendix D for sizing reports for OGS units.

Drainage			OGS Unit			TSS Removal (%)		Runoff Treated (%)
Catchment	Area (ha)	IMP (%)	NO.	Make	Model	Sizing	Credit	
1003	1.11	87.2	#1	Stormceptor	EFO8	62	50	> 90
1004	0.41	87.6	#2	Stormceptor	EFO4	60	50	> 90

5.4.4 Isolator rows

The Isolator within StormTech Chamber (SC-740) system shall be configurated to provide 80% TSS removal (by ADS).
Refer to Appendix E for Isolator Row Testing Summary.

5.4.5 Overall TSS Removal Efficiency

Table 6.3 in 2003 MECP SWMPDM is used to estimate TSS Loading based on site imperviousness level.

Imperviousness (%)	Annual Loading (m^3/ha)
35	0.60
55	1.90
70	2.80
85	3.80

Overall TSS removal efficiency is calculated as follows.

Catchment	Area (ha)	Imp (%)	TSS Load (m^3/ha)	TSS Load (m^3)	TSS Removal (%)			TSS Removed (m^3)
					OGS	Isolator Rows	Overall	
1101	0.311	100.0	4.80	1.49	0.0	80.0	80.0	1.19
1102	0.109	100.0	4.80	0.53	0.0	80.0	80.0	0.42
1103	1.114	87.2	3.95	4.40	50.0	80.0	90.0	3.96
1104	0.414	87.6	3.97	1.64	50.0	80.0	90.0	1.48
Uncontr.*	0.122	96.9	4.59	0.56	---	---	0.0	0.00
Total	**2.070**	**90.5**		**8.62**			**81.8**	**7.05**

** Includes 1132 m^2 impervious area outside Phase 1 development boundary (second access and two entrances).*

5.5 Water Quantity Control _ Ultimate Conditions

StormTech SC-740 chamber systems is proposed for Phase 1 Development for quantity control up to 100-year event.

5.5.1 Provided Storage

Description	Elevation (m)	Total Volume (m^3)
Bottom of Stone Base	212.27	0
Invert of Chamber	212.42	85
Top of Chamber	213.18	816
Top of Stone Cover	213.33	900

5.5.2 Outlet Design

5.5.2.1 Infiltration

The storage volume available within the stone base of the StormTech Chamber System will detain runoff for infiltration, which provides water balance and quality benefits.

$$Q = fpAn/3600000$$

Equation 4.20 in 2003 MECP SWMPDM

Where,			
	Q = Infiltration Flow Rate (m^3/s)	0.0013	m^3/s
	f = Longevity Factor	0.50	for P < 25 mm/hr
	P = Soil Percolation Rate (mm/hr)	17	mm/hr
	A = Footprint Area (m^2)	1387	m^2
	n = Void Ratio in the Stone Base	0.40	

5.5.2.2 Orifice Devices

A 250 mm orifice plate is proposed to control up to 100-year storm events.
Orifice Discharge Equation is used to calculate the release rate from the 250 mm orifice plate:

$$Q = CA\sqrt{2gh}$$

Where,			
	Q = Orifice Plate Controlled Flow Rate (m^3/s)	0.122	m^3/s
	C = Flow Coefficient for Orifice Plate	0.63	
	d = Diameter of Orifice Plate (mm)	250	mm
	A = Cross-section Area of Orifice Plate (m^2)	0.0491	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h = Water Head above Centerline of Orifice Plate (m)	0.789	m
	Invert of Orifice Plate	212.42	m

5.5.3 Stage - Storage - Discharge Relationships for Storage Chamber System

Elevation (m)	Infiltration Flow (m^3/s)	Orifice Tube #1		Total Flow (m^3/s)	Available Storage (m^3)
		Depth (m)	Flow (m^3/s)		
212.27	0.0000	0.000	0.000	0.0000	0
212.42	0.0013	0.000	0.000	0.0013	85
212.57	0.0013	0.027	0.023	0.0238	256
212.72	0.0013	0.179	0.058	0.0593	421
212.87	0.0013	0.331	0.079	0.0801	575
213.03	0.0013	0.483	0.095	0.0965	712
213.18	0.0013	0.637	0.109	0.1106	816
213.33	0.0013	0.789	0.122	0.1230	900

5.5.4 Quantity Control Performance

Visual OTTHYMO model was simulated for 24 hour Chicago storm and 24 hour SCS storm distribution.

5.5.4.1 24 hour SCS Storm

Storm Event	Q_{out} (m^3/s)	V (m^3)	WSE (m)
2	0.057	413	212.71
5	0.072	517	212.82
10	0.080	577	212.88
25	0.090	661	212.97
50	0.097	719	213.17
100	0.105	779	213.12

5.5.4.2. 24 Hour Chicago Storm

Storm Event	Q_{out} (m^3/s)	V (m^3)	WSE (m)
2	0.058	416	212.72
5	0.076	544	212.84
10	0.086	627	212.93
25	0.100	737	213.06
50	0.111	821	213.19
100	0.122	898	213.33

5.5.4.3. Target Flow and Required Volume for Future Development

Storm Event	Target Peak Flow Rate (m^3/s)	Required Storage (m^3)
2	0.180	870
5	0.300	1120
10	0.375	1280
25	0.495	1485
50	0.575	1645
100	0.665	**1815**

5.5.4.4. Total Flow at Culvert beneath Beamish Road

Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rates (m^3/s)	
		24 hour SCS Type II	24 hour Chicago
2	0.249	0.228	0.249
5	0.395	0.335	0.394
10	0.487	0.407	0.486
25	0.625	0.510	0.622
50	0.724	0.591	0.720
100	0.830	0.669	0.830

5.6 Water Quantity Control _ Interim Conditions

5.6.1 Drainage Plan Under Interim Conditions

Refer to Figure 4.

Drainage swales, culvert, and DICB are proposed to facilitate the drainage under interim conditions. Thus, the catchment boundaries and hydrologic parameters for catchment 1200 and 1400 are revised to reflect the interim conditions.

Catchment ID	Area (ha)	TIMP (%)	CN	IA (mm)	Tp (hrs)	Commend	Notes
1101	0.311	100.0	75	5.0	---	StandHyd	Phase 1 Development
1102	0.109	100.0	75	5.0	---	StandHyd	Phase 1 Development
1103	1.114	87.2	75	5.0	---	StandHyd	Phase 1 Development
1104	0.414	87.6	75	5.0	---	StandHyd	Phase 1 Development
1200	4.991	7.5	76	5.0	0.15	NasHyd	Future Dev. & External
1300	0.410	0.0	75	5.0	0.06	NasHyd	External
1400	1.052	16.0	78	5.0	0.28	NasHyd	Fut. Dev. & ROW
Total	8.401	27.4					

Time of concentration (tc) was calculated using Upland Method, then time to peak (tp) was determined using Equation tp=2/3*Tc. Refer to Section 4.2.3.

Catchment	Flow Pattern & Ground Cover	L (m)	EL_1 (m)	EL_2 (m)	Sw	K	V (m/s)	Tc* (min)	Tp hr)
1200	Overland, Pasture	207	232.70	213.50	9.3%	2.1	0.64	5.4	0.06
	Grassed Waterway	164	213.50	212.65	0.5%	4.6	0.33	8.3	0.09
	Total							13.6	0.15
1300	Overland, Pasture	218	216.80	212.50	2.0%	4.6	0.65	5.6	0.06
1400	Overland, Pasture	76	214.10	213.30	1.0%	2.1	0.22	5.9	0.07
	Grassed Waterway	228	213.30	211.24	0.9%	2.1	0.20	19.0	0.21
	Total							24.9	0.28

5.6.2 Quantity Control

Quantity control at Phase 1 development remains the same.
Quantity control is required for runoff from catchment 1200 to ensure the target flow rates at twin culvert are satisfied under interim conditions.

5.6.2.1 Available Surface Storage

Surface storage is available at the open space to temporarily detain runoff from catchment 1200 and release at the orifice plate controlled flow rate.

Ponding Depth (m)	Surface Area (m^2)	Storage (m^3)
0.00	0	0
0.25	778	65
0.50	1702	375

5.6.2.2 Orifice Devices

A 500 mm orifice plate is proposed to control up to 100-year storm events.

Orifice Discharge Equation is used to calculate the release rate from the 500 mm orifice plate:

$$Q = CA\sqrt{2gh}$$

Where,

Q = Orifice Plate Controlled Flow Rate (m^3/s)	0.564	m^3/s
C = Flow Coefficient for Orifice Plate	0.63	
d = Diameter of Orifice Plate (mm)	500	mm
A = Cross-section Area of Orifice Plate (m^2)	0.1963	m^2
g = Gravity Acceleration (m/s^2)	9.81	m/s^2
h = Water Head above Centerline of Orifice Plate (m)	1.060	m
Invert of Orifice Plate	211.84	m
Maximum Surface Ponding Elevation	213.15	m

5.6.2.3 Storage - Discharge

Discharge (m^3/s)	Storage (ha.m)
0.000	0.0000
0.564	0.0375

5.6.2.4 Quantity Control Performance

Storm Event	Q_{out} (m^3/s)	V (m^3)
100-yr SCS	0.486	332
100-yr Chicago	0.539	358

5.6.2.5. Total Flow at Culvert beneath Beamish Road

Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rates (m^3/s)	
		24 hour SCS Type II	24 hour Chicago
2	0.249	0.239	0.227
5	0.395	0.359	0.361
10	0.487	0.433	0.454
25	0.625	0.542	0.584
50	0.724	0.620	0.689
100	0.830	0.703	0.795

6 Other Design Considerations _ DICB and Entrance Culverts

6.1 Ditch Inlet Catch Basin (DICB)

Under Interim Conditions, Ditch Inlet Catch Basin (DICB) is proposed to capture the 100-year peak flow rate from Phase 2 lands and external area to the west.

6.1.1 Peak Flow Rates from Catchment 1200 (Future Development & External)

Storm Event	Peak Flow Rates from Catchment 1200* (m^3/s)	
	24 hour SCS Type II	24 hour Chicago
2	0.20	0.18
5	0.32	0.30
10	0.39	0.39
25	0.50	0.52
50	0.58	0.61
100	0.67	**0.72**

100-year peak flow rate from Catchment 1200 under Interim Conditions 0.72 m^3/s

6.1.2 DICB Conveyance Capacity and Ponding Depth

A 1200 x 600 mm precast concrete ditch inlet (OPSD 705.040) with 1200 X 600 mm grate (OPSD 403.010) with flat slope is proposed to capture the 100-year flow rate.

The flow rate through the grate can be estimated using orifice discharge equation. Note that a 50% blockage is assumed in the flow capacity calculations.

$$Q = C'CA\sqrt{2gh}$$

Where,

Q = Orifice Plate Flow Rate (m^3/s)		0.64	
C' = Flow Coefficient for Blockage		50%	
C = Flow Coefficient for Orifice Plate		0.63	
A = Cross-section Area of Orifice Plate (m^2)		0.648	m^2
Length of Grate:	1200 mm		
Width of Grate:	600 mm		
Opening Ratio:	0.90		
g = Gravity Acceleration (m/s^2)		9.81	m/s^2
h = Water Head above centerline of the grate (m)		0.50	m

Water Head (m)	Flow Rate (m^3/s)	Remark
0.629	0.72	Uncontrolled Flow
0.500	0.64	Controlled Flow

It shows that the grating of the DICB can convey runoff up to 0.64 m^3/s at a ponding depth of 0.50 m, which is greater than the flow rate (0.564 m^3/s, see previous page) of the 500 mm orifice plate at the same ponding elevation.

Therefore, the DICB has capacity to convey the runoff from catchment 1200 and the 500 mm orifice plate shall function as quantity control device.

6.2 Entrance Culvert #1 (S) Design

Culvert is proposed at entrance to convey the flow within the roadside ditch along Beamish Road from upstream to downstream.

6.2.1 Peak Flow Rates from Catchment 1400 (Beamish Road ROW)

Storm Event	Peak Flow Rates from Catchment 1400* (m^3/s)	
	24 hour SCS Type II	24 hour Chicago
2	0.03	0.03
5	0.05	0.05
10	0.06	**0.06**
25	0.08	0.08
50	0.09	0.10
100	0.10	**0.11**

6.2.2 Design Criteria

For entrance culverts, a minimum 0.30 m freeboard should be provided during a design storm event and there is no overtopping during check event.

Culvert #	Road Type	Span (<6.0 m Y/N?)	Design Event		Check Event	
			Return Period	Minimum Freeboard (m)	Return Period	Minimum Freeboard (m)
1	Entrance (Local)	Y	10-yr	0.30	100-yr	0.00

6.2.3 Peak Flow Rates

Culvert #	Drainage Catchment	Design Event		Check Event	
		Return Period	Flow (m^3/s)	Return Period	Flow (m^3/s)
1	1400	10-yr	0.06	100-yr	0.11

6.2.4 Proposed Culverts

Culvert #	Material	Shape	Dia. (mm)	U/S Inv. (m)	D/S Inv. (m)	Length (m)	Slope (%)	Road Crown (m)
1	CSP	Circular	450	211.90	211.74	16.0	1.00	212.80

6.2.5 Hydraulic Performance of Proposed Culverts

Culvert #	Road Crown (m)	Design Event (10-yr)			Check Event (100-yr)		
		Flow (m^3/s)	Elev. (m)	Freeboard (m)	Flow (m^3/s)	Elev. (m)	Overtopping (Y/N)
1	212.80	0.06	212.13	0.67	0.114	212.24	N

6.3 Entrance Culvert #2 (N) Design

Culvert is proposed at entrance to convey the flow within the roadside ditch along Beamish Road from upstream to downstream.

6.3.1 Peak Flow Rates from Catchment 1400 (Beamish Road ROW)

Storm Event	Peak Flow Rates from Catchment 1400* (m^3/s)	
	24 hour SCS Type II	24 hour Chicago
2	0.03	0.03
5	0.05	0.05
10	0.06	**0.06**
25	0.08	0.08
50	0.09	0.10
100	0.10	**0.11**

6.3.2 Design Criteria

For entrance culverts, a minimum 0.30 m freeboard should be provided during a design storm event and there is no overtopping during check event.

Culvert #	Road Type	Span (<6.0 m Y/N?)	Design Event		Check Event	
			Return Period	Minimum Freeboard (m)	Return Period	Minimum Freeboard (m)
1	Entrance (Local)	Y	10-yr	0.30	100-yr	0.00

6.3.3 Peak Flow Rates

Culvert #	Drainage Catchment	Design Event		Check Event	
		Return Period	Flow (m^3/s)	Return Period	Flow (m^3/s)
1	1400	10-yr	0.06	100-yr	0.11

6.3.4 Proposed Culverts

Culvert #	Material	Shape	Dia. (mm)	U/S Inv. (m)	D/S Inv. (m)	Length (m)	Slope (%)	Road Crown (m)
1	CSP	Circular	450	212.62	212.40	17.0	1.300	213.12

6.3.5 Hydraulic Performance of Proposed Culverts

Culvert #	Road Crown (m)	Design Event (10-yr)			Check Event (100-yr)		
		Flow (m^3/s)	Elev. (m)	Freeboard (m)	Flow (m^3/s)	Elev. (m)	Overtopping (Y/N)
1	213.12	0.06	212.85	0.27	0.11	212.96	N

6.4 Culvert Cross North Access Road

Culvert is proposed at entrance to convey the flow within the roadside ditch along Beamish Road from upstream to downstream.

6.4.1 Peak Flow Rates from Catchment 1200 (Future Development & External)

Storm Event	Peak Flow Rates from Catchment 1200* (m^3/s)	
	24 hour SCS Type II	24 hour Chicago
2	0.20	0.18
5	0.32	0.30
10	0.39	**0.39**
25	0.50	0.52
50	0.58	0.61
100	0.67	**0.72**

6.4.2 Design Criteria

For entrance culverts, a minimum 0.30 m freeboard should be provided during a design storm event and there is no overtopping during check event.

Culvert #	Road Type	Span (<6.0 m Y/N?)	Design Event		Check Event	
			Return Period	Minimum Freeboard (m)	Return Period	Minimum Freeboard (m)
1	Entrance (Local)	Y	10-yr	0.30	100-yr	0.00

6.4.3 Peak Flow Rates

Culvert #	Drainage Catchment	Design Event		Check Event	
		Return Period	Flow (m^3/s)	Return Period	Flow (m^3/s)
1	1400	10-yr	0.39	100-yr	0.72

6.4.4 Proposed Culverts

Culvert #	Material	Shape	Dia. (mm)	U/S Inv. (m)	D/S Inv. (m)	Length (m)	Slope (%)	Road Crown (m)
1	CSP	Circular	525	213.11	212.99	22.5	0.50	215.00

6.4.5 Hydraulic Performance of Proposed Culverts

Culvert #	Road Crown (m)	Design Event (10-yr)			Check Event (100-yr)		
		Flow (m^3/s)	Elev. (m)	Freeboard (m)	Flow (m^3/s)	Elev. (m)	Overtopping (Y/N)
1	215.00	0.39	213.88	1.12	0.72	214.92	N

APPENDIX

B

VISUAL OTTHYMO MODEL OUTPUT

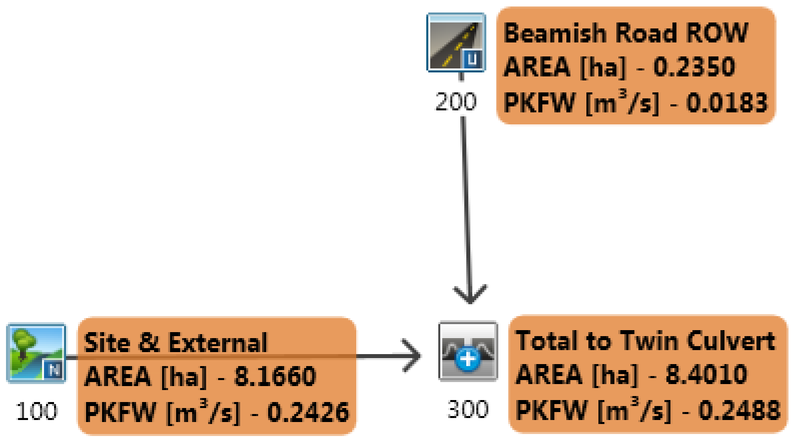


Figure B1
Visual OTTHYMO Model Schematic _ Pre-Development Conditions

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

      V    V   I    SSSSS  U    U     A     L
      V     V   I    SS      U    U    A A    L
       V  V     I     SS     U    U   AAAAA   L
        V  V     I       SS   U    U   A     A   L
         VV      I    SSSSS  UUUUU  A     A   LLLLL

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


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  Output  filename:
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b5-cbf0-4c8a-afc6-c6e6c7e63a78\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\aa2db8
b5-cbf0-4c8a-afc6-c6e6c7e63a78\scenar


DATE: 02/11/2020                              TIME: 01:50:52

USER:


COMMENTS: ____________________________________________________________


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  **************************************************
  ** SIMULATION : Run 01                           **
  **************************************************


--------------------
|    READ STORM     |    Filename: C:\Users\zhouj\AppD
|                   |              ata\Local\Temp\
|                   |              ab21cadd-8504-4915-ac65-c48fa5627c1d\6d48df83
| Ptotal= 46.77 mm |    Comments: 2yr24hrSCS_Midland
--------------------
                  TIME     RAIN |   TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                   hrs    mm/hr |    hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                  0.25     0.51 |   6.25     0.94 | 12.25     6.74 | 18.25     0.84
                  0.50     0.51 |   6.50     0.94 | 12.50     6.74 | 18.50     0.84
                  0.75     0.51 |   6.75     0.94 | 12.75     3.46 | 18.75     0.84
                  1.00     0.51 |   7.00     0.94 | 13.00     3.46 | 19.00     0.84
                  1.25     0.51 |   7.25     0.94 | 13.25     0.66 | 19.25     0.84
                  1.50     0.51 |   7.50     0.94 | 13.50     0.66 | 19.50     0.84
                  1.75     0.51 |   7.75     0.94 | 13.75     3.84 | 19.75     0.84
                  2.00     0.51 |   8.00     0.94 | 14.00     3.84 | 20.00     0.84
```



```
                  2.25     0.61 |   8.25     1.26 | 14.25     1.40 | 20.25     0.56
                  2.50     0.61 |   8.50     1.26 | 14.50     1.40 | 20.50     0.56
                  2.75     0.61 |   8.75     1.26 | 14.75     1.40 | 20.75     0.56
                  3.00     0.61 |   9.00     1.26 | 15.00     1.40 | 21.00     0.56
                  3.25     0.61 |   9.25     1.50 | 15.25     1.40 | 21.25     0.56
                  3.50     0.61 |   9.50     1.50 | 15.50     1.40 | 21.50     0.56
                  3.75     0.61 |   9.75     1.68 | 15.75     1.40 | 21.75     0.56
                  4.00     0.61 |  10.00     1.68 | 16.00     1.40 | 22.00     0.56
                  4.25     0.75 |  10.25     2.15 | 16.25     0.84 | 22.25     0.56
                  4.50     0.75 |  10.50     2.15 | 16.50     0.84 | 22.50     0.56
                  4.75     0.75 |  10.75     2.90 | 16.75     0.84 | 22.75     0.56
                  5.00     0.75 |  11.00     2.90 | 17.00     0.84 | 23.00     0.56
                  5.25     0.75 |  11.25     4.49 | 17.25     0.84 | 23.25     0.56
                  5.50     0.75 |  11.50     4.49 | 17.50     0.84 | 23.50     0.56
                  5.75     0.75 |  11.75    19.47 | 17.75     0.84 | 23.75     0.56
                  6.00     0.75 |  12.00    51.67 | 18.00     0.84 | 24.00     0.56

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

--------------------
| CALIB              |
| NASHYD   (  0100)|   Area    (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25

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


                          ---- TRANSFORMED HYETOGRAPH ----
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                0.083     0.51 | 6.083     0.94 |12.083     6.75 | 18.08     0.84
                0.167     0.51 | 6.167     0.94 |12.167     6.74 | 18.17     0.84
                0.250     0.51 | 6.250     0.94 |12.250     6.74 | 18.25     0.84
                0.333     0.51 | 6.333     0.94 |12.333     6.74 | 18.33     0.84
                0.417     0.51 | 6.417     0.94 |12.417     6.74 | 18.42     0.84
                0.500     0.51 | 6.500     0.94 |12.500     6.74 | 18.50     0.84
                0.583     0.51 | 6.583     0.94 |12.583     3.46 | 18.58     0.84
                0.667     0.51 | 6.667     0.94 |12.667     3.46 | 18.67     0.84
                0.750     0.51 | 6.750     0.94 |12.750     3.46 | 18.75     0.84
                0.833     0.51 | 6.833     0.94 |12.833     3.46 | 18.83     0.84
                0.917     0.51 | 6.917     0.94 |12.917     3.46 | 18.92     0.84
                1.000     0.51 | 7.000     0.94 |13.000     3.46 | 19.00     0.84
                1.083     0.51 | 7.083     0.94 |13.083     0.66 | 19.08     0.84
                1.167     0.51 | 7.167     0.94 |13.167     0.66 | 19.17     0.84
                1.250     0.51 | 7.250     0.94 |13.250     0.66 | 19.25     0.84
                1.333     0.51 | 7.333     0.94 |13.333     0.66 | 19.33     0.84
                1.417     0.51 | 7.417     0.94 |13.417     0.66 | 19.42     0.84
                1.500     0.51 | 7.500     0.94 |13.500     0.66 | 19.50     0.84
                1.583     0.51 | 7.583     0.94 |13.583     3.84 | 19.58     0.84
                1.667     0.51 | 7.667     0.94 |13.667     3.84 | 19.67     0.84
                1.750     0.51 | 7.750     0.94 |13.750     3.84 | 19.75     0.84
                1.833     0.51 | 7.833     0.94 |13.833     3.84 | 19.83     0.84
                1.917     0.51 | 7.917     0.94 |13.917     3.84 | 19.92     0.84
                2.000     0.51 | 8.000     0.94 |14.000     3.84 | 20.00     0.84
                2.083     0.61 | 8.083     1.26 |14.083     1.40 | 20.08     0.56
                2.167     0.61 | 8.167     1.26 |14.167     1.40 | 20.17     0.56
                2.250     0.61 | 8.250     1.26 |14.250     1.40 | 20.25     0.56
                2.333     0.61 | 8.333     1.26 |14.333     1.40 | 20.33     0.56
                2.417     0.61 | 8.417     1.26 |14.417     1.40 | 20.42     0.56
                2.500     0.61 | 8.500     1.26 |14.500     1.40 | 20.50     0.56
                2.583     0.61 | 8.583     1.26 |14.583     1.40 | 20.58     0.56
                2.667     0.61 | 8.667     1.26 |14.667     1.40 | 20.67     0.56
```



```
                2.750     0.61 | 8.750     1.26 |14.750     1.40 | 20.75     0.56
                2.833     0.61 | 8.833     1.26 |14.833     1.40 | 20.83     0.56
                2.917     0.61 | 8.917     1.26 |14.917     1.40 | 20.92     0.56
                3.000     0.61 | 9.000     1.26 |15.000     1.40 | 21.00     0.56
                3.083     0.61 | 9.083     1.50 |15.083     1.40 | 21.08     0.56
                3.167     0.61 | 9.167     1.50 |15.167     1.40 | 21.17     0.56
                3.250     0.61 | 9.250     1.50 |15.250     1.40 | 21.25     0.56
                3.333     0.61 | 9.333     1.50 |15.333     1.40 | 21.33     0.56
                3.417     0.61 | 9.417     1.50 |15.417     1.40 | 21.42     0.56
                3.500     0.61 | 9.500     1.50 |15.500     1.40 | 21.50     0.56
                3.583     0.61 | 9.583     1.68 |15.583     1.40 | 21.58     0.56
                3.667     0.61 | 9.667     1.68 |15.667     1.40 | 21.67     0.56
                3.750     0.61 | 9.750     1.68 |15.750     1.40 | 21.75     0.56
                3.833     0.61 | 9.833     1.68 |15.833     1.40 | 21.83     0.56
                3.917     0.61 | 9.917     1.68 |15.917     1.40 | 21.92     0.56
                4.000     0.61 |10.000     1.68 |16.000     1.40 | 22.00     0.56
                4.083     0.75 |10.083     2.15 |16.083     0.84 | 22.08     0.56
                4.167     0.75 |10.167     2.15 |16.167     0.84 | 22.17     0.56
                4.250     0.75 |10.250     2.15 |16.250     0.84 | 22.25     0.56
                4.333     0.75 |10.333     2.15 |16.333     0.84 | 22.33     0.56
                4.417     0.75 |10.417     2.15 |16.417     0.84 | 22.42     0.56
                4.500     0.75 |10.500     2.15 |16.500     0.84 | 22.50     0.56
                4.583     0.75 |10.583     2.90 |16.583     0.84 | 22.58     0.56
                4.667     0.75 |10.667     2.90 |16.667     0.84 | 22.67     0.56
                4.750     0.75 |10.750     2.90 |16.750     0.84 | 22.75     0.56
                4.833     0.75 |10.833     2.90 |16.833     0.84 | 22.83     0.56
                4.917     0.75 |10.917     2.90 |16.917     0.84 | 22.92     0.56
                5.000     0.75 |11.000     2.90 |17.000     0.84 | 23.00     0.56
                5.083     0.75 |11.083     4.49 |17.083     0.84 | 23.08     0.56
                5.167     0.75 |11.167     4.49 |17.167     0.84 | 23.17     0.56
                5.250     0.75 |11.250     4.49 |17.250     0.84 | 23.25     0.56
                5.333     0.75 |11.333     4.49 |17.333     0.84 | 23.33     0.56
                5.417     0.75 |11.417     4.49 |17.417     0.84 | 23.42     0.56
                5.500     0.75 |11.500     4.49 |17.500     0.84 | 23.50     0.56
                5.583     0.75 |11.583    19.47 |17.583     0.84 | 23.58     0.56
                5.667     0.75 |11.667    19.47 |17.667     0.84 | 23.67     0.56
                5.750     0.75 |11.750    19.47 |17.750     0.84 | 23.75     0.56
                5.833     0.75 |11.833    51.67 |17.833     0.84 | 23.83     0.56
                5.917     0.75 |11.917    51.67 |17.917     0.84 | 23.92     0.56
                6.000     0.75 |12.000    51.67 |18.000     0.84 | 24.00     0.56

     Unit Hyd Qpeak  (cms)=   1.248

     PEAK FLOW       (cms)=   0.243 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  14.295
     TOTAL RAINFALL   (mm)=  46.775
     RUNOFF COEFFICIENT   =   0.306

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

----------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0200)|   Area    (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         0.11           0.12
     Dep. Storage     (mm)=         1.00           5.00
     Average Slope     (%)=         1.00           2.00
     Length            (m)=        39.58          40.00
     Mannings n           =        0.013          0.250
```



```
     Max.Eff.Inten.(mm/hr)=       51.67          17.45
               over (min)         5.00          20.00
     Storage Coeff.  (min)=        1.91 (ii)     16.10 (ii)
     Unit Hyd. Tpeak (min)=        5.00          20.00
     Unit Hyd. peak  (cms)=        0.32           0.06
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.02           0.00        0.018 (iii)
     TIME TO PEAK    (hrs)=       12.00          12.17        12.00
     RUNOFF VOLUME    (mm)=       45.77          13.80        28.94
     TOTAL RAINFALL   (mm)=       46.78          46.78        46.78
     RUNOFF COEFFICIENT   =        0.98           0.30         0.62

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0300)|
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):      8.17   0.243    12.08    14.29
      + ID2= 2 (  0200):      0.23   0.018    12.00    28.94
        ====================================================
        ID = 3 (  0300):      8.40   0.249    12.08    14.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U    U     A     L
      V     V   I    SS      U    U    A A    L
       V  V     I     SS     U    U   AAAAA   L
        V  V     I       SS   U    U   A     A   L
         VV      I    SSSSS  UUUUU  A     A   LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\b718c3
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DATE: 02/11/2020   TIME: 01:50:53

USER:

COMMENTS: ____

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--------------------------------------------------------------------------------
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  **********************************************
  ** SIMULATION : Run 02                      **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              ab21cadd-8504-4915-ac65-c48fa5627c1d\455ee265
| Ptotal= 59.94 mm |    Comments: 5yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.66	6.25	1.20	12.25	8.63	18.25	1.08
0.50	0.66	6.50	1.20	12.50	8.63	18.50	1.08
0.75	0.66	6.75	1.20	12.75	4.43	18.75	1.08
1.00	0.66	7.00	1.20	13.00	4.43	19.00	1.08
1.25	0.66	7.25	1.20	13.25	0.84	19.25	1.08
1.50	0.66	7.50	1.20	13.50	0.84	19.50	1.08
1.75	0.66	7.75	1.20	13.75	4.91	19.75	1.08
2.00	0.66	8.00	1.20	14.00	4.91	20.00	1.08
2.25	0.78	8.25	1.62	14.25	1.80	20.25	0.72
2.50	0.78	8.50	1.62	14.50	1.80	20.50	0.72
2.75	0.78	8.75	1.62	14.75	1.80	20.75	0.72
3.00	0.78	9.00	1.62	15.00	1.80	21.00	0.72
3.25	0.78	9.25	1.92	15.25	1.80	21.25	0.72
3.50	0.78	9.50	1.92	15.50	1.80	21.50	0.72
3.75	0.78	9.75	2.16	15.75	1.80	21.75	0.72
4.00	0.78	10.00	2.16	16.00	1.80	22.00	0.72
4.25	0.96	10.25	2.76	16.25	1.08	22.25	0.72
4.50	0.96	10.50	2.76	16.50	1.08	22.50	0.72
4.75	0.96	10.75	3.71	16.75	1.08	22.75	0.72
5.00	0.96	11.00	3.71	17.00	1.08	23.00	0.72
5.25	0.96	11.25	5.75	17.25	1.08	23.25	0.72
5.50	0.96	11.50	5.75	17.50	1.08	23.50	0.72
5.75	0.96	11.75	24.92	17.75	1.08	23.75	0.72
6.00	0.96	12.00	66.13	18.00	1.08	24.00	0.72

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| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25

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


---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.66	6.083	1.20	12.083	8.64	18.08	1.08
0.167	0.66	6.167	1.20	12.167	8.63	18.17	1.08
0.250	0.66	6.250	1.20	12.250	8.63	18.25	1.08
0.333	0.66	6.333	1.20	12.333	8.63	18.33	1.08
0.417	0.66	6.417	1.20	12.417	8.63	18.42	1.08
0.500	0.66	6.500	1.20	12.500	8.63	18.50	1.08
0.583	0.66	6.583	1.20	12.583	4.43	18.58	1.08
0.667	0.66	6.667	1.20	12.667	4.43	18.67	1.08
0.750	0.66	6.750	1.20	12.750	4.43	18.75	1.08
0.833	0.66	6.833	1.20	12.833	4.43	18.83	1.08
0.917	0.66	6.917	1.20	12.917	4.43	18.92	1.08
1.000	0.66	7.000	1.20	13.000	4.43	19.00	1.08
1.083	0.66	7.083	1.20	13.083	0.84	19.08	1.08
1.167	0.66	7.167	1.20	13.167	0.84	19.17	1.08
1.250	0.66	7.250	1.20	13.250	0.84	19.25	1.08
1.333	0.66	7.333	1.20	13.333	0.84	19.33	1.08
1.417	0.66	7.417	1.20	13.417	0.84	19.42	1.08
1.500	0.66	7.500	1.20	13.500	0.84	19.50	1.08
1.583	0.66	7.583	1.20	13.583	4.91	19.58	1.08
1.667	0.66	7.667	1.20	13.667	4.91	19.67	1.08
1.750	0.66	7.750	1.20	13.750	4.91	19.75	1.08
1.833	0.66	7.833	1.20	13.833	4.91	19.83	1.08
1.917	0.66	7.917	1.20	13.917	4.91	19.92	1.08
2.000	0.66	8.000	1.20	14.000	4.91	20.00	1.08
2.083	0.78	8.083	1.62	14.083	1.80	20.08	0.72
2.167	0.78	8.167	1.62	14.167	1.80	20.17	0.72
2.250	0.78	8.250	1.62	14.250	1.80	20.25	0.72
2.333	0.78	8.333	1.62	14.333	1.80	20.33	0.72
2.417	0.78	8.417	1.62	14.417	1.80	20.42	0.72
2.500	0.78	8.500	1.62	14.500	1.80	20.50	0.72
2.583	0.78	8.583	1.62	14.583	1.80	20.58	0.72
2.667	0.78	8.667	1.62	14.667	1.80	20.67	0.72
2.750	0.78	8.750	1.62	14.750	1.80	20.75	0.72
2.833	0.78	8.833	1.62	14.833	1.80	20.83	0.72
2.917	0.78	8.917	1.62	14.917	1.80	20.92	0.72
3.000	0.78	9.000	1.62	15.000	1.80	21.00	0.72
3.083	0.78	9.083	1.92	15.083	1.80	21.08	0.72
3.167	0.78	9.167	1.92	15.167	1.80	21.17	0.72
3.250	0.78	9.250	1.92	15.250	1.80	21.25	0.72
3.333	0.78	9.333	1.92	15.333	1.80	21.33	0.72
3.417	0.78	9.417	1.92	15.417	1.80	21.42	0.72
3.500	0.78	9.500	1.92	15.500	1.80	21.50	0.72
3.583	0.78	9.583	2.16	15.583	1.80	21.58	0.72
3.667	0.78	9.667	2.16	15.667	1.80	21.67	0.72
3.750	0.78	9.750	2.16	15.750	1.80	21.75	0.72
3.833	0.78	9.833	2.16	15.833	1.80	21.83	0.72
3.917	0.78	9.917	2.16	15.917	1.80	21.92	0.72
4.000	0.78	10.000	2.16	16.000	1.80	22.00	0.72
4.083	0.96	10.083	2.76	16.083	1.08	22.08	0.72
4.167	0.96	10.167	2.76	16.167	1.08	22.17	0.72
4.250	0.96	10.250	2.76	16.250	1.08	22.25	0.72
4.333	0.96	10.333	2.76	16.333	1.08	22.33	0.72
4.417	0.96	10.417	2.76	16.417	1.08	22.42	0.72
4.500	0.96	10.500	2.76	16.500	1.08	22.50	0.72
4.583	0.96	10.583	3.71	16.583	1.08	22.58	0.72
4.667	0.96	10.667	3.71	16.667	1.08	22.67	0.72
4.750	0.96	10.750	3.71	16.750	1.08	22.75	0.72
4.833	0.96	10.833	3.71	16.833	1.08	22.83	0.72
4.917	0.96	10.917	3.71	16.917	1.08	22.92	0.72
5.000	0.96	11.000	3.71	17.000	1.08	23.00	0.72

5.083	0.96	11.083	5.75	17.083	1.08	23.08	0.72
5.167	0.96	11.167	5.75	17.167	1.08	23.17	0.72
5.250	0.96	11.250	5.75	17.250	1.08	23.25	0.72
5.333	0.96	11.333	5.75	17.333	1.08	23.33	0.72
5.417	0.96	11.417	5.75	17.417	1.08	23.42	0.72
5.500	0.96	11.500	5.75	17.500	1.08	23.50	0.72
5.583	0.96	11.583	24.92	17.583	1.08	23.58	0.72
5.667	0.96	11.667	24.92	17.667	1.08	23.67	0.72
5.750	0.96	11.750	24.92	17.750	1.08	23.75	0.72
5.833	0.96	11.833	66.13	17.833	1.08	23.83	0.72
5.917	0.96	11.917	66.13	17.917	1.08	23.92	0.72
6.000	0.96	12.000	66.13	18.000	1.08	24.00	0.72

```
     Unit Hyd Qpeak  (cms)=   1.248

     PEAK FLOW       (cms)=   0.385 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  22.314
     TOTAL RAINFALL   (mm)=  59.938
     RUNOFF COEFFICIENT   =   0.372

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

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--------------------
| CALIB            |
| STANDHYD (  0200)|   Area     (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.12
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     39.58         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     66.13         27.53
               over (min)       5.00         15.00
     Storage Coeff.  (min)=      1.73 (ii)    13.55 (ii)
     Unit Hyd. Tpeak (min)=      5.00         15.00
     Unit Hyd. peak  (cms)=      0.32          0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.02          0.01        0.026 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.08        12.00
     RUNOFF VOLUME    (mm)=     58.94         21.62        39.31
     TOTAL RAINFALL   (mm)=     59.94         59.94        59.94
     RUNOFF COEFFICIENT   =      0.98          0.36         0.66

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0300)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):     8.17   0.385    12.08    22.31
```



```
   + ID2= 2 (  0200):     0.23   0.026    12.00    39.31
     ===============================================
     ID = 3 (  0300):     8.40   0.395    12.08    22.79

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
```



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

   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\e7d98c
1d-9235-4b73-a55e-e8c8717eed25\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\e7d98c
1d-9235-4b73-a55e-e8c8717eed25\scenar


DATE: 02/11/2020                         TIME: 01:50:53

USER:


COMMENTS: ____________________________________________________


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  **********************************************
  ** SIMULATION : Run 03                      **
  **********************************************


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|    READ STORM    |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              ab21cadd-8504-4915-ac65-c48fa5627c1d\cef3ad34
| Ptotal= 67.54 mm |    Comments: 10yr24hrSCS_Midland
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```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.74	6.25	1.35	12.25	9.72	18.25	1.22

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
0.50	0.74	6.50	1.35	12.50	9.72	18.50	1.22
0.75	0.74	6.75	1.35	12.75	5.00	18.75	1.22
1.00	0.74	7.00	1.35	13.00	5.00	19.00	1.22
1.25	0.74	7.25	1.35	13.25	0.95	19.25	1.22
1.50	0.74	7.50	1.35	13.50	0.95	19.50	1.22
1.75	0.74	7.75	1.35	13.75	5.54	19.75	1.22
2.00	0.74	8.00	1.35	14.00	5.54	20.00	1.22
2.25	0.88	8.25	1.82	14.25	2.03	20.25	0.81
2.50	0.88	8.50	1.82	14.50	2.03	20.50	0.81
2.75	0.88	8.75	1.82	14.75	2.03	20.75	0.81
3.00	0.88	9.00	1.82	15.00	2.03	21.00	0.81
3.25	0.88	9.25	2.16	15.25	2.03	21.25	0.81
3.50	0.88	9.50	2.16	15.50	2.03	21.50	0.81
3.75	0.88	9.75	2.43	15.75	2.03	21.75	0.81
4.00	0.88	10.00	2.43	16.00	2.03	22.00	0.81
4.25	1.08	10.25	3.11	16.25	1.22	22.25	0.81
4.50	1.08	10.50	3.11	16.50	1.22	22.50	0.81
4.75	1.08	10.75	4.19	16.75	1.22	22.75	0.81
5.00	1.08	11.00	4.19	17.00	1.22	23.00	0.81
5.25	1.08	11.25	6.48	17.25	1.22	23.25	0.81
5.50	1.08	11.50	6.48	17.50	1.22	23.50	0.81
5.75	1.08	11.75	28.08	17.75	1.22	23.75	0.81
6.00	1.08	12.00	74.52	18.00	1.22	24.00	0.81

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--------------------
| CALIB              |
| NASHYD   ( 0100)|   Area     (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25
```

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.74	6.083	1.35	12.083	9.73	18.08	1.22
0.167	0.74	6.167	1.35	12.167	9.72	18.17	1.22
0.250	0.74	6.250	1.35	12.250	9.72	18.25	1.22
0.333	0.74	6.333	1.35	12.333	9.72	18.33	1.22
0.417	0.74	6.417	1.35	12.417	9.72	18.42	1.22
0.500	0.74	6.500	1.35	12.500	9.72	18.50	1.22
0.583	0.74	6.583	1.35	12.583	5.00	18.58	1.22
0.667	0.74	6.667	1.35	12.667	5.00	18.67	1.22
0.750	0.74	6.750	1.35	12.750	5.00	18.75	1.22
0.833	0.74	6.833	1.35	12.833	5.00	18.83	1.22
0.917	0.74	6.917	1.35	12.917	5.00	18.92	1.22
1.000	0.74	7.000	1.35	13.000	5.00	19.00	1.22
1.083	0.74	7.083	1.35	13.083	0.95	19.08	1.22
1.167	0.74	7.167	1.35	13.167	0.95	19.17	1.22
1.250	0.74	7.250	1.35	13.250	0.95	19.25	1.22
1.333	0.74	7.333	1.35	13.333	0.95	19.33	1.22
1.417	0.74	7.417	1.35	13.417	0.95	19.42	1.22
1.500	0.74	7.500	1.35	13.500	0.95	19.50	1.22
1.583	0.74	7.583	1.35	13.583	5.54	19.58	1.22
1.667	0.74	7.667	1.35	13.667	5.54	19.67	1.22
1.750	0.74	7.750	1.35	13.750	5.54	19.75	1.22
1.833	0.74	7.833	1.35	13.833	5.54	19.83	1.22
1.917	0.74	7.917	1.35	13.917	5.54	19.92	1.22
2.000	0.74	8.000	1.35	14.000	5.54	20.00	1.22
2.083	0.88	8.083	1.82	14.083	2.03	20.08	0.81

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
2.167	0.88	8.167	1.82	14.167	2.03	20.17	0.81
2.250	0.88	8.250	1.82	14.250	2.03	20.25	0.81
2.333	0.88	8.333	1.82	14.333	2.03	20.33	0.81
2.417	0.88	8.417	1.82	14.417	2.03	20.42	0.81
2.500	0.88	8.500	1.82	14.500	2.03	20.50	0.81
2.583	0.88	8.583	1.82	14.583	2.03	20.58	0.81
2.667	0.88	8.667	1.82	14.667	2.03	20.67	0.81
2.750	0.88	8.750	1.82	14.750	2.03	20.75	0.81
2.833	0.88	8.833	1.82	14.833	2.03	20.83	0.81
2.917	0.88	8.917	1.82	14.917	2.03	20.92	0.81
3.000	0.88	9.000	1.82	15.000	2.03	21.00	0.81
3.083	0.88	9.083	2.16	15.083	2.03	21.08	0.81
3.167	0.88	9.167	2.16	15.167	2.03	21.17	0.81
3.250	0.88	9.250	2.16	15.250	2.03	21.25	0.81
3.333	0.88	9.333	2.16	15.333	2.03	21.33	0.81
3.417	0.88	9.417	2.16	15.417	2.03	21.42	0.81
3.500	0.88	9.500	2.16	15.500	2.03	21.50	0.81
3.583	0.88	9.583	2.43	15.583	2.03	21.58	0.81
3.667	0.88	9.667	2.43	15.667	2.03	21.67	0.81
3.750	0.88	9.750	2.43	15.750	2.03	21.75	0.81
3.833	0.88	9.833	2.43	15.833	2.03	21.83	0.81
3.917	0.88	9.917	2.43	15.917	2.03	21.92	0.81
4.000	0.88	10.000	2.43	16.000	2.03	22.00	0.81
4.083	1.08	10.083	3.11	16.083	1.22	22.08	0.81
4.167	1.08	10.167	3.11	16.167	1.22	22.17	0.81
4.250	1.08	10.250	3.11	16.250	1.22	22.25	0.81
4.333	1.08	10.333	3.11	16.333	1.22	22.33	0.81
4.417	1.08	10.417	3.11	16.417	1.22	22.42	0.81
4.500	1.08	10.500	3.11	16.500	1.22	22.50	0.81
4.583	1.08	10.583	4.19	16.583	1.22	22.58	0.81
4.667	1.08	10.667	4.19	16.667	1.22	22.67	0.81
4.750	1.08	10.750	4.19	16.750	1.22	22.75	0.81
4.833	1.08	10.833	4.19	16.833	1.22	22.83	0.81
4.917	1.08	10.917	4.19	16.917	1.22	22.92	0.81
5.000	1.08	11.000	4.19	17.000	1.22	23.00	0.81
5.083	1.08	11.083	6.48	17.083	1.22	23.08	0.81
5.167	1.08	11.167	6.48	17.167	1.22	23.17	0.81
5.250	1.08	11.250	6.48	17.250	1.22	23.25	0.81
5.333	1.08	11.333	6.48	17.333	1.22	23.33	0.81
5.417	1.08	11.417	6.48	17.417	1.22	23.42	0.81
5.500	1.08	11.500	6.48	17.500	1.22	23.50	0.81
5.583	1.08	11.583	28.08	17.583	1.22	23.58	0.81
5.667	1.08	11.667	28.08	17.667	1.22	23.67	0.81
5.750	1.08	11.750	28.08	17.750	1.22	23.75	0.81
5.833	1.08	11.833	74.51	17.833	1.22	23.83	0.81
5.917	1.08	11.917	74.52	17.917	1.22	23.92	0.81
6.000	1.08	12.000	74.52	18.000	1.22	24.00	0.81

```
Unit Hyd Qpeak  (cms)=   1.248

PEAK FLOW        (cms)=   0.476 (i)
TIME TO PEAK     (hrs)=  12.083
RUNOFF VOLUME     (mm)=  27.377
TOTAL RAINFALL    (mm)=  67.540
RUNOFF COEFFICIENT   =   0.405

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

```
--------------------
| CALIB              |
| STANDHYD ( 0200)|   Area    (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
```



```
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     0.11          0.12
     Dep. Storage     (mm)=     1.00          5.00
     Average Slope     (%)=     1.00          2.00
     Length            (m)=    39.58         40.00
     Mannings n           =    0.013         0.250

     Max.Eff.Inten.(mm/hr)=    74.52         33.94
              over (min)       5.00         15.00
     Storage Coeff.  (min)=     1.65 (ii)    12.52 (ii)
     Unit Hyd. Tpeak (min)=     5.00         15.00
     Unit Hyd. peak  (cms)=     0.32          0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=     0.02          0.01          0.030 (iii)
     TIME TO PEAK    (hrs)=    12.00         12.08         12.00
     RUNOFF VOLUME    (mm)=    66.54         26.57         45.52
     TOTAL RAINFALL   (mm)=    67.54         67.54         67.54
     RUNOFF COEFFICIENT   =     0.99          0.39          0.67

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------
| ADD HYD  (  0300)|
|   1 + 2 =  3     |          AREA    QPEAK     TPEAK      R.V.
--------------------          (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  0100):       8.17   0.476     12.08     27.38
      + ID2= 2 (  0200):       0.23   0.030     12.00     45.52
        ==================================================
        ID = 3 (  0300):       8.40   0.487     12.08     27.88

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

FINISH

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

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

     V    V   I    SSSSS  U    U     A     L
     V    V   I    SS     U    U    A A    L
      V  V    I     SS    U    U   AAAAA   L
      V  V    I      SS   U    U   A   A   L
       VV     I    SSSSS  UUUUU   A     A  LLLLL

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

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\30003e11-df76-4ebd-94c9-9443565574fe\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\30003e11-df76-4ebd-94c9-9443565574fe\scenar

DATE: 02/11/2020   TIME: 01:50:52

USER:

COMMENTS: ____

```
************************************************
** SIMULATION : Run 04                        **
************************************************
```

```
--------------------
|    READ STORM    |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              ab21cadd-8504-4915-ac65-c48fa5627c1d\b3885e87
| Ptotal= 78.13 mm |    Comments: 25yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.86	6.25	1.56	12.25	11.25	18.25	1.41
0.50	0.86	6.50	1.56	12.50	11.25	18.50	1.41
0.75	0.86	6.75	1.56	12.75	5.78	18.75	1.41
1.00	0.86	7.00	1.56	13.00	5.78	19.00	1.41
1.25	0.86	7.25	1.56	13.25	1.09	19.25	1.41
1.50	0.86	7.50	1.56	13.50	1.09	19.50	1.41
1.75	0.86	7.75	1.56	13.75	6.40	19.75	1.41
2.00	0.86	8.00	1.56	14.00	6.40	20.00	1.41
2.25	1.02	8.25	2.11	14.25	2.34	20.25	0.94
2.50	1.02	8.50	2.11	14.50	2.34	20.50	0.94
2.75	1.02	8.75	2.11	14.75	2.34	20.75	0.94
3.00	1.02	9.00	2.11	15.00	2.34	21.00	0.94
3.25	1.02	9.25	2.50	15.25	2.34	21.25	0.94
3.50	1.02	9.50	2.50	15.50	2.34	21.50	0.94
3.75	1.02	9.75	2.81	15.75	2.34	21.75	0.94
4.00	1.02	10.00	2.81	16.00	2.34	22.00	0.94
4.25	1.25	10.25	3.59	16.25	1.41	22.25	0.94
4.50	1.25	10.50	3.59	16.50	1.41	22.50	0.94
4.75	1.25	10.75	4.84	16.75	1.41	22.75	0.94
5.00	1.25	11.00	4.84	17.00	1.41	23.00	0.94
5.25	1.25	11.25	7.50	17.25	1.41	23.25	0.94
5.50	1.25	11.50	7.50	17.50	1.41	23.50	0.94
5.75	1.25	11.75	32.49	17.75	1.41	23.75	0.94
6.00	1.25	12.00	86.22	18.00	1.41	24.00	0.94

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0100)|   Area    (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	' TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.86	6.083	1.56	12.083	11.26	18.08	1.41
0.167	0.86	6.167	1.56	12.167	11.25	18.17	1.41
0.250	0.86	6.250	1.56	12.250	11.25	18.25	1.41
0.333	0.86	6.333	1.56	12.333	11.25	18.33	1.41
0.417	0.86	6.417	1.56	12.417	11.25	18.42	1.41
0.500	0.86	6.500	1.56	12.500	11.25	18.50	1.41
0.583	0.86	6.583	1.56	12.583	5.78	18.58	1.41
0.667	0.86	6.667	1.56	12.667	5.78	18.67	1.41
0.750	0.86	6.750	1.56	12.750	5.78	18.75	1.41
0.833	0.86	6.833	1.56	12.833	5.78	18.83	1.41
0.917	0.86	6.917	1.56	12.917	5.78	18.92	1.41
1.000	0.86	7.000	1.56	13.000	5.78	19.00	1.41
1.083	0.86	7.083	1.56	13.083	1.09	19.08	1.41
1.167	0.86	7.167	1.56	13.167	1.09	19.17	1.41
1.250	0.86	7.250	1.56	13.250	1.09	19.25	1.41
1.333	0.86	7.333	1.56	13.333	1.09	19.33	1.41
1.417	0.86	7.417	1.56	13.417	1.09	19.42	1.41
1.500	0.86	7.500	1.56	13.500	1.09	19.50	1.41
1.583	0.86	7.583	1.56	13.583	6.40	19.58	1.41
1.667	0.86	7.667	1.56	13.667	6.40	19.67	1.41
1.750	0.86	7.750	1.56	13.750	6.40	19.75	1.41
1.833	0.86	7.833	1.56	13.833	6.40	19.83	1.41
1.917	0.86	7.917	1.56	13.917	6.40	19.92	1.41
2.000	0.86	8.000	1.56	14.000	6.40	20.00	1.41
2.083	1.02	8.083	2.11	14.083	2.34	20.08	0.94
2.167	1.02	8.167	2.11	14.167	2.34	20.17	0.94
2.250	1.02	8.250	2.11	14.250	2.34	20.25	0.94
2.333	1.02	8.333	2.11	14.333	2.34	20.33	0.94
2.417	1.02	8.417	2.11	14.417	2.34	20.42	0.94
2.500	1.02	8.500	2.11	14.500	2.34	20.50	0.94
2.583	1.02	8.583	2.11	14.583	2.34	20.58	0.94
2.667	1.02	8.667	2.11	14.667	2.34	20.67	0.94
2.750	1.02	8.750	2.11	14.750	2.34	20.75	0.94
2.833	1.02	8.833	2.11	14.833	2.34	20.83	0.94
2.917	1.02	8.917	2.11	14.917	2.34	20.92	0.94
3.000	1.02	9.000	2.11	15.000	2.34	21.00	0.94
3.083	1.02	9.083	2.50	15.083	2.34	21.08	0.94
3.167	1.02	9.167	2.50	15.167	2.34	21.17	0.94
3.250	1.02	9.250	2.50	15.250	2.34	21.25	0.94
3.333	1.02	9.333	2.50	15.333	2.34	21.33	0.94
3.417	1.02	9.417	2.50	15.417	2.34	21.42	0.94
3.500	1.02	9.500	2.50	15.500	2.34	21.50	0.94
3.583	1.02	9.583	2.81	15.583	2.34	21.58	0.94
3.667	1.02	9.667	2.81	15.667	2.34	21.67	0.94
3.750	1.02	9.750	2.81	15.750	2.34	21.75	0.94
3.833	1.02	9.833	2.81	15.833	2.34	21.83	0.94
3.917	1.02	9.917	2.81	15.917	2.34	21.92	0.94
4.000	1.02	10.000	2.81	16.000	2.34	22.00	0.94

4.083	1.25	10.083	3.59	16.083	1.41	22.08	0.94
4.167	1.25	10.167	3.59	16.167	1.41	22.17	0.94
4.250	1.25	10.250	3.59	16.250	1.41	22.25	0.94
4.333	1.25	10.333	3.59	16.333	1.41	22.33	0.94
4.417	1.25	10.417	3.59	16.417	1.41	22.42	0.94
4.500	1.25	10.500	3.59	16.500	1.41	22.50	0.94
4.583	1.25	10.583	4.84	16.583	1.41	22.58	0.94
4.667	1.25	10.667	4.84	16.667	1.41	22.67	0.94
4.750	1.25	10.750	4.84	16.750	1.41	22.75	0.94
4.833	1.25	10.833	4.84	16.833	1.41	22.83	0.94
4.917	1.25	10.917	4.84	16.917	1.41	22.92	0.94
5.000	1.25	11.000	4.84	17.000	1.41	23.00	0.94
5.083	1.25	11.083	7.50	17.083	1.41	23.08	0.94
5.167	1.25	11.167	7.50	17.167	1.41	23.17	0.94
5.250	1.25	11.250	7.50	17.250	1.41	23.25	0.94
5.333	1.25	11.333	7.50	17.333	1.41	23.33	0.94
5.417	1.25	11.417	7.50	17.417	1.41	23.42	0.94
5.500	1.25	11.500	7.50	17.500	1.41	23.50	0.94
5.583	1.25	11.583	32.49	17.583	1.41	23.58	0.94
5.667	1.25	11.667	32.49	17.667	1.41	23.67	0.94
5.750	1.25	11.750	32.49	17.750	1.41	23.75	0.94
5.833	1.25	11.833	86.21	17.833	1.41	23.83	0.94
5.917	1.25	11.917	86.22	17.917	1.41	23.92	0.94
6.000	1.25	12.000	86.22	18.000	1.41	24.00	0.94

```
     Unit Hyd Qpeak  (cms)=   1.248

     PEAK FLOW       (cms)=   0.610 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  34.847
     TOTAL RAINFALL   (mm)=  78.128
     RUNOFF COEFFICIENT   =   0.446

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 0200)|   Area    (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.12
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     39.58         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     86.22         46.06
               over (min)       5.00         15.00
     Storage Coeff.   (min)=     1.55 (ii)    11.18 (ii)
     Unit Hyd. Tpeak  (min)=     5.00         15.00
     Unit Hyd. peak   (cms)=     0.33          0.09
                                                        *TOTALS*
     PEAK FLOW        (cms)=     0.03          0.01          0.036 (iii)
     TIME TO PEAK     (hrs)=    12.00         12.08         12.00
     RUNOFF VOLUME     (mm)=    77.13         33.89         54.40
     TOTAL RAINFALL    (mm)=    78.13         78.13         78.13
     RUNOFF COEFFICIENT   =      0.99          0.43          0.70

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```



```
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0300)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  0100):     8.17    0.610     12.08     34.85
      + ID2= 2 (  0200):     0.23    0.036     12.00     54.40
        ==================================================
        ID = 3 (  0300):     8.40    0.625     12.08     35.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V    I    SSSSS  U    U    A    L
      V    V    I    SS     U    U   A A   L
       V  V     I     SS    U    U  AAAAA  L
       V  V     I      SS   U    U  A   A  L
        VV      I    SSSSS  UUUUU  A    A  LLLLL

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

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\559189
09-38f7-43c5-afa5-f4dc809eaa3f\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\559189
09-38f7-43c5-afa5-f4dc809eaa3f\scenar


DATE: 02/11/2020                              TIME: 01:50:52

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
----------------------
  ************************************************
  ** SIMULATION : Run 05                        **
```



```
  ************************************************

--------------------
|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               ab21cadd-8504-4915-ac65-c48fa5627c1d\9cd8582c
| Ptotal= 85.40 mm |     Comments: 50yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	' TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.94	6.25	1.71	12.25	12.30	18.25	1.54
0.50	0.94	6.50	1.71	12.50	12.30	18.50	1.54
0.75	0.94	6.75	1.71	12.75	6.32	18.75	1.54
1.00	0.94	7.00	1.71	13.00	6.32	19.00	1.54
1.25	0.94	7.25	1.71	13.25	1.20	19.25	1.54
1.50	0.94	7.50	1.71	13.50	1.20	19.50	1.54
1.75	0.94	7.75	1.71	13.75	7.00	19.75	1.54
2.00	0.94	8.00	1.71	14.00	7.00	20.00	1.54
2.25	1.11	8.25	2.31	14.25	2.56	20.25	1.02
2.50	1.11	8.50	2.31	14.50	2.56	20.50	1.02
2.75	1.11	8.75	2.31	14.75	2.56	20.75	1.02
3.00	1.11	9.00	2.31	15.00	2.56	21.00	1.02
3.25	1.11	9.25	2.73	15.25	2.56	21.25	1.02
3.50	1.11	9.50	2.73	15.50	2.56	21.50	1.02
3.75	1.11	9.75	3.07	15.75	2.56	21.75	1.02
4.00	1.11	10.00	3.07	16.00	2.56	22.00	1.02
4.25	1.37	10.25	3.93	16.25	1.54	22.25	1.02
4.50	1.37	10.50	3.93	16.50	1.54	22.50	1.02
4.75	1.37	10.75	5.29	16.75	1.54	22.75	1.02
5.00	1.37	11.00	5.29	17.00	1.54	23.00	1.02
5.25	1.37	11.25	8.20	17.25	1.54	23.25	1.02
5.50	1.37	11.50	8.20	17.50	1.54	23.50	1.02
5.75	1.37	11.75	35.53	17.75	1.54	23.75	1.02
6.00	1.37	12.00	94.28	18.00	1.54	24.00	1.02

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0100)|   Area    (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	' TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.94	6.083	1.71	12.083	12.31	18.08	1.54
0.167	0.94	6.167	1.71	12.167	12.30	18.17	1.54
0.250	0.94	6.250	1.71	12.250	12.30	18.25	1.54
0.333	0.94	6.333	1.71	12.333	12.30	18.33	1.54
0.417	0.94	6.417	1.71	12.417	12.30	18.42	1.54
0.500	0.94	6.500	1.71	12.500	12.30	18.50	1.54
0.583	0.94	6.583	1.71	12.583	6.32	18.58	1.54
0.667	0.94	6.667	1.71	12.667	6.32	18.67	1.54
0.750	0.94	6.750	1.71	12.750	6.32	18.75	1.54
0.833	0.94	6.833	1.71	12.833	6.32	18.83	1.54
0.917	0.94	6.917	1.71	12.917	6.32	18.92	1.54
1.000	0.94	7.000	1.71	13.000	6.32	19.00	1.54
1.083	0.94	7.083	1.71	13.083	1.20	19.08	1.54

1.167	0.94	7.167	1.71	13.167	1.20	19.17	1.54
1.250	0.94	7.250	1.71	13.250	1.20	19.25	1.54
1.333	0.94	7.333	1.71	13.333	1.20	19.33	1.54
1.417	0.94	7.417	1.71	13.417	1.20	19.42	1.54
1.500	0.94	7.500	1.71	13.500	1.20	19.50	1.54
1.583	0.94	7.583	1.71	13.583	7.00	19.58	1.54
1.667	0.94	7.667	1.71	13.667	7.00	19.67	1.54
1.750	0.94	7.750	1.71	13.750	7.00	19.75	1.54
1.833	0.94	7.833	1.71	13.833	7.00	19.83	1.54
1.917	0.94	7.917	1.71	13.917	7.00	19.92	1.54
2.000	0.94	8.000	1.71	14.000	7.00	20.00	1.54
2.083	1.11	8.083	2.31	14.083	2.56	20.08	1.02
2.167	1.11	8.167	2.31	14.167	2.56	20.17	1.02
2.250	1.11	8.250	2.31	14.250	2.56	20.25	1.02
2.333	1.11	8.333	2.31	14.333	2.56	20.33	1.02
2.417	1.11	8.417	2.31	14.417	2.56	20.42	1.02
2.500	1.11	8.500	2.31	14.500	2.56	20.50	1.02
2.583	1.11	8.583	2.31	14.583	2.56	20.58	1.02
2.667	1.11	8.667	2.31	14.667	2.56	20.67	1.02
2.750	1.11	8.750	2.31	14.750	2.56	20.75	1.02
2.833	1.11	8.833	2.31	14.833	2.56	20.83	1.02
2.917	1.11	8.917	2.31	14.917	2.56	20.92	1.02
3.000	1.11	9.000	2.31	15.000	2.56	21.00	1.02
3.083	1.11	9.083	2.73	15.083	2.56	21.08	1.02
3.167	1.11	9.167	2.73	15.167	2.56	21.17	1.02
3.250	1.11	9.250	2.73	15.250	2.56	21.25	1.02
3.333	1.11	9.333	2.73	15.333	2.56	21.33	1.02
3.417	1.11	9.417	2.73	15.417	2.56	21.42	1.02
3.500	1.11	9.500	2.73	15.500	2.56	21.50	1.02
3.583	1.11	9.583	3.07	15.583	2.56	21.58	1.02
3.667	1.11	9.667	3.07	15.667	2.56	21.67	1.02
3.750	1.11	9.750	3.07	15.750	2.56	21.75	1.02
3.833	1.11	9.833	3.07	15.833	2.56	21.83	1.02
3.917	1.11	9.917	3.07	15.917	2.56	21.92	1.02
4.000	1.11	10.000	3.07	16.000	2.56	22.00	1.02
4.083	1.37	10.083	3.93	16.083	1.54	22.08	1.02
4.167	1.37	10.167	3.93	16.167	1.54	22.17	1.02
4.250	1.37	10.250	3.93	16.250	1.54	22.25	1.02
4.333	1.37	10.333	3.93	16.333	1.54	22.33	1.02
4.417	1.37	10.417	3.93	16.417	1.54	22.42	1.02
4.500	1.37	10.500	3.93	16.500	1.54	22.50	1.02
4.583	1.37	10.583	5.29	16.583	1.54	22.58	1.02
4.667	1.37	10.667	5.29	16.667	1.54	22.67	1.02
4.750	1.37	10.750	5.29	16.750	1.54	22.75	1.02
4.833	1.37	10.833	5.29	16.833	1.54	22.83	1.02
4.917	1.37	10.917	5.29	16.917	1.54	22.92	1.02
5.000	1.37	11.000	5.29	17.000	1.54	23.00	1.02
5.083	1.37	11.083	8.20	17.083	1.54	23.08	1.02
5.167	1.37	11.167	8.20	17.167	1.54	23.17	1.02
5.250	1.37	11.250	8.20	17.250	1.54	23.25	1.02
5.333	1.37	11.333	8.20	17.333	1.54	23.33	1.02
5.417	1.37	11.417	8.20	17.417	1.54	23.42	1.02
5.500	1.37	11.500	8.20	17.500	1.54	23.50	1.02
5.583	1.37	11.583	35.53	17.583	1.54	23.58	1.02
5.667	1.37	11.667	35.53	17.667	1.54	23.67	1.02
5.750	1.37	11.750	35.53	17.750	1.54	23.75	1.02
5.833	1.37	11.833	94.27	17.833	1.54	23.83	1.02
5.917	1.37	11.917	94.28	17.917	1.54	23.92	1.02
6.000	1.37	12.000	94.28	18.000	1.54	24.00	1.02

Unit Hyd Qpeak (cms)= 1.248

PEAK FLOW (cms)= 0.707 (i)


```
TIME TO PEAK     (hrs)=  12.083
RUNOFF VOLUME     (mm)=  40.217
TOTAL RAINFALL    (mm)=  85.403
RUNOFF COEFFICIENT   =    0.471

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 0200)|   Area    (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
--------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.12
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     39.58         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     94.28         53.16
              over (min)        5.00         15.00
     Storage Coeff.  (min)=      1.50 (ii)    10.59 (ii)
     Unit Hyd. Tpeak (min)=      5.00         15.00
     Unit Hyd. peak  (cms)=      0.33          0.09
                                                            *TOTALS*
     PEAK FLOW        (cms)=      0.03          0.01          0.040 (iii)
     TIME TO PEAK     (hrs)=     12.00         12.08         12.00
     RUNOFF VOLUME     (mm)=     84.40         39.16         60.63
     TOTAL RAINFALL    (mm)=     85.40         85.40         85.40
     RUNOFF COEFFICIENT   =       0.99          0.46          0.71

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =   75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

```
--------------------
| ADD HYD  (  0300)|
|   1 + 2 = 3      |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
        ID1= 1 ( 0100):      8.17     0.707     12.08     40.22
      + ID2= 2 ( 0200):      0.23     0.040     12.00     60.63
        ===================================================
        ID = 3 ( 0300):      8.40     0.724     12.08     40.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
================================================================================
=====================
```

```
     V    V   I    SSSSS  U    U    A    L
     V    V   I    SS     U    U   A A   L
      V  V    I     SS    U    U  AAAAA  L
      V  V    I      SS   U    U  A   A  L
       VV     I    SSSSS  UUUUU  A    A  LLLLL
```



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

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2f5a1b95-01bf-4bd2-8465-70d75241e1a9\scenar

Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2f5a1b95-01bf-4bd2-8465-70d75241e1a9\scenar

DATE: 02/11/2020　　　　TIME: 01:50:52

USER:

COMMENTS: ____

```
--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : Run 06                        **
  ************************************************

--------------------
|    READ STORM     |    Filename: C:\Users\zhouj\AppD
|                   |              ata\Local\Temp\
|                   |              ab21cadd-8504-4915-ac65-c48fa5627c1d\5db06ce4
| Ptotal= 92.89 mm |    Comments: 100yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.02	6.25	1.86	12.25	13.38	18.25	1.67
0.50	1.02	6.50	1.86	12.50	13.38	18.50	1.67
0.75	1.02	6.75	1.86	12.75	6.87	18.75	1.67
1.00	1.02	7.00	1.86	13.00	6.87	19.00	1.67
1.25	1.02	7.25	1.86	13.25	1.30	19.25	1.67
1.50	1.02	7.50	1.86	13.50	1.30	19.50	1.67
1.75	1.02	7.75	1.86	13.75	7.62	19.75	1.67
2.00	1.02	8.00	1.86	14.00	7.62	20.00	1.67
2.25	1.21	8.25	2.51	14.25	2.79	20.25	1.11
2.50	1.21	8.50	2.51	14.50	2.79	20.50	1.11
2.75	1.21	8.75	2.51	14.75	2.79	20.75	1.11
3.00	1.21	9.00	2.51	15.00	2.79	21.00	1.11
3.25	1.21	9.25	2.97	15.25	2.79	21.25	1.11
3.50	1.21	9.50	2.97	15.50	2.79	21.50	1.11
3.75	1.21	9.75	3.34	15.75	2.79	21.75	1.11
4.00	1.21	10.00	3.34	16.00	2.79	22.00	1.11
4.25	1.49	10.25	4.27	16.25	1.67	22.25	1.11

4.50	1.49	10.50	4.27	16.50	1.67	22.50	1.11
4.75	1.49	10.75	5.76	16.75	1.67	22.75	1.11
5.00	1.49	11.00	5.76	17.00	1.67	23.00	1.11
5.25	1.49	11.25	8.92	17.25	1.67	23.25	1.11
5.50	1.49	11.50	8.92	17.50	1.67	23.50	1.11
5.75	1.49	11.75	38.65	17.75	1.67	23.75	1.11
6.00	1.49	12.00	102.56	18.00	1.67	24.00	1.11

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0100)|   Area     (ha)=   8.17   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.25

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.02	6.083	1.86	12.083	13.39	18.08	1.67
0.167	1.02	6.167	1.86	12.167	13.38	18.17	1.67
0.250	1.02	6.250	1.86	12.250	13.38	18.25	1.67
0.333	1.02	6.333	1.86	12.333	13.38	18.33	1.67
0.417	1.02	6.417	1.86	12.417	13.38	18.42	1.67
0.500	1.02	6.500	1.86	12.500	13.38	18.50	1.67
0.583	1.02	6.583	1.86	12.583	6.87	18.58	1.67
0.667	1.02	6.667	1.86	12.667	6.87	18.67	1.67
0.750	1.02	6.750	1.86	12.750	6.87	18.75	1.67
0.833	1.02	6.833	1.86	12.833	6.87	18.83	1.67
0.917	1.02	6.917	1.86	12.917	6.87	18.92	1.67
1.000	1.02	7.000	1.86	13.000	6.87	19.00	1.67
1.083	1.02	7.083	1.86	13.083	1.30	19.08	1.67
1.167	1.02	7.167	1.86	13.167	1.30	19.17	1.67
1.250	1.02	7.250	1.86	13.250	1.30	19.25	1.67
1.333	1.02	7.333	1.86	13.333	1.30	19.33	1.67
1.417	1.02	7.417	1.86	13.417	1.30	19.42	1.67
1.500	1.02	7.500	1.86	13.500	1.30	19.50	1.67
1.583	1.02	7.583	1.86	13.583	7.62	19.58	1.67
1.667	1.02	7.667	1.86	13.667	7.62	19.67	1.67
1.750	1.02	7.750	1.86	13.750	7.62	19.75	1.67
1.833	1.02	7.833	1.86	13.833	7.62	19.83	1.67
1.917	1.02	7.917	1.86	13.917	7.62	19.92	1.67
2.000	1.02	8.000	1.86	14.000	7.62	20.00	1.67
2.083	1.21	8.083	2.51	14.083	2.79	20.08	1.11
2.167	1.21	8.167	2.51	14.167	2.79	20.17	1.11
2.250	1.21	8.250	2.51	14.250	2.79	20.25	1.11
2.333	1.21	8.333	2.51	14.333	2.79	20.33	1.11
2.417	1.21	8.417	2.51	14.417	2.79	20.42	1.11
2.500	1.21	8.500	2.51	14.500	2.79	20.50	1.11
2.583	1.21	8.583	2.51	14.583	2.79	20.58	1.11
2.667	1.21	8.667	2.51	14.667	2.79	20.67	1.11
2.750	1.21	8.750	2.51	14.750	2.79	20.75	1.11
2.833	1.21	8.833	2.51	14.833	2.79	20.83	1.11
2.917	1.21	8.917	2.51	14.917	2.79	20.92	1.11
3.000	1.21	9.000	2.51	15.000	2.79	21.00	1.11
3.083	1.21	9.083	2.97	15.083	2.79	21.08	1.11
3.167	1.21	9.167	2.97	15.167	2.79	21.17	1.11
3.250	1.21	9.250	2.97	15.250	2.79	21.25	1.11
3.333	1.21	9.333	2.97	15.333	2.79	21.33	1.11
3.417	1.21	9.417	2.97	15.417	2.79	21.42	1.11

3.500	1.21	9.500	2.97	15.500	2.79	21.50	1.11
3.583	1.21	9.583	3.34	15.583	2.79	21.58	1.11
3.667	1.21	9.667	3.34	15.667	2.79	21.67	1.11
3.750	1.21	9.750	3.34	15.750	2.79	21.75	1.11
3.833	1.21	9.833	3.34	15.833	2.79	21.83	1.11
3.917	1.21	9.917	3.34	15.917	2.79	21.92	1.11
4.000	1.21	10.000	3.34	16.000	2.79	22.00	1.11
4.083	1.49	10.083	4.27	16.083	1.67	22.08	1.11
4.167	1.49	10.167	4.27	16.167	1.67	22.17	1.11
4.250	1.49	10.250	4.27	16.250	1.67	22.25	1.11
4.333	1.49	10.333	4.27	16.333	1.67	22.33	1.11
4.417	1.49	10.417	4.27	16.417	1.67	22.42	1.11
4.500	1.49	10.500	4.27	16.500	1.67	22.50	1.11
4.583	1.49	10.583	5.76	16.583	1.67	22.58	1.11
4.667	1.49	10.667	5.76	16.667	1.67	22.67	1.11
4.750	1.49	10.750	5.76	16.750	1.67	22.75	1.11
4.833	1.49	10.833	5.76	16.833	1.67	22.83	1.11
4.917	1.49	10.917	5.76	16.917	1.67	22.92	1.11
5.000	1.49	11.000	5.76	17.000	1.67	23.00	1.11
5.083	1.49	11.083	8.92	17.083	1.67	23.08	1.11
5.167	1.49	11.167	8.92	17.167	1.67	23.17	1.11
5.250	1.49	11.250	8.92	17.250	1.67	23.25	1.11
5.333	1.49	11.333	8.92	17.333	1.67	23.33	1.11
5.417	1.49	11.417	8.92	17.417	1.67	23.42	1.11
5.500	1.49	11.500	8.92	17.500	1.67	23.50	1.11
5.583	1.49	11.583	38.65	17.583	1.67	23.58	1.11
5.667	1.49	11.667	38.65	17.667	1.67	23.67	1.11
5.750	1.49	11.750	38.65	17.750	1.67	23.75	1.11
5.833	1.49	11.833	102.55	17.833	1.67	23.83	1.11
5.917	1.49	11.917	102.56	17.917	1.67	23.92	1.11
6.000	1.49	12.000	102.56	18.000	1.67	24.00	1.11

```
     Unit Hyd Qpeak  (cms)=   1.248

     PEAK FLOW       (cms)=   0.810 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  45.914
     TOTAL RAINFALL   (mm)=  92.888
     RUNOFF COEFFICIENT   =   0.494

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0200)|   Area    (ha)=   0.23
|ID= 1 DT= 5.0 min |   Total Imp(%)=  47.50   Dir. Conn.(%)=  47.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      39.58        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     102.56        60.65
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.45 (ii)   10.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.10
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.01          0.045 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
```



```
     RUNOFF VOLUME    (mm)=      91.89        44.76         67.12
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.72

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0300)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):      8.17   0.810    12.08    45.91
      + ID2= 2 (  0200):      0.23   0.045    12.00    67.12
        ====================================================
        ID = 3 (  0300):      8.40   0.829    12.08    46.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

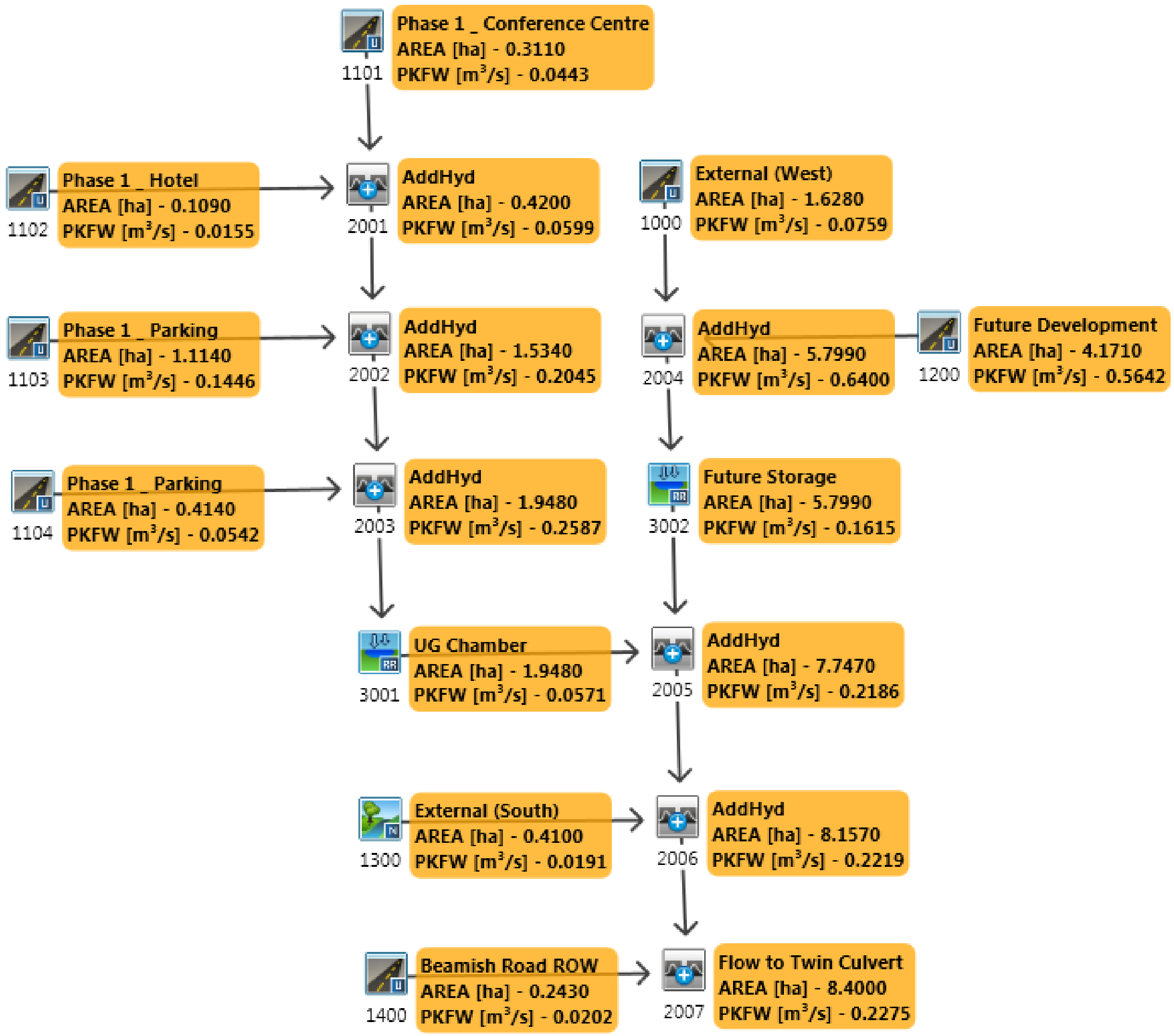

Figure B2

Visual OTTHYMO Model Schematic _ Post- Development (Ultimate) Conditions

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

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\b260c3
30-cd5a-4aa5-8205-1ed808630b0e\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\b260c3
30-cd5a-4aa5-8205-1ed808630b0e\scenar


DATE: 02/11/2020                          TIME: 01:51:22

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : Run 01                      **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              24804864-1db5-42ad-98d7-7770ddd644f0\6d48df83
| Ptotal= 46.77 mm |    Comments: 2yr24hrSCS_Midland
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.51 |  6.25    0.94 | 12.25    6.74 | 18.25    0.84
                 0.50    0.51 |  6.50    0.94 | 12.50    6.74 | 18.50    0.84
                 0.75    0.51 |  6.75    0.94 | 12.75    3.46 | 18.75    0.84
                 1.00    0.51 |  7.00    0.94 | 13.00    3.46 | 19.00    0.84
                 1.25    0.51 |  7.25    0.94 | 13.25    0.66 | 19.25    0.84
                 1.50    0.51 |  7.50    0.94 | 13.50    0.66 | 19.50    0.84
                 1.75    0.51 |  7.75    0.94 | 13.75    3.84 | 19.75    0.84
                 2.00    0.51 |  8.00    0.94 | 14.00    3.84 | 20.00    0.84
```



```
                 2.25    0.61 |  8.25    1.26 | 14.25    1.40 | 20.25    0.56
                 2.50    0.61 |  8.50    1.26 | 14.50    1.40 | 20.50    0.56
                 2.75    0.61 |  8.75    1.26 | 14.75    1.40 | 20.75    0.56
                 3.00    0.61 |  9.00    1.26 | 15.00    1.40 | 21.00    0.56
                 3.25    0.61 |  9.25    1.50 | 15.25    1.40 | 21.25    0.56
                 3.50    0.61 |  9.50    1.50 | 15.50    1.40 | 21.50    0.56
                 3.75    0.61 |  9.75    1.68 | 15.75    1.40 | 21.75    0.56
                 4.00    0.61 | 10.00    1.68 | 16.00    1.40 | 22.00    0.56
                 4.25    0.75 | 10.25    2.15 | 16.25    0.84 | 22.25    0.56
                 4.50    0.75 | 10.50    2.15 | 16.50    0.84 | 22.50    0.56
                 4.75    0.75 | 10.75    2.90 | 16.75    0.84 | 22.75    0.56
                 5.00    0.75 | 11.00    2.90 | 17.00    0.84 | 23.00    0.56
                 5.25    0.75 | 11.25    4.49 | 17.25    0.84 | 23.25    0.56
                 5.50    0.75 | 11.50    4.49 | 17.50    0.84 | 23.50    0.56
                 5.75    0.75 | 11.75   19.47 | 17.75    0.84 | 23.75    0.56
                 6.00    0.75 | 12.00   51.67 | 18.00    0.84 | 24.00    0.56

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

--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


                         ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    0.51 | 6.083    0.94 |12.083    6.75 | 18.08    0.84
                0.167    0.51 | 6.167    0.94 |12.167    6.74 | 18.17    0.84
                0.250    0.51 | 6.250    0.94 |12.250    6.74 | 18.25    0.84
                0.333    0.51 | 6.333    0.94 |12.333    6.74 | 18.33    0.84
                0.417    0.51 | 6.417    0.94 |12.417    6.74 | 18.42    0.84
                0.500    0.51 | 6.500    0.94 |12.500    6.74 | 18.50    0.84
                0.583    0.51 | 6.583    0.94 |12.583    3.46 | 18.58    0.84
                0.667    0.51 | 6.667    0.94 |12.667    3.46 | 18.67    0.84
                0.750    0.51 | 6.750    0.94 |12.750    3.46 | 18.75    0.84
                0.833    0.51 | 6.833    0.94 |12.833    3.46 | 18.83    0.84
                0.917    0.51 | 6.917    0.94 |12.917    3.46 | 18.92    0.84
                1.000    0.51 | 7.000    0.94 |13.000    3.46 | 19.00    0.84
                1.083    0.51 | 7.083    0.94 |13.083    0.66 | 19.08    0.84
                1.167    0.51 | 7.167    0.94 |13.167    0.66 | 19.17    0.84
                1.250    0.51 | 7.250    0.94 |13.250    0.66 | 19.25    0.84
                1.333    0.51 | 7.333    0.94 |13.333    0.66 | 19.33    0.84
                1.417    0.51 | 7.417    0.94 |13.417    0.66 | 19.42    0.84
                1.500    0.51 | 7.500    0.94 |13.500    0.66 | 19.50    0.84
                1.583    0.51 | 7.583    0.94 |13.583    3.84 | 19.58    0.84
                1.667    0.51 | 7.667    0.94 |13.667    3.84 | 19.67    0.84
                1.750    0.51 | 7.750    0.94 |13.750    3.84 | 19.75    0.84
                1.833    0.51 | 7.833    0.94 |13.833    3.84 | 19.83    0.84
                1.917    0.51 | 7.917    0.94 |13.917    3.84 | 19.92    0.84
                2.000    0.51 | 8.000    0.94 |14.000    3.84 | 20.00    0.84
                2.083    0.61 | 8.083    1.26 |14.083    1.40 | 20.08    0.56
                2.167    0.61 | 8.167    1.26 |14.167    1.40 | 20.17    0.56
                2.250    0.61 | 8.250    1.26 |14.250    1.40 | 20.25    0.56
                2.333    0.61 | 8.333    1.26 |14.333    1.40 | 20.33    0.56
                2.417    0.61 | 8.417    1.26 |14.417    1.40 | 20.42    0.56
                2.500    0.61 | 8.500    1.26 |14.500    1.40 | 20.50    0.56
                2.583    0.61 | 8.583    1.26 |14.583    1.40 | 20.58    0.56
                2.667    0.61 | 8.667    1.26 |14.667    1.40 | 20.67    0.56
```



```
                2.750    0.61 | 8.750    1.26 |14.750    1.40 | 20.75    0.56
                2.833    0.61 | 8.833    1.26 |14.833    1.40 | 20.83    0.56
                2.917    0.61 | 8.917    1.26 |14.917    1.40 | 20.92    0.56
                3.000    0.61 | 9.000    1.26 |15.000    1.40 | 21.00    0.56
                3.083    0.61 | 9.083    1.50 |15.083    1.40 | 21.08    0.56
                3.167    0.61 | 9.167    1.50 |15.167    1.40 | 21.17    0.56
                3.250    0.61 | 9.250    1.50 |15.250    1.40 | 21.25    0.56
                3.333    0.61 | 9.333    1.50 |15.333    1.40 | 21.33    0.56
                3.417    0.61 | 9.417    1.50 |15.417    1.40 | 21.42    0.56
                3.500    0.61 | 9.500    1.50 |15.500    1.40 | 21.50    0.56
                3.583    0.61 | 9.583    1.68 |15.583    1.40 | 21.58    0.56
                3.667    0.61 | 9.667    1.68 |15.667    1.40 | 21.67    0.56
                3.750    0.61 | 9.750    1.68 |15.750    1.40 | 21.75    0.56
                3.833    0.61 | 9.833    1.68 |15.833    1.40 | 21.83    0.56
                3.917    0.61 | 9.917    1.68 |15.917    1.40 | 21.92    0.56
                4.000    0.61 |10.000    1.68 |16.000    1.40 | 22.00    0.56
                4.083    0.75 |10.083    2.15 |16.083    0.84 | 22.08    0.56
                4.167    0.75 |10.167    2.15 |16.167    0.84 | 22.17    0.56
                4.250    0.75 |10.250    2.15 |16.250    0.84 | 22.25    0.56
                4.333    0.75 |10.333    2.15 |16.333    0.84 | 22.33    0.56
                4.417    0.75 |10.417    2.15 |16.417    0.84 | 22.42    0.56
                4.500    0.75 |10.500    2.15 |16.500    0.84 | 22.50    0.56
                4.583    0.75 |10.583    2.90 |16.583    0.84 | 22.58    0.56
                4.667    0.75 |10.667    2.90 |16.667    0.84 | 22.67    0.56
                4.750    0.75 |10.750    2.90 |16.750    0.84 | 22.75    0.56
                4.833    0.75 |10.833    2.90 |16.833    0.84 | 22.83    0.56
                4.917    0.75 |10.917    2.90 |16.917    0.84 | 22.92    0.56
                5.000    0.75 |11.000    2.90 |17.000    0.84 | 23.00    0.56
                5.083    0.75 |11.083    4.49 |17.083    0.84 | 23.08    0.56
                5.167    0.75 |11.167    4.49 |17.167    0.84 | 23.17    0.56
                5.250    0.75 |11.250    4.49 |17.250    0.84 | 23.25    0.56
                5.333    0.75 |11.333    4.49 |17.333    0.84 | 23.33    0.56
                5.417    0.75 |11.417    4.49 |17.417    0.84 | 23.42    0.56
                5.500    0.75 |11.500    4.49 |17.500    0.84 | 23.50    0.56
                5.583    0.75 |11.583   19.47 |17.583    0.84 | 23.58    0.56
                5.667    0.75 |11.667   19.47 |17.667    0.84 | 23.67    0.56
                5.750    0.75 |11.750   19.47 |17.750    0.84 | 23.75    0.56
                5.833    0.75 |11.833   51.67 |17.833    0.84 | 23.83    0.56
                5.917    0.75 |11.917   51.67 |17.917    0.84 | 23.92    0.56
                6.000    0.75 |12.000   51.67 |18.000    0.84 | 24.00    0.56

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.019 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  11.842
     TOTAL RAINFALL   (mm)=  46.775
     RUNOFF COEFFICIENT   =   0.253

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

-----------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.31          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       45.53         40.00
     Mannings n           =       0.013         0.250
```



```
     Max.Eff.Inten.(mm/hr)=       51.67         18.89
               over (min)          5.00          5.00
     Storage Coeff.  (min)=        2.08 (ii)     3.54 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.31          0.26
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.04          0.00          0.044 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=       45.78         13.80          45.45
     TOTAL RAINFALL   (mm)=       46.78         46.78          46.78
     RUNOFF COEFFICIENT   =        0.98          0.30           0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.11          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       26.96         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=       51.67         18.89
               over (min)          5.00          5.00
     Storage Coeff.  (min)=        1.52 (ii)     2.98 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.33          0.28
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.02          0.00          0.016 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=       45.78         13.80          45.45
     TOTAL RAINFALL   (mm)=       46.78         46.78          46.78
     RUNOFF COEFFICIENT   =        0.98          0.30           0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):      0.31   0.044    12.00    45.45
      + ID2= 2 (  1102):      0.11   0.016    12.00    45.45
        ===================================================
```

```
    ID = 3 (  2001):     0.42   0.060    12.00    45.45

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      51.67         18.89
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       3.04 (ii)     7.31 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.27          0.13
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.14          0.01          0.145 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      45.78         13.80         41.68
     TOTAL RAINFALL   (mm)=      46.78         46.78         46.78
     RUNOFF COEFFICIENT   =       0.98          0.30          0.89

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1103):       1.11   0.145    12.00    41.68
     + ID2= 2 (  2001):       0.42   0.060    12.00    45.45
       ==================================================
       ID = 3 (  2002):       1.53   0.204    12.00    42.71

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36          0.05
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      52.54         40.00
     Mannings n           =      0.013         0.250
```



```
     Max.Eff.Inten.(mm/hr)=      51.67         18.89
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       2.26 (ii)     6.47 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.30          0.14
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.05          0.00          0.054 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      45.77         13.80         41.80
     TOTAL RAINFALL   (mm)=      46.78         46.78         46.78
     RUNOFF COEFFICIENT   =       0.98          0.30          0.89

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1104):       0.41   0.054    12.00    41.80
     + ID2= 2 (  2002):       1.53   0.204    12.00    42.71
       ==================================================
       ID = 3 (  2003):       1.95   0.259    12.00    42.52

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  2003)     1.948      0.259     12.00      42.52
  OUTFLOW: ID= 1 (  3001)     1.948      0.057     12.17      42.51

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.07
               TIME SHIFT OF PEAK FLOW         (min)= 10.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0413

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96          0.21
     Dep. Storage     (mm)=       1.00          5.00
```



```
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     166.75         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      51.67         18.89
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       4.52 (ii)     7.35 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.23          0.13
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.56          0.01          0.564 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      45.77         13.80         44.18
     TOTAL RAINFALL   (mm)=      46.78         46.78         46.78
     RUNOFF COEFFICIENT   =       0.98          0.30          0.94

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38          1.25
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     104.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      51.67         17.45
                over (min)        5.00         20.00
     Storage Coeff.  (min)=       3.41 (ii)    17.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00         20.00
     Unit Hyd. peak  (cms)=       0.26          0.06
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.05          0.03          0.076 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.17         12.00
     RUNOFF VOLUME    (mm)=      45.77         13.80         21.18
     TOTAL RAINFALL   (mm)=      46.78         46.78         46.78
     RUNOFF COEFFICIENT   =       0.98          0.30          0.45

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```



```
       ID1= 1 (  1000):       1.63   0.076    12.00    21.18
     + ID2= 2 (  1200):       4.17   0.564    12.00    44.18
       ==================================================
       ID = 3 (  2004):       5.80   0.640    12.00    37.72

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950     0.1485
                          0.1800     0.0870   |   0.5750     0.1645
                          0.3000     0.1120   |   0.6650     0.1815
                          0.3750     0.1280   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  2004)     5.799      0.640     12.00      37.72
  OUTFLOW: ID= 1 (  3002)     5.799      0.162     12.17      37.70

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.24
               TIME SHIFT OF PEAK FLOW         (min)= 10.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0783

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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  3001):       1.95   0.057    12.17    42.51
     + ID2= 2 (  3002):       5.80   0.162    12.17    37.70
       ==================================================
       ID = 3 (  2005):       7.75   0.219    12.17    38.91

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1300):       0.41   0.019    12.00    11.84
     + ID2= 2 (  2005):       7.75   0.219    12.17    38.91
       ==================================================
       ID = 3 (  2006):       8.16   0.222    12.17    37.55

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13          0.12
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
```

```
Length          (m)=      40.25         40.00
Mannings n         =      0.013         0.250

Max.Eff.Inten.(mm/hr)=      51.67         17.45
          over (min)       5.00         20.00
Storage Coeff.  (min)=       1.93 (ii)    16.12 (ii)
Unit Hyd. Tpeak (min)=       5.00         20.00
Unit Hyd. peak  (cms)=       0.31          0.06
                                                    *TOTALS*
PEAK FLOW       (cms)=       0.02          0.00        0.020 (iii)
TIME TO PEAK    (hrs)=      12.00         12.17        12.00
RUNOFF VOLUME    (mm)=      45.77         13.80        30.22
TOTAL RAINFALL   (mm)=      46.78         46.78        46.78
RUNOFF COEFFICIENT   =       0.98          0.30         0.65

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
       ID1= 1 (  1400):      0.24    0.020     12.00     30.22
     + ID2= 2 (  2006):      8.16    0.222     12.17     37.55
       ==================================================
       ID = 3 (  2007):      8.40    0.228     12.17     37.34

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO   TTTTT  TTTTT  H    H  Y   Y  M    M   OOO     TM
      O   O    T      T    H    H   Y Y   MM  MM  O   O
      O   O    T      T    H    H    Y    M    M  O   O
       OOO     T      T    H    H    Y    M    M   OOO
Developed and Distributed by Civica Infrastructure
```



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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2ccf25
1f-fe3d-41b9-af9b-4620f1595201\scenar
```



```
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2ccf25
1f-fe3d-41b9-af9b-4620f1595201\scenar


DATE: 02/11/2020                           TIME: 01:51:18

USER:


COMMENTS: ____________________________________________________

------------------------------------------------------------------------------
--------------------
  **********************************************
  ** SIMULATION : Run 02                       **
  **********************************************


--------------------
|    READ STORM     |     Filename: C:\Users\zhouj\AppD
|                   |               ata\Local\Temp\
|                   |               24804864-1db5-42ad-98d7-7770ddd644f0\455ee265
| Ptotal= 59.94 mm  |     Comments: 5yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.66	6.25	1.20	12.25	8.63	18.25	1.08
0.50	0.66	6.50	1.20	12.50	8.63	18.50	1.08
0.75	0.66	6.75	1.20	12.75	4.43	18.75	1.08
1.00	0.66	7.00	1.20	13.00	4.43	19.00	1.08
1.25	0.66	7.25	1.20	13.25	0.84	19.25	1.08
1.50	0.66	7.50	1.20	13.50	0.84	19.50	1.08
1.75	0.66	7.75	1.20	13.75	4.91	19.75	1.08
2.00	0.66	8.00	1.20	14.00	4.91	20.00	1.08
2.25	0.78	8.25	1.62	14.25	1.80	20.25	0.72
2.50	0.78	8.50	1.62	14.50	1.80	20.50	0.72
2.75	0.78	8.75	1.62	14.75	1.80	20.75	0.72
3.00	0.78	9.00	1.62	15.00	1.80	21.00	0.72
3.25	0.78	9.25	1.92	15.25	1.80	21.25	0.72
3.50	0.78	9.50	1.92	15.50	1.80	21.50	0.72
3.75	0.78	9.75	2.16	15.75	1.80	21.75	0.72
4.00	0.78	10.00	2.16	16.00	1.80	22.00	0.72
4.25	0.96	10.25	2.76	16.25	1.08	22.25	0.72
4.50	0.96	10.50	2.76	16.50	1.08	22.50	0.72
4.75	0.96	10.75	3.71	16.75	1.08	22.75	0.72
5.00	0.96	11.00	3.71	17.00	1.08	23.00	0.72
5.25	0.96	11.25	5.75	17.25	1.08	23.25	0.72
5.50	0.96	11.50	5.75	17.50	1.08	23.50	0.72
5.75	0.96	11.75	24.92	17.75	1.08	23.75	0.72
6.00	0.96	12.00	66.13	18.00	1.08	24.00	0.72

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

--------------------
| CALIB             |
| NASHYD   (  1300)|    Area     (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |    Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    0.06

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


---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.66	6.083	1.20	12.083	8.64	18.08	1.08
0.167	0.66	6.167	1.20	12.167	8.63	18.17	1.08
0.250	0.66	6.250	1.20	12.250	8.63	18.25	1.08
0.333	0.66	6.333	1.20	12.333	8.63	18.33	1.08
0.417	0.66	6.417	1.20	12.417	8.63	18.42	1.08
0.500	0.66	6.500	1.20	12.500	8.63	18.50	1.08
0.583	0.66	6.583	1.20	12.583	4.43	18.58	1.08
0.667	0.66	6.667	1.20	12.667	4.43	18.67	1.08
0.750	0.66	6.750	1.20	12.750	4.43	18.75	1.08
0.833	0.66	6.833	1.20	12.833	4.43	18.83	1.08
0.917	0.66	6.917	1.20	12.917	4.43	18.92	1.08
1.000	0.66	7.000	1.20	13.000	4.43	19.00	1.08
1.083	0.66	7.083	1.20	13.083	0.84	19.08	1.08
1.167	0.66	7.167	1.20	13.167	0.84	19.17	1.08
1.250	0.66	7.250	1.20	13.250	0.84	19.25	1.08
1.333	0.66	7.333	1.20	13.333	0.84	19.33	1.08
1.417	0.66	7.417	1.20	13.417	0.84	19.42	1.08
1.500	0.66	7.500	1.20	13.500	0.84	19.50	1.08
1.583	0.66	7.583	1.20	13.583	4.91	19.58	1.08
1.667	0.66	7.667	1.20	13.667	4.91	19.67	1.08
1.750	0.66	7.750	1.20	13.750	4.91	19.75	1.08
1.833	0.66	7.833	1.20	13.833	4.91	19.83	1.08
1.917	0.66	7.917	1.20	13.917	4.91	19.92	1.08
2.000	0.66	8.000	1.20	14.000	4.91	20.00	1.08
2.083	0.78	8.083	1.62	14.083	1.80	20.08	0.72
2.167	0.78	8.167	1.62	14.167	1.80	20.17	0.72
2.250	0.78	8.250	1.62	14.250	1.80	20.25	0.72
2.333	0.78	8.333	1.62	14.333	1.80	20.33	0.72
2.417	0.78	8.417	1.62	14.417	1.80	20.42	0.72
2.500	0.78	8.500	1.62	14.500	1.80	20.50	0.72
2.583	0.78	8.583	1.62	14.583	1.80	20.58	0.72
2.667	0.78	8.667	1.62	14.667	1.80	20.67	0.72
2.750	0.78	8.750	1.62	14.750	1.80	20.75	0.72
2.833	0.78	8.833	1.62	14.833	1.80	20.83	0.72
2.917	0.78	8.917	1.62	14.917	1.80	20.92	0.72
3.000	0.78	9.000	1.62	15.000	1.80	21.00	0.72
3.083	0.78	9.083	1.92	15.083	1.80	21.08	0.72
3.167	0.78	9.167	1.92	15.167	1.80	21.17	0.72
3.250	0.78	9.250	1.92	15.250	1.80	21.25	0.72
3.333	0.78	9.333	1.92	15.333	1.80	21.33	0.72
3.417	0.78	9.417	1.92	15.417	1.80	21.42	0.72
3.500	0.78	9.500	1.92	15.500	1.80	21.50	0.72
3.583	0.78	9.583	2.16	15.583	1.80	21.58	0.72
3.667	0.78	9.667	2.16	15.667	1.80	21.67	0.72
3.750	0.78	9.750	2.16	15.750	1.80	21.75	0.72
3.833	0.78	9.833	2.16	15.833	1.80	21.83	0.72
3.917	0.78	9.917	2.16	15.917	1.80	21.92	0.72
4.000	0.78	10.000	2.16	16.000	1.80	22.00	0.72
4.083	0.96	10.083	2.76	16.083	1.08	22.08	0.72
4.167	0.96	10.167	2.76	16.167	1.08	22.17	0.72
4.250	0.96	10.250	2.76	16.250	1.08	22.25	0.72
4.333	0.96	10.333	2.76	16.333	1.08	22.33	0.72
4.417	0.96	10.417	2.76	16.417	1.08	22.42	0.72
4.500	0.96	10.500	2.76	16.500	1.08	22.50	0.72
4.583	0.96	10.583	3.71	16.583	1.08	22.58	0.72
4.667	0.96	10.667	3.71	16.667	1.08	22.67	0.72
4.750	0.96	10.750	3.71	16.750	1.08	22.75	0.72
4.833	0.96	10.833	3.71	16.833	1.08	22.83	0.72

4.917	0.96	10.917	3.71	16.917	1.08	22.92	0.72
5.000	0.96	11.000	3.71	17.000	1.08	23.00	0.72
5.083	0.96	11.083	5.75	17.083	1.08	23.08	0.72
5.167	0.96	11.167	5.75	17.167	1.08	23.17	0.72
5.250	0.96	11.250	5.75	17.250	1.08	23.25	0.72
5.333	0.96	11.333	5.75	17.333	1.08	23.33	0.72
5.417	0.96	11.417	5.75	17.417	1.08	23.42	0.72
5.500	0.96	11.500	5.75	17.500	1.08	23.50	0.72
5.583	0.96	11.583	24.92	17.583	1.08	23.58	0.72
5.667	0.96	11.667	24.92	17.667	1.08	23.67	0.72
5.750	0.96	11.750	24.92	17.750	1.08	23.75	0.72
5.833	0.96	11.833	66.13	17.833	1.08	23.83	0.72
5.917	0.96	11.917	66.13	17.917	1.08	23.92	0.72
6.000	0.96	12.000	66.13	18.000	1.08	24.00	0.72

```
    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW       (cms)=   0.030 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  18.551
    TOTAL RAINFALL   (mm)=  59.938
    RUNOFF COEFFICIENT   =   0.310

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

------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1101)|    Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |    Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.31          0.00
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     45.53         40.00
    Mannings n          =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     66.13         29.50
              over (min)       5.00          5.00
    Storage Coeff.  (min)=      1.88 (ii)     3.21 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.32          0.27
                                                      *TOTALS*
    PEAK FLOW       (cms)=      0.06          0.00       0.057 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00       12.00
    RUNOFF VOLUME    (mm)=     58.94         21.62       58.56
    TOTAL RAINFALL   (mm)=     59.94         59.94       59.94
    RUNOFF COEFFICIENT   =      0.98          0.36        0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  1102)|    Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |    Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
```

```
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.11          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       26.96         40.00
     Mannings n           =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=       66.13         29.50
                over (min)         5.00          5.00
     Storage Coeff.  (min)=        1.37 (ii)     2.70 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.33          0.29
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.02          0.00          0.020 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       58.94         21.62         58.56
     TOTAL RAINFALL   (mm)=       59.94         59.94         59.94
     RUNOFF COEFFICIENT   =        0.98          0.36          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1101):     0.31   0.057     12.00     58.56
      + ID2= 2 (  1102):     0.11   0.020     12.00     58.56
        ================================================
        ID = 3 (  2001):     0.42   0.077     12.00     58.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.97          0.14
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       86.18         40.00
     Mannings n           =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=       66.13         29.50
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        2.76 (ii)     6.62 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.28          0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.18          0.01          0.187 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       58.94         21.62         54.16
```



```
     TOTAL RAINFALL   (mm)=       59.94         59.94         59.94
     RUNOFF COEFFICIENT   =        0.98          0.36          0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1103):     1.11   0.187     12.00     54.16
      + ID2= 2 (  2001):     0.42   0.077     12.00     58.56
        ================================================
        ID = 3 (  2002):     1.53   0.264     12.00     55.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.36          0.05
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       52.54         40.00
     Mannings n           =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=       66.13         29.50
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        2.05 (ii)     5.86 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.31          0.15
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.07          0.00          0.070 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       58.94         21.62         54.31
     TOTAL RAINFALL   (mm)=       59.94         59.94         59.94
     RUNOFF COEFFICIENT   =        0.98          0.36          0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
```



```
        ID1= 1 (  1104):     0.41   0.070     12.00     54.31
      + ID2= 2 (  2002):     1.53   0.264     12.00     55.36
        ================================================
        ID = 3 (  2003):     1.95   0.334     12.00     55.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0801     0.0575
                         0.0012     0.0001   |   0.0965     0.0712
                         0.0013     0.0085   |   0.1106     0.0816
                         0.0238     0.0256   |   0.1230     0.0900
                         0.0593     0.0421   |   0.0000     0.0000

                              AREA      QPEAK      TPEAK        R.V.
                              (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)    1.948      0.334      12.00       55.14
   OUTFLOW: ID= 1 (  3001)    1.948      0.072      12.08       55.13

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.51
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0517

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--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        3.96          0.21
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=      166.75         40.00
     Mannings n           =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=       66.13         29.50
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        4.10 (ii)     6.66 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.24          0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.72          0.01          0.730 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       58.94         21.62         57.07
     TOTAL RAINFALL   (mm)=       59.94         59.94         59.94
     RUNOFF COEFFICIENT   =        0.98          0.36          0.95

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.38          1.25
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=      104.18         40.00
     Mannings n           =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=       66.13         27.53
                over (min)         5.00         15.00
     Storage Coeff.  (min)=        3.09 (ii)    14.91 (ii)
     Unit Hyd. Tpeak (min)=        5.00         15.00
     Unit Hyd. peak  (cms)=        0.27          0.08
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.07          0.06          0.119 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.08         12.00
     RUNOFF VOLUME    (mm)=       58.94         21.62         30.23
     TOTAL RAINFALL   (mm)=       59.94         59.94         59.94
     RUNOFF COEFFICIENT   =        0.98          0.36          0.50

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1000):     1.63   0.119     12.00     30.23
      + ID2= 2 (  1200):     4.17   0.730     12.00     57.07
        ================================================
        ID = 3 (  2004):     5.80   0.849     12.00     49.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950     0.1485
                         0.1800     0.0870   |   0.5750     0.1645
                         0.3000     0.1120   |   0.6650     0.1815
                         0.3750     0.1280   |   0.0000     0.0000

                              AREA      QPEAK      TPEAK        R.V.
                              (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)    5.799      0.849      12.00       49.54
   OUTFLOW: ID= 1 (  3002)    5.799      0.249      12.17       49.52

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.34
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1017
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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  3001):     1.95   0.072    12.08    55.13
       + ID2= 2 (  3002):     5.80   0.249    12.17    49.52
         ==================================================
         ID = 3 (  2005):     7.75   0.321    12.17    50.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1300):     0.41   0.030    12.00    18.55
       + ID2= 2 (  2005):     7.75   0.321    12.17    50.93
         ==================================================
         ID = 3 (  2006):     8.16   0.326    12.17    49.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     0.13          0.12
     Dep. Storage     (mm)=     1.00          5.00
     Average Slope     (%)=     1.00          2.00
     Length            (m)=    40.25         40.00
     Mannings n          =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=    66.13         27.53
              over (min)       5.00         15.00
     Storage Coeff.  (min)=     1.75 (ii)    13.57 (ii)
     Unit Hyd. Tpeak (min)=     5.00         15.00
     Unit Hyd. peak  (cms)=     0.32          0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=     0.02          0.01        0.028 (iii)
     TIME TO PEAK    (hrs)=    12.00         12.08        12.00
     RUNOFF VOLUME    (mm)=    58.94         21.62        40.81
     TOTAL RAINFALL   (mm)=    59.94         59.94        59.94
     RUNOFF COEFFICIENT   =     0.98          0.36         0.68

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1400):     0.24   0.028    12.00    40.81
       + ID2= 2 (  2006):     8.16   0.326    12.17    49.30
         ==================================================
         ID = 3 (  2007):     8.40   0.335    12.17    49.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\9e0a3f
bf-aa91-46c9-b185-899e1192498d\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\9e0a3f
bf-aa91-46c9-b185-899e1192498d\scenar


DATE: 02/11/2020                         TIME: 01:51:20

USER:


COMMENTS: ____________________________________________________________

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  **************************************************
  ** SIMULATION : Run 03                          **
  **************************************************


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|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               24804864-1db5-42ad-98d7-7770ddd644f0\cef3ad34
| Ptotal= 67.54 mm |     Comments: 10yr24hrSCS_Midland
```



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--------------------
                  TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.25    0.74 |   6.25    1.35 | 12.25    9.72 | 18.25    1.22
                  0.50    0.74 |   6.50    1.35 | 12.50    9.72 | 18.50    1.22
                  0.75    0.74 |   6.75    1.35 | 12.75    5.00 | 18.75    1.22
                  1.00    0.74 |   7.00    1.35 | 13.00    5.00 | 19.00    1.22
                  1.25    0.74 |   7.25    1.35 | 13.25    0.95 | 19.25    1.22
                  1.50    0.74 |   7.50    1.35 | 13.50    0.95 | 19.50    1.22
                  1.75    0.74 |   7.75    1.35 | 13.75    5.54 | 19.75    1.22
                  2.00    0.74 |   8.00    1.35 | 14.00    5.54 | 20.00    1.22
                  2.25    0.88 |   8.25    1.82 | 14.25    2.03 | 20.25    0.81
                  2.50    0.88 |   8.50    1.82 | 14.50    2.03 | 20.50    0.81
                  2.75    0.88 |   8.75    1.82 | 14.75    2.03 | 20.75    0.81
                  3.00    0.88 |   9.00    1.82 | 15.00    2.03 | 21.00    0.81
                  3.25    0.88 |   9.25    2.16 | 15.25    2.03 | 21.25    0.81
                  3.50    0.88 |   9.50    2.16 | 15.50    2.03 | 21.50    0.81
                  3.75    0.88 |   9.75    2.43 | 15.75    2.03 | 21.75    0.81
                  4.00    0.88 |  10.00    2.43 | 16.00    2.03 | 22.00    0.81
                  4.25    1.08 |  10.25    3.11 | 16.25    1.22 | 22.25    0.81
                  4.50    1.08 |  10.50    3.11 | 16.50    1.22 | 22.50    0.81
                  4.75    1.08 |  10.75    4.19 | 16.75    1.22 | 22.75    0.81
                  5.00    1.08 |  11.00    4.19 | 17.00    1.22 | 23.00    0.81
                  5.25    1.08 |  11.25    6.48 | 17.25    1.22 | 23.25    0.81
                  5.50    1.08 |  11.50    6.48 | 17.50    1.22 | 23.50    0.81
                  5.75    1.08 |  11.75   28.08 | 17.75    1.22 | 23.75    0.81
                  6.00    1.08 |  12.00   74.52 | 18.00    1.22 | 24.00    0.81

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--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


                            ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    0.74 | 6.083    1.35 |12.083    9.73 | 18.08    1.22
                 0.167    0.74 | 6.167    1.35 |12.167    9.72 | 18.17    1.22
                 0.250    0.74 | 6.250    1.35 |12.250    9.72 | 18.25    1.22
                 0.333    0.74 | 6.333    1.35 |12.333    9.72 | 18.33    1.22
                 0.417    0.74 | 6.417    1.35 |12.417    9.72 | 18.42    1.22
                 0.500    0.74 | 6.500    1.35 |12.500    9.72 | 18.50    1.22
                 0.583    0.74 | 6.583    1.35 |12.583    5.00 | 18.58    1.22
                 0.667    0.74 | 6.667    1.35 |12.667    5.00 | 18.67    1.22
                 0.750    0.74 | 6.750    1.35 |12.750    5.00 | 18.75    1.22
                 0.833    0.74 | 6.833    1.35 |12.833    5.00 | 18.83    1.22
                 0.917    0.74 | 6.917    1.35 |12.917    5.00 | 18.92    1.22
                 1.000    0.74 | 7.000    1.35 |13.000    5.00 | 19.00    1.22
                 1.083    0.74 | 7.083    1.35 |13.083    0.95 | 19.08    1.22
                 1.167    0.74 | 7.167    1.35 |13.167    0.95 | 19.17    1.22
                 1.250    0.74 | 7.250    1.35 |13.250    0.95 | 19.25    1.22
                 1.333    0.74 | 7.333    1.35 |13.333    0.95 | 19.33    1.22
                 1.417    0.74 | 7.417    1.35 |13.417    0.95 | 19.42    1.22
                 1.500    0.74 | 7.500    1.35 |13.500    0.95 | 19.50    1.22
                 1.583    0.74 | 7.583    1.35 |13.583    5.54 | 19.58    1.22
                 1.667    0.74 | 7.667    1.35 |13.667    5.54 | 19.67    1.22
                 1.750    0.74 | 7.750    1.35 |13.750    5.54 | 19.75    1.22
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                 1.833    0.74 | 7.833    1.35 |13.833    5.54 | 19.83    1.22
                 1.917    0.74 | 7.917    1.35 |13.917    5.54 | 19.92    1.22
                 2.000    0.74 | 8.000    1.35 |14.000    5.54 | 20.00    1.22
                 2.083    0.88 | 8.083    1.82 |14.083    2.03 | 20.08    0.81
                 2.167    0.88 | 8.167    1.82 |14.167    2.03 | 20.17    0.81
                 2.250    0.88 | 8.250    1.82 |14.250    2.03 | 20.25    0.81
                 2.333    0.88 | 8.333    1.82 |14.333    2.03 | 20.33    0.81
                 2.417    0.88 | 8.417    1.82 |14.417    2.03 | 20.42    0.81
                 2.500    0.88 | 8.500    1.82 |14.500    2.03 | 20.50    0.81
                 2.583    0.88 | 8.583    1.82 |14.583    2.03 | 20.58    0.81
                 2.667    0.88 | 8.667    1.82 |14.667    2.03 | 20.67    0.81
                 2.750    0.88 | 8.750    1.82 |14.750    2.03 | 20.75    0.81
                 2.833    0.88 | 8.833    1.82 |14.833    2.03 | 20.83    0.81
                 2.917    0.88 | 8.917    1.82 |14.917    2.03 | 20.92    0.81
                 3.000    0.88 | 9.000    1.82 |15.000    2.03 | 21.00    0.81
                 3.083    0.88 | 9.083    2.16 |15.083    2.03 | 21.08    0.81
                 3.167    0.88 | 9.167    2.16 |15.167    2.03 | 21.17    0.81
                 3.250    0.88 | 9.250    2.16 |15.250    2.03 | 21.25    0.81
                 3.333    0.88 | 9.333    2.16 |15.333    2.03 | 21.33    0.81
                 3.417    0.88 | 9.417    2.16 |15.417    2.03 | 21.42    0.81
                 3.500    0.88 | 9.500    2.16 |15.500    2.03 | 21.50    0.81
                 3.583    0.88 | 9.583    2.43 |15.583    2.03 | 21.58    0.81
                 3.667    0.88 | 9.667    2.43 |15.667    2.03 | 21.67    0.81
                 3.750    0.88 | 9.750    2.43 |15.750    2.03 | 21.75    0.81
                 3.833    0.88 | 9.833    2.43 |15.833    2.03 | 21.83    0.81
                 3.917    0.88 | 9.917    2.43 |15.917    2.03 | 21.92    0.81
                 4.000    0.88 |10.000    2.43 |16.000    2.03 | 22.00    0.81
                 4.083    1.08 |10.083    3.11 |16.083    1.22 | 22.08    0.81
                 4.167    1.08 |10.167    3.11 |16.167    1.22 | 22.17    0.81
                 4.250    1.08 |10.250    3.11 |16.250    1.22 | 22.25    0.81
                 4.333    1.08 |10.333    3.11 |16.333    1.22 | 22.33    0.81
                 4.417    1.08 |10.417    3.11 |16.417    1.22 | 22.42    0.81
                 4.500    1.08 |10.500    3.11 |16.500    1.22 | 22.50    0.81
                 4.583    1.08 |10.583    4.19 |16.583    1.22 | 22.58    0.81
                 4.667    1.08 |10.667    4.19 |16.667    1.22 | 22.67    0.81
                 4.750    1.08 |10.750    4.19 |16.750    1.22 | 22.75    0.81
                 4.833    1.08 |10.833    4.19 |16.833    1.22 | 22.83    0.81
                 4.917    1.08 |10.917    4.19 |16.917    1.22 | 22.92    0.81
                 5.000    1.08 |11.000    4.19 |17.000    1.22 | 23.00    0.81
                 5.083    1.08 |11.083    6.48 |17.083    1.22 | 23.08    0.81
                 5.167    1.08 |11.167    6.48 |17.167    1.22 | 23.17    0.81
                 5.250    1.08 |11.250    6.48 |17.250    1.22 | 23.25    0.81
                 5.333    1.08 |11.333    6.48 |17.333    1.22 | 23.33    0.81
                 5.417    1.08 |11.417    6.48 |17.417    1.22 | 23.42    0.81
                 5.500    1.08 |11.500    6.48 |17.500    1.22 | 23.50    0.81
                 5.583    1.08 |11.583   28.08 |17.583    1.22 | 23.58    0.81
                 5.667    1.08 |11.667   28.08 |17.667    1.22 | 23.67    0.81
                 5.750    1.08 |11.750   28.08 |17.750    1.22 | 23.75    0.81
                 5.833    1.08 |11.833   74.51 |17.833    1.22 | 23.83    0.81
                 5.917    1.08 |11.917   74.52 |17.917    1.22 | 23.92    0.81
                 6.000    1.08 |12.000   74.52 |18.000    1.22 | 24.00    0.81

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.036 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  22.799
     TOTAL RAINFALL   (mm)=  67.540
     RUNOFF COEFFICIENT   =   0.338

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

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--------------------
| CALIB              |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.31          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     45.53         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         36.19
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.79 (ii)     3.06 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.32          0.27
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.06          0.00           0.064 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          66.14
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB              |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     26.96         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         36.19
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.31 (ii)     2.57 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.33          0.29
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.02          0.00           0.022 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          66.14
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
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     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1101):      0.31   0.064    12.00    66.14
      + ID2= 2 ( 1102):      0.11   0.022    12.00    66.14
        ==================================================
        ID = 3 ( 2001):      0.42   0.086    12.00    66.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.97          0.14
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     86.18         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         36.19
                over (min)       5.00         10.00
     Storage Coeff.  (min)=      2.63 (ii)     6.31 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
     Unit Hyd. peak  (cms)=      0.29          0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.20          0.01           0.213 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          61.42
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1103):      1.11   0.213    12.00    61.42
      + ID2= 2 ( 2001):      0.42   0.086    12.00    66.14
        ==================================================
        ID = 3 ( 2002):      1.53   0.299    12.00    62.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```



```
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.36          0.05
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     52.54         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         36.19
                over (min)       5.00         10.00
     Storage Coeff.  (min)=      1.95 (ii)     5.58 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
     Unit Hyd. peak  (cms)=      0.31          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.08          0.00           0.079 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          61.58
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1104):      0.41   0.079    12.00    61.58
      + ID2= 2 ( 2002):      1.53   0.299    12.00    62.71
        ==================================================
        ID = 3 ( 2003):      1.95   0.379    12.00    62.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801      0.0575
                          0.0012     0.0001   |   0.0965      0.0712
                          0.0013     0.0085   |   0.1106      0.0816
                          0.0238     0.0256   |   0.1230      0.0900
                          0.0593     0.0421   |   0.0000      0.0000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 ( 2003)      1.948      0.379      12.00       62.47
   OUTFLOW: ID= 1 ( 3001)      1.948      0.080      12.08       62.46

              PEAK   FLOW    REDUCTION [Qout/Qin](%)= 21.13
              TIME SHIFT OF PEAK FLOW          (min)=  5.00
```



```
              MAXIMUM  STORAGE   USED       (ha.m.)=  0.0577

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      3.96          0.21
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    166.75         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         36.19
                over (min)       5.00         10.00
     Storage Coeff.  (min)=      3.91 (ii)     6.35 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
     Unit Hyd. peak  (cms)=      0.25          0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.81          0.02           0.826 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          64.54
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.38          1.25
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    104.18         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     74.52         33.94
                over (min)       5.00         15.00
     Storage Coeff.  (min)=      2.95 (ii)    13.82 (ii)
     Unit Hyd. Tpeak (min)=      5.00         15.00
     Unit Hyd. peak  (cms)=      0.28          0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=      0.08          0.07           0.142 (iii)
     TIME TO PEAK    (hrs)=     12.00         12.08          12.00
     RUNOFF VOLUME    (mm)=     66.54         26.57          35.80
     TOTAL RAINFALL   (mm)=     67.54         67.54          67.54
     RUNOFF COEFFICIENT   =      0.99          0.39           0.53

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
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```
          CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 + 2 =  3     |        AREA    QPEAK     TPEAK      R.V.
--------------------        (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1000):    1.63    0.142     12.00     35.80
      + ID2= 2 (  1200):    4.17    0.826     12.00     64.54
        ==================================================
        ID = 3 (  2004):    5.80    0.969     12.00     56.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR( 3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000   |    0.4950     0.1485
                          0.1800     0.0870   |    0.5750     0.1645
                          0.3000     0.1120   |    0.6650     0.1815
                          0.3750     0.1280   |    0.0000     0.0000

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)     5.799     0.969      12.00       56.47
   OUTFLOW: ID= 1 (  3002)     5.799     0.307      12.17       56.45

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 31.69
                 TIME SHIFT OF PEAK FLOW        (min)= 10.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.1143

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--------------------
| ADD HYD  (  2005)|
|   1 + 2 =  3     |        AREA    QPEAK     TPEAK      R.V.
--------------------        (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  3001):    1.95    0.080     12.08     62.46
      + ID2= 2 (  3002):    5.80    0.307     12.17     56.45
        ==================================================
        ID = 3 (  2005):    7.75    0.387     12.17     57.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 + 2 =  3     |        AREA    QPEAK     TPEAK      R.V.
--------------------        (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1300):    0.41    0.036     12.00     22.80
      + ID2= 2 (  2005):    7.75    0.387     12.17     57.96
        ==================================================
        ID = 3 (  2006):    8.16    0.395     12.08     56.20

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



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--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.13         0.12
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     40.25        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     74.52        33.94
                over (min)      5.00        15.00
     Storage Coeff.  (min)=      1.66 (ii)   12.54 (ii)
     Unit Hyd. Tpeak (min)=      5.00        15.00
     Unit Hyd. peak  (cms)=      0.32         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.03         0.01          0.032 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.08         12.00
     RUNOFF VOLUME    (mm)=     66.54        26.57         47.12
     TOTAL RAINFALL   (mm)=     67.54        67.54         67.54
     RUNOFF COEFFICIENT   =      0.99         0.39          0.70

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2007)|
|   1 + 2 =  3     |        AREA    QPEAK     TPEAK      R.V.
--------------------        (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1400):    0.24    0.032     12.00     47.12
      + ID2= 2 (  2006):    8.16    0.395     12.08     56.20
        ==================================================
        ID = 3 (  2007):    8.40    0.407     12.08     55.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V     V   I    SSSSS  U   U    A    L
       V     V   I    SS     U   U   A A   L
        V   V    I     SS    U   U  AAAAA  L
         V V     I      SS   U   U  A   A  L
          VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\0ca75d
eb-7f1c-404e-a5cf-7f79ee02930a\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\0ca75d
eb-7f1c-404e-a5cf-7f79ee02930a\scenar


DATE: 02/11/2020                          TIME: 01:51:16

USER:


COMMENTS: ____________________________________________________


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  **************************************************
  ** SIMULATION : Run 04                          **
  **************************************************


--------------------
|    READ STORM     |    Filename: C:\Users\zhouj\AppD
|                   |              ata\Local\Temp\
|                   |              24804864-1db5-42ad-98d7-7770ddd644f0\b3885e87
| Ptotal= 78.13 mm  |    Comments: 25yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.86	6.25	1.56	12.25	11.25	18.25	1.41
0.50	0.86	6.50	1.56	12.50	11.25	18.50	1.41
0.75	0.86	6.75	1.56	12.75	5.78	18.75	1.41
1.00	0.86	7.00	1.56	13.00	5.78	19.00	1.41
1.25	0.86	7.25	1.56	13.25	1.09	19.25	1.41
1.50	0.86	7.50	1.56	13.50	1.09	19.50	1.41
1.75	0.86	7.75	1.56	13.75	6.40	19.75	1.41
2.00	0.86	8.00	1.56	14.00	6.40	20.00	1.41
2.25	1.02	8.25	2.11	14.25	2.34	20.25	0.94
2.50	1.02	8.50	2.11	14.50	2.34	20.50	0.94
2.75	1.02	8.75	2.11	14.75	2.34	20.75	0.94
3.00	1.02	9.00	2.11	15.00	2.34	21.00	0.94
3.25	1.02	9.25	2.50	15.25	2.34	21.25	0.94
3.50	1.02	9.50	2.50	15.50	2.34	21.50	0.94
3.75	1.02	9.75	2.81	15.75	2.34	21.75	0.94
4.00	1.02	10.00	2.81	16.00	2.34	22.00	0.94
4.25	1.25	10.25	3.59	16.25	1.41	22.25	0.94
4.50	1.25	10.50	3.59	16.50	1.41	22.50	0.94
4.75	1.25	10.75	4.84	16.75	1.41	22.75	0.94
5.00	1.25	11.00	4.84	17.00	1.41	23.00	0.94
5.25	1.25	11.25	7.50	17.25	1.41	23.25	0.94
5.50	1.25	11.50	7.50	17.50	1.41	23.50	0.94
5.75	1.25	11.75	32.49	17.75	1.41	23.75	0.94

6.00	1.25	12.00	86.22	18.00	1.41	24.00	0.94

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--------------------
| CALIB            |
| NASHYD  (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.86	6.083	1.56	12.083	11.26	18.08	1.41
0.167	0.86	6.167	1.56	12.167	11.25	18.17	1.41
0.250	0.86	6.250	1.56	12.250	11.25	18.25	1.41
0.333	0.86	6.333	1.56	12.333	11.25	18.33	1.41
0.417	0.86	6.417	1.56	12.417	11.25	18.42	1.41
0.500	0.86	6.500	1.56	12.500	11.25	18.50	1.41
0.583	0.86	6.583	1.56	12.583	5.78	18.58	1.41
0.667	0.86	6.667	1.56	12.667	5.78	18.67	1.41
0.750	0.86	6.750	1.56	12.750	5.78	18.75	1.41
0.833	0.86	6.833	1.56	12.833	5.78	18.83	1.41
0.917	0.86	6.917	1.56	12.917	5.78	18.92	1.41
1.000	0.86	7.000	1.56	13.000	5.78	19.00	1.41
1.083	0.86	7.083	1.56	13.083	1.09	19.08	1.41
1.167	0.86	7.167	1.56	13.167	1.09	19.17	1.41
1.250	0.86	7.250	1.56	13.250	1.09	19.25	1.41
1.333	0.86	7.333	1.56	13.333	1.09	19.33	1.41
1.417	0.86	7.417	1.56	13.417	1.09	19.42	1.41
1.500	0.86	7.500	1.56	13.500	1.09	19.50	1.41
1.583	0.86	7.583	1.56	13.583	6.40	19.58	1.41
1.667	0.86	7.667	1.56	13.667	6.40	19.67	1.41
1.750	0.86	7.750	1.56	13.750	6.40	19.75	1.41
1.833	0.86	7.833	1.56	13.833	6.40	19.83	1.41
1.917	0.86	7.917	1.56	13.917	6.40	19.92	1.41
2.000	0.86	8.000	1.56	14.000	6.40	20.00	1.41
2.083	1.02	8.083	2.11	14.083	2.34	20.08	0.94
2.167	1.02	8.167	2.11	14.167	2.34	20.17	0.94
2.250	1.02	8.250	2.11	14.250	2.34	20.25	0.94
2.333	1.02	8.333	2.11	14.333	2.34	20.33	0.94
2.417	1.02	8.417	2.11	14.417	2.34	20.42	0.94
2.500	1.02	8.500	2.11	14.500	2.34	20.50	0.94
2.583	1.02	8.583	2.11	14.583	2.34	20.58	0.94
2.667	1.02	8.667	2.11	14.667	2.34	20.67	0.94
2.750	1.02	8.750	2.11	14.750	2.34	20.75	0.94
2.833	1.02	8.833	2.11	14.833	2.34	20.83	0.94
2.917	1.02	8.917	2.11	14.917	2.34	20.92	0.94
3.000	1.02	9.000	2.11	15.000	2.34	21.00	0.94
3.083	1.02	9.083	2.50	15.083	2.34	21.08	0.94
3.167	1.02	9.167	2.50	15.167	2.34	21.17	0.94
3.250	1.02	9.250	2.50	15.250	2.34	21.25	0.94
3.333	1.02	9.333	2.50	15.333	2.34	21.33	0.94
3.417	1.02	9.417	2.50	15.417	2.34	21.42	0.94
3.500	1.02	9.500	2.50	15.500	2.34	21.50	0.94
3.583	1.02	9.583	2.81	15.583	2.34	21.58	0.94
3.667	1.02	9.667	2.81	15.667	2.34	21.67	0.94
3.750	1.02	9.750	2.81	15.750	2.34	21.75	0.94
3.833	1.02	9.833	2.81	15.833	2.34	21.83	0.94
3.917	1.02	9.917	2.81	15.917	2.34	21.92	0.94

```
           4.000    1.02 |10.000    2.81 |16.000    2.34 | 22.00    0.94
           4.083    1.25 |10.083    3.59 |16.083    1.41 | 22.08    0.94
           4.167    1.25 |10.167    3.59 |16.167    1.41 | 22.17    0.94
           4.250    1.25 |10.250    3.59 |16.250    1.41 | 22.25    0.94
           4.333    1.25 |10.333    3.59 |16.333    1.41 | 22.33    0.94
           4.417    1.25 |10.417    3.59 |16.417    1.41 | 22.42    0.94
           4.500    1.25 |10.500    3.59 |16.500    1.41 | 22.50    0.94
           4.583    1.25 |10.583    4.84 |16.583    1.41 | 22.58    0.94
           4.667    1.25 |10.667    4.84 |16.667    1.41 | 22.67    0.94
           4.750    1.25 |10.750    4.84 |16.750    1.41 | 22.75    0.94
           4.833    1.25 |10.833    4.84 |16.833    1.41 | 22.83    0.94
           4.917    1.25 |10.917    4.84 |16.917    1.41 | 22.92    0.94
           5.000    1.25 |11.000    4.84 |17.000    1.41 | 23.00    0.94
           5.083    1.25 |11.083    7.50 |17.083    1.41 | 23.08    0.94
           5.167    1.25 |11.167    7.50 |17.167    1.41 | 23.17    0.94
           5.250    1.25 |11.250    7.50 |17.250    1.41 | 23.25    0.94
           5.333    1.25 |11.333    7.50 |17.333    1.41 | 23.33    0.94
           5.417    1.25 |11.417    7.50 |17.417    1.41 | 23.42    0.94
           5.500    1.25 |11.500    7.50 |17.500    1.41 | 23.50    0.94
           5.583    1.25 |11.583   32.49 |17.583    1.41 | 23.58    0.94
           5.667    1.25 |11.667   32.49 |17.667    1.41 | 23.67    0.94
           5.750    1.25 |11.750   32.49 |17.750    1.41 | 23.75    0.94
           5.833    1.25 |11.833   86.21 |17.833    1.41 | 23.83    0.94
           5.917    1.25 |11.917   86.22 |17.917    1.41 | 23.92    0.94
           6.000    1.25 |12.000   86.22 |18.000    1.41 | 24.00    0.94

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.046 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  29.080
     TOTAL RAINFALL   (mm)=  78.128
     RUNOFF COEFFICIENT   =   0.372

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.31         0.00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     45.53        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     86.22        46.06
                over (min)       5.00         5.00
     Storage Coeff.  (min)=      1.69 (ii)    2.88 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.32         0.28
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.07         0.00          0.074 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00         12.00
     RUNOFF VOLUME    (mm)=     77.13        33.89         76.69
     TOTAL RAINFALL   (mm)=     78.13        78.13         78.13
     RUNOFF COEFFICIENT   =      0.99         0.43          0.98

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



```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11         0.00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     26.96        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     86.22        46.06
                over (min)       5.00         5.00
     Storage Coeff.  (min)=      1.23 (ii)    2.43 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.33         0.30
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.03         0.00          0.026 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00         12.00
     RUNOFF VOLUME    (mm)=     77.13        33.89         76.69
     TOTAL RAINFALL   (mm)=     78.13        78.13         78.13
     RUNOFF COEFFICIENT   =      0.99         0.43          0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2001)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1101):     0.31   0.074    12.00    76.69
      + ID2= 2 ( 1102):     0.11   0.026    12.00    76.69
        ==================================================
        ID = 3 ( 2001):     0.42   0.100    12.00    76.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.97         0.14
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     86.18        40.00
```



```
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     86.22        46.06
                over (min)       5.00        10.00
     Storage Coeff.  (min)=      2.48 (ii)    5.96 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.29         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.23         0.02          0.248 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00         12.00
     RUNOFF VOLUME    (mm)=     77.13        33.89         71.59
     TOTAL RAINFALL   (mm)=     78.13        78.13         78.13
     RUNOFF COEFFICIENT   =      0.99         0.43          0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2002)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1103):     1.11   0.248    12.00    71.59
      + ID2= 2 ( 2001):     0.42   0.100    12.00    76.69
        ==================================================
        ID = 3 ( 2002):     1.53   0.348    12.00    72.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.36         0.05
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     52.54        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     86.22        46.06
                over (min)       5.00        10.00
     Storage Coeff.  (min)=      1.84 (ii)    5.27 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.32         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.09         0.01          0.093 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00         12.00
     RUNOFF VOLUME    (mm)=     77.13        33.89         71.76
     TOTAL RAINFALL   (mm)=     78.13        78.13         78.13
     RUNOFF COEFFICIENT   =      0.99         0.43          0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```



```
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2003)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1104):     0.41   0.093    12.00    71.76
      + ID2= 2 ( 2002):     1.53   0.348    12.00    72.99
        ==================================================
        ID = 3 ( 2003):     1.95   0.440    12.00    72.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000   |    0.0801     0.0575
                          0.0012     0.0001   |    0.0965     0.0712
                          0.0013     0.0085   |    0.1106     0.0816
                          0.0238     0.0256   |    0.1230     0.0900
                          0.0593     0.0421   |    0.0000     0.0000

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 ( 2003)     1.948      0.440      12.00       72.73
   OUTFLOW: ID= 1 ( 3001)     1.948      0.090      12.08       72.72

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.44
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0661

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      3.96         0.21
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    166.75        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     86.22        46.06
                over (min)       5.00        10.00
     Storage Coeff.  (min)=      3.68 (ii)    5.99 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.25         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.94         0.02          0.961 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00         12.00
     RUNOFF VOLUME    (mm)=     77.13        33.89         74.96
     TOTAL RAINFALL   (mm)=     78.13        78.13         78.13
     RUNOFF COEFFICIENT   =      0.99         0.43          0.96
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38         1.25
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     104.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      86.22        46.06
                over (min)       5.00        15.00
     Storage Coeff.  (min)=       2.78 (ii)   12.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.10         0.178 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.00
     RUNOFF VOLUME    (mm)=      77.13        33.89         43.87
     TOTAL RAINFALL   (mm)=      78.13        78.13         78.13
     RUNOFF COEFFICIENT   =       0.99         0.43          0.56

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):    1.63    0.178    12.00    43.87
      + ID2= 2 (  1200):    4.17    0.961    12.00    74.96
        ==================================================
        ID = 3 (  2004):    5.80    1.139    12.00    66.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |  0.4950      0.1485
                         0.1800     0.0870    |  0.5750      0.1645
```



```
                         0.3000     0.1120    |  0.6650      0.1815
                         0.3750     0.1280    |  0.0000      0.0000

                            AREA     QPEAK      TPEAK        R.V.
                            (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)  5.799     1.139      12.00       66.24
   OUTFLOW: ID= 1 (  3002)  5.799     0.389      12.08       66.22

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 34.17
                TIME SHIFT OF PEAK FLOW         (min)=  5.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1318

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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):    1.95    0.090    12.08    72.72
      + ID2= 2 (  3002):    5.80    0.389    12.08    66.22
        ==================================================
        ID = 3 (  2005):    7.75    0.479    12.08    67.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):    0.41    0.046    12.00    29.08
      + ID2= 2 (  2005):    7.75    0.479    12.08    67.85
        ==================================================
        ID = 3 (  2006):    8.16    0.495    12.08    65.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13         0.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      86.22        46.06
                over (min)       5.00        15.00
     Storage Coeff.  (min)=       1.57 (ii)   11.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.01         0.039 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.00
     RUNOFF VOLUME    (mm)=      77.13        33.89         56.13
     TOTAL RAINFALL   (mm)=      78.13        78.13         78.13
     RUNOFF COEFFICIENT   =       0.99         0.43          0.72
```



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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):    0.24    0.039    12.00    56.13
      + ID2= 2 (  2006):    8.16    0.495    12.08    65.90
        ==================================================
        ID = 3 (  2007):    8.40    0.510    12.08    65.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U    U    A     L
       V    V   I    SS     U    U   A A    L
        V  V    I     SS    U    U  AAAAA   L
        V  V    I      SS   U    U  A   A   L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\0b624e
bc-4b35-408c-90c3-24ee3bc56e7b\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\0b624e
bc-4b35-408c-90c3-24ee3bc56e7b\scenar


DATE: 02/11/2020                              TIME: 01:51:16

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
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------------------------
 **********************************************
 ** SIMULATION : Run 05                     **
 **********************************************

--------------------
|    READ STORM    |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              24804864-1db5-42ad-98d7-7770ddd644f0\9cd8582c
| Ptotal= 85.40 mm |    Comments: 50yr24hrSCS_Midland
--------------------
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.25    0.94 |  6.25    1.71 | 12.25   12.30 | 18.25    1.54
               0.50    0.94 |  6.50    1.71 | 12.50   12.30 | 18.50    1.54
               0.75    0.94 |  6.75    1.71 | 12.75    6.32 | 18.75    1.54
               1.00    0.94 |  7.00    1.71 | 13.00    6.32 | 19.00    1.54
               1.25    0.94 |  7.25    1.71 | 13.25    1.20 | 19.25    1.54
               1.50    0.94 |  7.50    1.71 | 13.50    1.20 | 19.50    1.54
               1.75    0.94 |  7.75    1.71 | 13.75    7.00 | 19.75    1.54
               2.00    0.94 |  8.00    1.71 | 14.00    7.00 | 20.00    1.54
               2.25    1.11 |  8.25    2.31 | 14.25    2.56 | 20.25    1.02
               2.50    1.11 |  8.50    2.31 | 14.50    2.56 | 20.50    1.02
               2.75    1.11 |  8.75    2.31 | 14.75    2.56 | 20.75    1.02
               3.00    1.11 |  9.00    2.31 | 15.00    2.56 | 21.00    1.02
               3.25    1.11 |  9.25    2.73 | 15.25    2.56 | 21.25    1.02
               3.50    1.11 |  9.50    2.73 | 15.50    2.56 | 21.50    1.02
               3.75    1.11 |  9.75    3.07 | 15.75    2.56 | 21.75    1.02
               4.00    1.11 | 10.00    3.07 | 16.00    2.56 | 22.00    1.02
               4.25    1.37 | 10.25    3.93 | 16.25    1.54 | 22.25    1.02
               4.50    1.37 | 10.50    3.93 | 16.50    1.54 | 22.50    1.02
               4.75    1.37 | 10.75    5.29 | 16.75    1.54 | 22.75    1.02
               5.00    1.37 | 11.00    5.29 | 17.00    1.54 | 23.00    1.02
               5.25    1.37 | 11.25    8.20 | 17.25    1.54 | 23.25    1.02
               5.50    1.37 | 11.50    8.20 | 17.50    1.54 | 23.50    1.02
               5.75    1.37 | 11.75   35.53 | 17.75    1.54 | 23.75    1.02
               6.00    1.37 | 12.00   94.28 | 18.00    1.54 | 24.00    1.02

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--------------------
| CALIB              |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


                          ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083    0.94 | 6.083    1.71 |12.083   12.31 | 18.08    1.54
             0.167    0.94 | 6.167    1.71 |12.167   12.30 | 18.17    1.54
             0.250    0.94 | 6.250    1.71 |12.250   12.30 | 18.25    1.54
             0.333    0.94 | 6.333    1.71 |12.333   12.30 | 18.33    1.54
             0.417    0.94 | 6.417    1.71 |12.417   12.30 | 18.42    1.54
             0.500    0.94 | 6.500    1.71 |12.500   12.30 | 18.50    1.54
             0.583    0.94 | 6.583    1.71 |12.583    6.32 | 18.58    1.54
             0.667    0.94 | 6.667    1.71 |12.667    6.32 | 18.67    1.54
             0.750    0.94 | 6.750    1.71 |12.750    6.32 | 18.75    1.54
             0.833    0.94 | 6.833    1.71 |12.833    6.32 | 18.83    1.54
```

0.917	0.94	6.917	1.71	12.917	6.32	18.92	1.54
1.000	0.94	7.000	1.71	13.000	6.32	19.00	1.54
1.083	0.94	7.083	1.71	13.083	1.20	19.08	1.54
1.167	0.94	7.167	1.71	13.167	1.20	19.17	1.54
1.250	0.94	7.250	1.71	13.250	1.20	19.25	1.54
1.333	0.94	7.333	1.71	13.333	1.20	19.33	1.54
1.417	0.94	7.417	1.71	13.417	1.20	19.42	1.54
1.500	0.94	7.500	1.71	13.500	1.20	19.50	1.54
1.583	0.94	7.583	1.71	13.583	7.00	19.58	1.54
1.667	0.94	7.667	1.71	13.667	7.00	19.67	1.54
1.750	0.94	7.750	1.71	13.750	7.00	19.75	1.54
1.833	0.94	7.833	1.71	13.833	7.00	19.83	1.54
1.917	0.94	7.917	1.71	13.917	7.00	19.92	1.54
2.000	0.94	8.000	1.71	14.000	7.00	20.00	1.54
2.083	1.11	8.083	2.31	14.083	2.56	20.08	1.02
2.167	1.11	8.167	2.31	14.167	2.56	20.17	1.02
2.250	1.11	8.250	2.31	14.250	2.56	20.25	1.02
2.333	1.11	8.333	2.31	14.333	2.56	20.33	1.02
2.417	1.11	8.417	2.31	14.417	2.56	20.42	1.02
2.500	1.11	8.500	2.31	14.500	2.56	20.50	1.02
2.583	1.11	8.583	2.31	14.583	2.56	20.58	1.02
2.667	1.11	8.667	2.31	14.667	2.56	20.67	1.02
2.750	1.11	8.750	2.31	14.750	2.56	20.75	1.02
2.833	1.11	8.833	2.31	14.833	2.56	20.83	1.02
2.917	1.11	8.917	2.31	14.917	2.56	20.92	1.02
3.000	1.11	9.000	2.31	15.000	2.56	21.00	1.02
3.083	1.11	9.083	2.73	15.083	2.56	21.08	1.02
3.167	1.11	9.167	2.73	15.167	2.56	21.17	1.02
3.250	1.11	9.250	2.73	15.250	2.56	21.25	1.02
3.333	1.11	9.333	2.73	15.333	2.56	21.33	1.02
3.417	1.11	9.417	2.73	15.417	2.56	21.42	1.02
3.500	1.11	9.500	2.73	15.500	2.56	21.50	1.02
3.583	1.11	9.583	3.07	15.583	2.56	21.58	1.02
3.667	1.11	9.667	3.07	15.667	2.56	21.67	1.02
3.750	1.11	9.750	3.07	15.750	2.56	21.75	1.02
3.833	1.11	9.833	3.07	15.833	2.56	21.83	1.02
3.917	1.11	9.917	3.07	15.917	2.56	21.92	1.02
4.000	1.11	10.000	3.07	16.000	2.56	22.00	1.02
4.083	1.37	10.083	3.93	16.083	1.54	22.08	1.02
4.167	1.37	10.167	3.93	16.167	1.54	22.17	1.02
4.250	1.37	10.250	3.93	16.250	1.54	22.25	1.02
4.333	1.37	10.333	3.93	16.333	1.54	22.33	1.02
4.417	1.37	10.417	3.93	16.417	1.54	22.42	1.02
4.500	1.37	10.500	3.93	16.500	1.54	22.50	1.02
4.583	1.37	10.583	5.29	16.583	1.54	22.58	1.02
4.667	1.37	10.667	5.29	16.667	1.54	22.67	1.02
4.750	1.37	10.750	5.29	16.750	1.54	22.75	1.02
4.833	1.37	10.833	5.29	16.833	1.54	22.83	1.02
4.917	1.37	10.917	5.29	16.917	1.54	22.92	1.02
5.000	1.37	11.000	5.29	17.000	1.54	23.00	1.02
5.083	1.37	11.083	8.20	17.083	1.54	23.08	1.02
5.167	1.37	11.167	8.20	17.167	1.54	23.17	1.02
5.250	1.37	11.250	8.20	17.250	1.54	23.25	1.02
5.333	1.37	11.333	8.20	17.333	1.54	23.33	1.02
5.417	1.37	11.417	8.20	17.417	1.54	23.42	1.02
5.500	1.37	11.500	8.20	17.500	1.54	23.50	1.02
5.583	1.37	11.583	35.53	17.583	1.54	23.58	1.02
5.667	1.37	11.667	35.53	17.667	1.54	23.67	1.02
5.750	1.37	11.750	35.53	17.750	1.54	23.75	1.02
5.833	1.37	11.833	94.27	17.833	1.54	23.83	1.02
5.917	1.37	11.917	94.28	17.917	1.54	23.92	1.02
6.000	1.37	12.000	94.28	18.000	1.54	24.00	1.02


```
    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW      (cms)=   0.053 (i)
    TIME TO PEAK   (hrs)=  12.000
    RUNOFF VOLUME   (mm)=  33.604
    TOTAL RAINFALL  (mm)=  85.403
    RUNOFF COEFFICIENT   =   0.393

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

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--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.31         0.00
    Dep. Storage     (mm)=       1.00         5.00
    Average Slope     (%)=       1.00         2.00
    Length            (m)=      45.53        40.00
    Mannings n           =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=      94.28        53.16
               over (min)        5.00         5.00
    Storage Coeff.  (min)=       1.63 (ii)    2.78 (ii)
    Unit Hyd. Tpeak (min)=       5.00         5.00
    Unit Hyd. peak  (cms)=       0.32         0.28
                                                          *TOTALS*
    PEAK FLOW      (cms)=        0.08         0.00          0.081 (iii)
    TIME TO PEAK   (hrs)=       12.00        12.00         12.00
    RUNOFF VOLUME   (mm)=       84.40        39.16         83.95
    TOTAL RAINFALL  (mm)=       85.40        85.40         85.40
    RUNOFF COEFFICIENT   =       0.99         0.46          0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.11         0.00
    Dep. Storage     (mm)=       1.00         5.00
    Average Slope     (%)=       1.00         2.00
    Length            (m)=      26.96        40.00
    Mannings n           =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=      94.28        53.16
               over (min)        5.00         5.00
    Storage Coeff.  (min)=       1.19 (ii)    2.34 (ii)
    Unit Hyd. Tpeak (min)=       5.00         5.00
    Unit Hyd. peak  (cms)=       0.33         0.30
                                                          *TOTALS*
    PEAK FLOW      (cms)=        0.03         0.00          0.028 (iii)
```



```
    TIME TO PEAK   (hrs)=       12.00        12.00         12.00
    RUNOFF VOLUME   (mm)=       84.40        39.16         83.95
    TOTAL RAINFALL  (mm)=       85.40        85.40         85.40
    RUNOFF COEFFICIENT   =       0.99         0.46          0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2001)|
|   1 + 2 =  3     |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):      0.31   0.081    12.00    83.95
      + ID2= 2 (  1102):      0.11   0.028    12.00    83.95
        ===============================================
        ID = 3 (  2001):      0.42   0.110    12.00    83.95

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.97         0.14
    Dep. Storage     (mm)=       1.00         5.00
    Average Slope     (%)=       1.00         2.00
    Length            (m)=      86.18        40.00
    Mannings n           =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=      94.28        53.16
               over (min)        5.00        10.00
    Storage Coeff.  (min)=       2.39 (ii)    5.75 (ii)
    Unit Hyd. Tpeak (min)=       5.00        10.00
    Unit Hyd. peak  (cms)=       0.30         0.15
                                                          *TOTALS*
    PEAK FLOW      (cms)=        0.25         0.02          0.272 (iii)
    TIME TO PEAK   (hrs)=       12.00        12.00         12.00
    RUNOFF VOLUME   (mm)=       84.40        39.16         78.61
    TOTAL RAINFALL  (mm)=       85.40        85.40         85.40
    RUNOFF COEFFICIENT   =       0.99         0.46          0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ADD HYD  (  2002)|
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|   1 + 2 =  3     |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):      1.11   0.272    12.00    78.61
      + ID2= 2 (  2001):      0.42   0.110    12.00    83.95
        ===============================================
        ID = 3 (  2002):      1.53   0.382    12.00    80.07

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.36         0.05
    Dep. Storage     (mm)=       1.00         5.00
    Average Slope     (%)=       1.00         2.00
    Length            (m)=      52.54        40.00
    Mannings n           =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=      94.28        53.16
               over (min)        5.00        10.00
    Storage Coeff.  (min)=       1.78 (ii)    5.08 (ii)
    Unit Hyd. Tpeak (min)=       5.00        10.00
    Unit Hyd. peak  (cms)=       0.32         0.16
                                                          *TOTALS*
    PEAK FLOW      (cms)=        0.09         0.01          0.102 (iii)
    TIME TO PEAK   (hrs)=       12.00        12.00         12.00
    RUNOFF VOLUME   (mm)=       84.40        39.16         78.79
    TOTAL RAINFALL  (mm)=       85.40        85.40         85.40
    RUNOFF COEFFICIENT   =       0.99         0.46          0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|   1 + 2 =  3     |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):      0.41   0.102    12.00    78.79
      + ID2= 2 (  2002):      1.53   0.382    12.00    80.07
        ===============================================
        ID = 3 (  2003):      1.95   0.483    12.00    79.80

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801      0.0575
                          0.0012     0.0001   |   0.0965      0.0712
```

```
                        0.0013     0.0085   |   0.1106      0.0816
                        0.0238     0.0256   |   0.1230      0.0900
                        0.0593     0.0421   |   0.0000      0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2003)    1.948     0.483     12.00      79.80
   OUTFLOW: ID= 1 (  3001)    1.948     0.097     12.08      79.79

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.07
                TIME SHIFT OF PEAK FLOW         (min)=  5.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0719

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--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96          0.21
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     166.75         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      94.28         53.16
                over (min)       5.00         10.00
     Storage Coeff.  (min)=       3.55 (ii)     5.78 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.26          0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.03          0.03           1.055 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00           12.00
     RUNOFF VOLUME    (mm)=      84.40         39.16           82.14
     TOTAL RAINFALL   (mm)=      85.40         85.40           85.40
     RUNOFF COEFFICIENT   =       0.99          0.46            0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38          1.25
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     104.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      94.28         53.16
                over (min)       5.00         15.00
     Storage Coeff.  (min)=       2.68 (ii)    11.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
```



```
     Unit Hyd. peak  (cms)=       0.29          0.09
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.10          0.12           0.203 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08           12.00
     RUNOFF VOLUME    (mm)=      84.40         39.16           49.61
     TOTAL RAINFALL   (mm)=      85.40         85.40           85.40
     RUNOFF COEFFICIENT   =       0.99          0.46            0.58

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1000):      1.63   0.203    12.00    49.61
     + ID2= 2 (  1200):      4.17   1.055    12.00    82.14
       ==================================================
       ID = 3 (  2004):      5.80   1.258    12.00    73.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      0.1485
                          0.1800     0.0870   |   0.5750      0.1645
                          0.3000     0.1120   |   0.6650      0.1815
                          0.3750     0.1280   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2004)     5.799     1.258     12.00      73.01
   OUTFLOW: ID= 1 (  3002)     5.799     0.459     12.08      72.99

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.49
                TIME SHIFT OF PEAK FLOW         (min)=  5.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1433

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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  3001):      1.95   0.097    12.08    79.79
     + ID2= 2 (  3002):      5.80   0.459    12.08    72.99
       ==================================================
       ID = 3 (  2005):      7.75   0.556    12.08    74.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1300):      0.41   0.053    12.00    33.60
     + ID2= 2 (  2005):      7.75   0.556    12.08    74.70
       ==================================================
       ID = 3 (  2006):      8.16   0.574    12.08    72.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13          0.12
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      40.25         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      94.28         53.16
                over (min)       5.00         15.00
     Storage Coeff.  (min)=       1.52 (ii)    10.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.33          0.09
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.03          0.01           0.043 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08           12.00
     RUNOFF VOLUME    (mm)=      84.40         39.16           62.44
     TOTAL RAINFALL   (mm)=      85.40         85.40           85.40
     RUNOFF COEFFICIENT   =       0.99          0.46            0.73

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1400):      0.24   0.043    12.00    62.44
     + ID2= 2 (  2006):      8.16   0.574    12.08    72.63
       ==================================================
       ID = 3 (  2007):      8.40   0.591    12.08    72.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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====================================================================================
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       V    V   I    SSSSS  U   U    A    L
```



```
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
```



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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\392f36
5d-a6b5-4027-affe-eaa7de29556c\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\392f36
5d-a6b5-4027-affe-eaa7de29556c\scenar


DATE: 02/11/2020                         TIME: 01:51:18

USER:


COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
------------------------
  *********************************************
  ** SIMULATION : Run 06                     **
  *********************************************


--------------------
|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               24804864-1db5-42ad-98d7-7770ddd644f0\5db06ce4
| Ptotal= 92.89 mm |     Comments: 100yr24hrSCS_Midland
--------------------
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.25     1.02 |  6.25     1.86 | 12.25    13.38 | 18.25     1.67
                 0.50     1.02 |  6.50     1.86 | 12.50    13.38 | 18.50     1.67
                 0.75     1.02 |  6.75     1.86 | 12.75     6.87 | 18.75     1.67
                 1.00     1.02 |  7.00     1.86 | 13.00     6.87 | 19.00     1.67
                 1.25     1.02 |  7.25     1.86 | 13.25     1.30 | 19.25     1.67
                 1.50     1.02 |  7.50     1.86 | 13.50     1.30 | 19.50     1.67
                 1.75     1.02 |  7.75     1.86 | 13.75     7.62 | 19.75     1.67
                 2.00     1.02 |  8.00     1.86 | 14.00     7.62 | 20.00     1.67
                 2.25     1.21 |  8.25     2.51 | 14.25     2.79 | 20.25     1.11
                 2.50     1.21 |  8.50     2.51 | 14.50     2.79 | 20.50     1.11
                 2.75     1.21 |  8.75     2.51 | 14.75     2.79 | 20.75     1.11
                 3.00     1.21 |  9.00     2.51 | 15.00     2.79 | 21.00     1.11
```

3.25	1.21	9.25	2.97	15.25	2.79	21.25	1.11
3.50	1.21	9.50	2.97	15.50	2.79	21.50	1.11
3.75	1.21	9.75	3.34	15.75	2.79	21.75	1.11
4.00	1.21	10.00	3.34	16.00	2.79	22.00	1.11
4.25	1.49	10.25	4.27	16.25	1.67	22.25	1.11
4.50	1.49	10.50	4.27	16.50	1.67	22.50	1.11
4.75	1.49	10.75	5.76	16.75	1.67	22.75	1.11
5.00	1.49	11.00	5.76	17.00	1.67	23.00	1.11
5.25	1.49	11.25	8.92	17.25	1.67	23.25	1.11
5.50	1.49	11.50	8.92	17.50	1.67	23.50	1.11
5.75	1.49	11.75	38.65	17.75	1.67	23.75	1.11
6.00	1.49	12.00	102.56	18.00	1.67	24.00	1.11

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

--------------------
| CALIB              |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06
```

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.02	6.083	1.86	12.083	13.39	18.08	1.67
0.167	1.02	6.167	1.86	12.167	13.38	18.17	1.67
0.250	1.02	6.250	1.86	12.250	13.38	18.25	1.67
0.333	1.02	6.333	1.86	12.333	13.38	18.33	1.67
0.417	1.02	6.417	1.86	12.417	13.38	18.42	1.67
0.500	1.02	6.500	1.86	12.500	13.38	18.50	1.67
0.583	1.02	6.583	1.86	12.583	6.87	18.58	1.67
0.667	1.02	6.667	1.86	12.667	6.87	18.67	1.67
0.750	1.02	6.750	1.86	12.750	6.87	18.75	1.67
0.833	1.02	6.833	1.86	12.833	6.87	18.83	1.67
0.917	1.02	6.917	1.86	12.917	6.87	18.92	1.67
1.000	1.02	7.000	1.86	13.000	6.87	19.00	1.67
1.083	1.02	7.083	1.86	13.083	1.30	19.08	1.67
1.167	1.02	7.167	1.86	13.167	1.30	19.17	1.67
1.250	1.02	7.250	1.86	13.250	1.30	19.25	1.67
1.333	1.02	7.333	1.86	13.333	1.30	19.33	1.67
1.417	1.02	7.417	1.86	13.417	1.30	19.42	1.67
1.500	1.02	7.500	1.86	13.500	1.30	19.50	1.67
1.583	1.02	7.583	1.86	13.583	7.62	19.58	1.67
1.667	1.02	7.667	1.86	13.667	7.62	19.67	1.67
1.750	1.02	7.750	1.86	13.750	7.62	19.75	1.67
1.833	1.02	7.833	1.86	13.833	7.62	19.83	1.67
1.917	1.02	7.917	1.86	13.917	7.62	19.92	1.67
2.000	1.02	8.000	1.86	14.000	7.62	20.00	1.67
2.083	1.21	8.083	2.51	14.083	2.79	20.08	1.11
2.167	1.21	8.167	2.51	14.167	2.79	20.17	1.11
2.250	1.21	8.250	2.51	14.250	2.79	20.25	1.11
2.333	1.21	8.333	2.51	14.333	2.79	20.33	1.11
2.417	1.21	8.417	2.51	14.417	2.79	20.42	1.11
2.500	1.21	8.500	2.51	14.500	2.79	20.50	1.11
2.583	1.21	8.583	2.51	14.583	2.79	20.58	1.11
2.667	1.21	8.667	2.51	14.667	2.79	20.67	1.11
2.750	1.21	8.750	2.51	14.750	2.79	20.75	1.11
2.833	1.21	8.833	2.51	14.833	2.79	20.83	1.11
2.917	1.21	8.917	2.51	14.917	2.79	20.92	1.11
3.000	1.21	9.000	2.51	15.000	2.79	21.00	1.11

3.083	1.21	9.083	2.97	15.083	2.79	21.08	1.11
3.167	1.21	9.167	2.97	15.167	2.79	21.17	1.11
3.250	1.21	9.250	2.97	15.250	2.79	21.25	1.11
3.333	1.21	9.333	2.97	15.333	2.79	21.33	1.11
3.417	1.21	9.417	2.97	15.417	2.79	21.42	1.11
3.500	1.21	9.500	2.97	15.500	2.79	21.50	1.11
3.583	1.21	9.583	3.34	15.583	2.79	21.58	1.11
3.667	1.21	9.667	3.34	15.667	2.79	21.67	1.11
3.750	1.21	9.750	3.34	15.750	2.79	21.75	1.11
3.833	1.21	9.833	3.34	15.833	2.79	21.83	1.11
3.917	1.21	9.917	3.34	15.917	2.79	21.92	1.11
4.000	1.21	10.000	3.34	16.000	2.79	22.00	1.11
4.083	1.49	10.083	4.27	16.083	1.67	22.08	1.11
4.167	1.49	10.167	4.27	16.167	1.67	22.17	1.11
4.250	1.49	10.250	4.27	16.250	1.67	22.25	1.11
4.333	1.49	10.333	4.27	16.333	1.67	22.33	1.11
4.417	1.49	10.417	4.27	16.417	1.67	22.42	1.11
4.500	1.49	10.500	4.27	16.500	1.67	22.50	1.11
4.583	1.49	10.583	5.76	16.583	1.67	22.58	1.11
4.667	1.49	10.667	5.76	16.667	1.67	22.67	1.11
4.750	1.49	10.750	5.76	16.750	1.67	22.75	1.11
4.833	1.49	10.833	5.76	16.833	1.67	22.83	1.11
4.917	1.49	10.917	5.76	16.917	1.67	22.92	1.11
5.000	1.49	11.000	5.76	17.000	1.67	23.00	1.11
5.083	1.49	11.083	8.92	17.083	1.67	23.08	1.11
5.167	1.49	11.167	8.92	17.167	1.67	23.17	1.11
5.250	1.49	11.250	8.92	17.250	1.67	23.25	1.11
5.333	1.49	11.333	8.92	17.333	1.67	23.33	1.11
5.417	1.49	11.417	8.92	17.417	1.67	23.42	1.11
5.500	1.49	11.500	8.92	17.500	1.67	23.50	1.11
5.583	1.49	11.583	38.65	17.583	1.67	23.58	1.11
5.667	1.49	11.667	38.65	17.667	1.67	23.67	1.11
5.750	1.49	11.750	38.65	17.750	1.67	23.75	1.11
5.833	1.49	11.833	102.55	17.833	1.67	23.83	1.11
5.917	1.49	11.917	102.56	17.917	1.67	23.92	1.11
6.000	1.49	12.000	102.56	18.000	1.67	24.00	1.11

```
Unit Hyd Qpeak  (cms)=   0.261

PEAK FLOW       (cms)=   0.060 (i)
TIME TO PEAK    (hrs)=  12.000
RUNOFF VOLUME    (mm)=  38.411
TOTAL RAINFALL   (mm)=  92.888
RUNOFF COEFFICIENT   =   0.414

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

----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.31          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      45.53         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     102.56         60.65
               over (min)       5.00          5.00
    Storage Coeff.  (min)=       1.58 (ii)     2.69 (ii)
```



```
    Unit Hyd. Tpeak (min)=       5.00          5.00
    Unit Hyd. peak  (cms)=       0.33          0.29
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.09          0.00         0.088 (iii)
    TIME TO PEAK    (hrs)=      12.00         12.00        12.00
    RUNOFF VOLUME    (mm)=      91.89         44.76        91.41
    TOTAL RAINFALL   (mm)=      92.89         92.89        92.89
    RUNOFF COEFFICIENT   =       0.99          0.48         0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.11          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      26.96         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     102.56         60.65
               over (min)       5.00          5.00
    Storage Coeff.  (min)=       1.15 (ii)     2.26 (ii)
    Unit Hyd. Tpeak (min)=       5.00          5.00
    Unit Hyd. peak  (cms)=       0.34          0.30
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.03          0.00         0.031 (iii)
    TIME TO PEAK    (hrs)=      12.00         12.00        12.00
    RUNOFF VOLUME    (mm)=      91.89         44.76        91.42
    TOTAL RAINFALL   (mm)=      92.89         92.89        92.89
    RUNOFF COEFFICIENT   =       0.99          0.48         0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1101):      0.31   0.088    12.00    91.41
     + ID2= 2 (  1102):      0.11   0.031    12.00    91.42
       =================================================
       ID = 3 (  2001):      0.42   0.119    12.00    91.41

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



```
----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.97          0.14
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      86.18         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     102.56         60.65
               over (min)       5.00         10.00
    Storage Coeff.  (min)=       2.31 (ii)     5.56 (ii)
    Unit Hyd. Tpeak (min)=       5.00         10.00
    Unit Hyd. peak  (cms)=       0.30          0.16
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.28          0.02         0.297 (iii)
    TIME TO PEAK    (hrs)=      12.00         12.00        12.00
    RUNOFF VOLUME    (mm)=      91.89         44.76        85.85
    TOTAL RAINFALL   (mm)=      92.89         92.89        92.89
    RUNOFF COEFFICIENT   =       0.99          0.48         0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1103):      1.11   0.297    12.00    85.85
     + ID2= 2 (  2001):      0.42   0.119    12.00    91.41
       =================================================
       ID = 3 (  2002):      1.53   0.416    12.00    87.38

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.36          0.05
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      52.54         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     102.56         60.65
               over (min)       5.00          5.00
    Storage Coeff.  (min)=       1.72 (ii)     4.92 (ii)
    Unit Hyd. Tpeak (min)=       5.00          5.00
```

```
     Unit Hyd. peak  (cms)=       0.32          0.22
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.10          0.01           0.112 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=      91.89         44.76          86.04
     TOTAL RAINFALL   (mm)=      92.89         92.89          92.89
     RUNOFF COEFFICIENT   =       0.99          0.48           0.93

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41   0.112    12.00    86.04
      + ID2= 2 (  2002):     1.53   0.416    12.00    87.38
        ===================================================
        ID = 3 (  2003):     1.95   0.528    12.00    87.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                                  AREA     QPEAK      TPEAK        R.V.
                                  (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)       1.948     0.528      12.00       87.09
   OUTFLOW: ID= 1 (  3001)       1.948     0.105      12.08       87.08

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.92
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0779

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

--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      3.96          0.21
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    166.75         40.00
     Mannings n           =     0.013         0.250
```



```
     Max.Eff.Inten.(mm/hr)=     102.56         60.65
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       3.44 (ii)     5.59 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.26          0.16
                                                              *TOTALS*
     PEAK FLOW       (cms)=       1.12          0.03           1.150 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00          12.00
     RUNOFF VOLUME    (mm)=      91.89         44.76          89.53
     TOTAL RAINFALL   (mm)=      92.89         92.89          92.89
     RUNOFF COEFFICIENT   =       0.99          0.48           0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.38          1.25
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    104.18         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     102.56         60.65
                over (min)        5.00         15.00
     Storage Coeff.  (min)=       2.59 (ii)    11.21 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.29          0.09
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.11          0.14           0.230 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08          12.00
     RUNOFF VOLUME    (mm)=      91.89         44.76          55.64
     TOTAL RAINFALL   (mm)=      92.89         92.89          92.89
     RUNOFF COEFFICIENT   =       0.99          0.48           0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2004)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):     1.63   0.230    12.00    55.64
      + ID2= 2 (  1200):     4.17   1.150    12.00    89.53
        ===================================================
        ID = 3 (  2004):     5.80   1.381    12.00    80.02
```



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

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

--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950     0.1485
                          0.1800     0.0870   |   0.5750     0.1645
                          0.3000     0.1120   |   0.6650     0.1815
                          0.3750     0.1280   |   0.0000     0.0000

                                  AREA     QPEAK      TPEAK        R.V.
                                  (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)       5.799     1.381      12.00       80.02
   OUTFLOW: ID= 1 (  3002)       5.799     0.524      12.08       80.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 37.98
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1550

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

--------------------
| ADD HYD  (  2005)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.105    12.08    87.08
      + ID2= 2 (  3002):     5.80   0.524    12.08    80.00
        ===================================================
        ID = 3 (  2005):     7.75   0.630    12.08    81.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2006)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.060    12.00    38.41
      + ID2= 2 (  2005):     7.75   0.630    12.08    81.78
        ===================================================
        ID = 3 (  2006):     8.16   0.650    12.08    79.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.13          0.12
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     40.25         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     102.56         60.65
```



```
                over (min)        5.00         15.00
     Storage Coeff.  (min)=       1.46 (ii)    10.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.33          0.10
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.04          0.01           0.048 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08          12.00
     RUNOFF VOLUME    (mm)=      91.89         44.76          69.01
     TOTAL RAINFALL   (mm)=      92.89         92.89          92.89
     RUNOFF COEFFICIENT   =       0.99          0.48           0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2007)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     0.24   0.048    12.00    69.01
      + ID2= 2 (  2006):     8.16   0.650    12.08    79.60
        ===================================================
        ID = 3 (  2007):     8.40   0.669    12.08    79.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U    U    A    L
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

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



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

   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\9ff41a
9d-b64d-40f9-a9c5-a3ba85d98301\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\9ff41a
9d-b64d-40f9-a9c5-a3ba85d98301\scenar
```

```
DATE: 02/11/2020                          TIME: 01:51:21

USER:


COMMENTS: ______________________________________________________________

------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : Run 07                        **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 807.440
| Ptotal= 46.83 mm |                           B=   6.750
--------------------                           C=   0.828
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.35	6.17	1.25	12.17	1.09	18.17	0.50
0.33	0.36	6.33	1.36	12.33	1.05	18.33	0.50
0.50	0.36	6.50	1.50	12.50	1.02	18.50	0.49
0.67	0.37	6.67	1.68	12.67	0.99	18.67	0.48
0.83	0.38	6.83	1.90	12.83	0.96	18.83	0.48
1.00	0.39	7.00	2.21	13.00	0.93	19.00	0.47
1.17	0.39	7.17	2.64	13.17	0.90	19.17	0.47
1.33	0.40	7.33	3.32	13.33	0.88	19.33	0.46
1.50	0.41	7.50	4.51	13.50	0.86	19.50	0.45
1.67	0.42	7.67	7.17	13.67	0.83	19.67	0.45
1.83	0.43	7.83	18.51	13.83	0.81	19.83	0.44
2.00	0.44	8.00	78.28	14.00	0.79	20.00	0.44
2.17	0.45	8.17	24.65	14.17	0.77	20.17	0.43
2.33	0.46	8.33	12.40	14.33	0.76	20.33	0.43
2.50	0.47	8.50	8.22	14.50	0.74	20.50	0.42
2.67	0.49	8.67	6.14	14.67	0.72	20.67	0.42
2.83	0.50	8.83	4.92	14.83	0.71	20.83	0.41
3.00	0.51	9.00	4.11	15.00	0.69	21.00	0.41
3.17	0.53	9.17	3.53	15.17	0.68	21.17	0.40
3.33	0.55	9.33	3.11	15.33	0.67	21.33	0.40
3.50	0.56	9.50	2.78	15.50	0.65	21.50	0.40
3.67	0.58	9.67	2.51	15.67	0.64	21.67	0.39
3.83	0.60	9.83	2.30	15.83	0.63	21.83	0.39
4.00	0.62	10.00	2.12	16.00	0.62	22.00	0.38
4.17	0.65	10.17	1.97	16.17	0.61	22.17	0.38
4.33	0.67	10.33	1.84	16.33	0.60	22.33	0.38
4.50	0.70	10.50	1.73	16.50	0.59	22.50	0.37
4.67	0.73	10.67	1.63	16.67	0.58	22.67	0.37
4.83	0.76	10.83	1.54	16.83	0.57	22.83	0.37
5.00	0.80	11.00	1.46	17.00	0.56	23.00	0.36
5.17	0.84	11.17	1.39	17.17	0.55	23.17	0.36
5.33	0.89	11.33	1.33	17.33	0.54	23.33	0.36
5.50	0.94	11.50	1.27	17.50	0.53	23.50	0.35
5.67	1.00	11.67	1.22	17.67	0.53	23.67	0.35
5.83	1.07	11.83	1.18	17.83	0.52	23.83	0.35


```
          6.00    1.15 | 12.00    1.13 | 18.00    0.51 | 24.00    0.34

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.35	6.083	1.25	12.083	1.09	18.08	0.50
0.167	0.35	6.167	1.25	12.167	1.09	18.17	0.50
0.250	0.36	6.250	1.36	12.250	1.05	18.25	0.50
0.333	0.36	6.333	1.36	12.333	1.05	18.33	0.50
0.417	0.36	6.417	1.50	12.417	1.02	18.42	0.49
0.500	0.36	6.500	1.50	12.500	1.02	18.50	0.49
0.583	0.37	6.583	1.68	12.583	0.99	18.58	0.48
0.667	0.37	6.667	1.68	12.667	0.99	18.67	0.48
0.750	0.38	6.750	1.90	12.750	0.96	18.75	0.48
0.833	0.38	6.833	1.90	12.833	0.96	18.83	0.48
0.917	0.39	6.917	2.21	12.917	0.93	18.92	0.47
1.000	0.39	7.000	2.21	13.000	0.93	19.00	0.47
1.083	0.39	7.083	2.64	13.083	0.90	19.08	0.47
1.167	0.39	7.167	2.64	13.167	0.90	19.17	0.47
1.250	0.40	7.250	3.32	13.250	0.88	19.25	0.46
1.333	0.40	7.333	3.32	13.333	0.88	19.33	0.46
1.417	0.41	7.417	4.51	13.417	0.86	19.42	0.45
1.500	0.41	7.500	4.51	13.500	0.86	19.50	0.45
1.583	0.42	7.583	7.17	13.583	0.83	19.58	0.45
1.667	0.42	7.667	7.17	13.667	0.83	19.67	0.45
1.750	0.43	7.750	18.51	13.750	0.81	19.75	0.44
1.833	0.43	7.833	18.52	13.833	0.81	19.83	0.44
1.917	0.44	7.917	78.28	13.917	0.79	19.92	0.44
2.000	0.44	8.000	78.27	14.000	0.79	20.00	0.44
2.083	0.45	8.083	24.65	14.083	0.77	20.08	0.43
2.167	0.45	8.167	24.65	14.167	0.77	20.17	0.43
2.250	0.46	8.250	12.40	14.250	0.76	20.25	0.43
2.333	0.46	8.333	12.40	14.333	0.76	20.33	0.43
2.417	0.47	8.417	8.22	14.417	0.74	20.42	0.42
2.500	0.47	8.500	8.21	14.500	0.74	20.50	0.42
2.583	0.49	8.583	6.14	14.583	0.72	20.58	0.42
2.667	0.49	8.667	6.14	14.667	0.72	20.67	0.42
2.750	0.50	8.750	4.92	14.750	0.71	20.75	0.41
2.833	0.50	8.833	4.92	14.833	0.71	20.83	0.41
2.917	0.51	8.917	4.11	14.917	0.69	20.92	0.41
3.000	0.51	9.000	4.11	15.000	0.69	21.00	0.41
3.083	0.53	9.083	3.53	15.083	0.68	21.08	0.40
3.167	0.53	9.167	3.53	15.167	0.68	21.17	0.40
3.250	0.55	9.250	3.11	15.250	0.67	21.25	0.40
3.333	0.55	9.333	3.11	15.333	0.67	21.33	0.40
3.417	0.56	9.417	2.78	15.417	0.65	21.42	0.40
3.500	0.56	9.500	2.78	15.500	0.65	21.50	0.40
3.583	0.58	9.583	2.51	15.583	0.64	21.58	0.39
3.667	0.58	9.667	2.51	15.667	0.64	21.67	0.39
3.750	0.60	9.750	2.30	15.750	0.63	21.75	0.39
3.833	0.60	9.833	2.30	15.833	0.63	21.83	0.39
3.917	0.62	9.917	2.12	15.917	0.62	21.92	0.38

4.000	0.62	10.000	2.12	16.000	0.62	22.00	0.38
4.083	0.65	10.083	1.97	16.083	0.61	22.08	0.38
4.167	0.65	10.167	1.97	16.167	0.61	22.17	0.38
4.250	0.67	10.250	1.84	16.250	0.60	22.25	0.38
4.333	0.67	10.333	1.84	16.333	0.60	22.33	0.38
4.417	0.70	10.417	1.73	16.417	0.59	22.42	0.37
4.500	0.70	10.500	1.73	16.500	0.59	22.50	0.37
4.583	0.73	10.583	1.63	16.583	0.58	22.58	0.37
4.667	0.73	10.667	1.63	16.667	0.58	22.67	0.37
4.750	0.76	10.750	1.54	16.750	0.57	22.75	0.37
4.833	0.76	10.833	1.54	16.833	0.57	22.83	0.37
4.917	0.80	10.917	1.46	16.917	0.56	22.92	0.36
5.000	0.80	11.000	1.46	17.000	0.56	23.00	0.36
5.083	0.84	11.083	1.39	17.083	0.55	23.08	0.36
5.167	0.84	11.167	1.39	17.167	0.55	23.17	0.36
5.250	0.89	11.250	1.33	17.250	0.54	23.25	0.36
5.333	0.89	11.333	1.33	17.333	0.54	23.33	0.36
5.417	0.94	11.417	1.27	17.417	0.53	23.42	0.35
5.500	0.94	11.500	1.27	17.500	0.53	23.50	0.35
5.583	1.00	11.583	1.22	17.583	0.53	23.58	0.35
5.667	1.00	11.667	1.22	17.667	0.53	23.67	0.35
5.750	1.07	11.750	1.18	17.750	0.52	23.75	0.35
5.833	1.07	11.833	1.18	17.833	0.52	23.83	0.35
5.917	1.15	11.917	1.13	17.917	0.51	23.92	0.34
6.000	1.15	12.000	1.13	18.000	0.51	24.00	0.34

```
    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW       (cms)=   0.020 (i)
    TIME TO PEAK    (hrs)=   8.000
    RUNOFF VOLUME    (mm)=  11.868
    TOTAL RAINFALL   (mm)=  46.829
    RUNOFF COEFFICIENT   =   0.253

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.31          0.00
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     45.53         40.00
    Mannings n          =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     78.28         18.87
               over (min)      5.00          5.00
    Storage Coeff.  (min)=      1.76 (ii)     3.00 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.32          0.28
                                                          *TOTALS*
    PEAK FLOW       (cms)=      0.07          0.00          0.067 (iii)
    TIME TO PEAK    (hrs)=      8.00          8.00           8.00
    RUNOFF VOLUME    (mm)=     45.83         13.83          45.51
    TOTAL RAINFALL   (mm)=     46.83         46.83          46.83
    RUNOFF COEFFICIENT   =      0.98          0.30           0.97

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



```
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  75.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.11          0.00
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     26.96         40.00
    Mannings n          =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=     78.28         18.87
               over (min)      5.00          5.00
    Storage Coeff.  (min)=      1.28 (ii)     2.52 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.33          0.29
                                                          *TOTALS*
    PEAK FLOW       (cms)=      0.02          0.00          0.024 (iii)
    TIME TO PEAK    (hrs)=      8.00          8.00           8.00
    RUNOFF VOLUME    (mm)=     45.83         13.83          45.51
    TOTAL RAINFALL   (mm)=     46.83         46.83          46.83
    RUNOFF COEFFICIENT   =      0.98          0.30           0.97

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

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  75.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1101):     0.31   0.067     8.00    45.51
     + ID2= 2 (  1102):     0.11   0.024     8.00    45.51
       ==================================================
       ID = 3 (  2001):     0.42   0.090     8.00    45.51

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.97          0.14
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     86.18         40.00
```

```
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=      78.28        18.87
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.58 (ii)    6.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.29         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.21         0.01         0.213 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08          8.00
     RUNOFF VOLUME    (mm)=      45.83        13.83         41.73
     TOTAL RAINFALL   (mm)=      46.83        46.83         46.83
     RUNOFF COEFFICIENT   =       0.98         0.30          0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):      1.11   0.213     8.00    41.73
      + ID2= 2 (  2001):      0.42   0.090     8.00    45.51
        ===============================================
        ID = 3 (  2002):      1.53   0.303     8.00    42.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.36         0.05
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     52.54        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     78.28        18.87
                over (min)       5.00        10.00
     Storage Coeff.  (min)=      1.92 (ii)    5.48 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.31         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.08         0.00          0.080 (iii)
     TIME TO PEAK    (hrs)=      8.00         8.08           8.00
     RUNOFF VOLUME    (mm)=     45.83        13.83          41.86
     TOTAL RAINFALL   (mm)=     46.83        46.83          46.83
     RUNOFF COEFFICIENT   =      0.98         0.30           0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```



```
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):      0.41   0.080     8.00    41.86
      + ID2= 2 (  2002):      1.53   0.303     8.00    42.77
        ===============================================
        ID = 3 (  2003):      1.95   0.383     8.00    42.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  2003)      1.948     0.383      8.00      42.57
   OUTFLOW: ID= 1 (  3001)      1.948     0.058      8.33      42.56

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.11
                  TIME SHIFT OF PEAK FLOW        (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0416

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      3.96         0.21
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    166.75        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     78.28        18.87
                over (min)       5.00        10.00
     Storage Coeff.  (min)=      3.83 (ii)    6.23 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.25         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.81         0.01          0.819 (iii)
     TIME TO PEAK    (hrs)=      8.00         8.08           8.00
     RUNOFF VOLUME    (mm)=     45.83        13.83          44.23
     TOTAL RAINFALL   (mm)=     46.83        46.83          46.83
     RUNOFF COEFFICIENT   =      0.98         0.30           0.94
```



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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.38         1.25
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    104.18        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     78.28        15.45
                over (min)       5.00        20.00
     Storage Coeff.  (min)=      2.89 (ii)   17.79 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=      0.28         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.08         0.03          0.090 (iii)
     TIME TO PEAK    (hrs)=      8.00         8.25           8.00
     RUNOFF VOLUME    (mm)=     45.83        13.83          21.22
     TOTAL RAINFALL   (mm)=     46.83        46.83          46.83
     RUNOFF COEFFICIENT   =      0.98         0.30           0.45

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):      1.63   0.090     8.00    21.22
      + ID2= 2 (  1200):      4.17   0.819     8.00    44.23
        ===============================================
        ID = 3 (  2004):      5.80   0.910     8.00    37.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950     0.1485
                          0.1800     0.0870   |   0.5750     0.1645
```



```
                          0.3000     0.1120   |   0.6650     0.1815
                          0.3750     0.1280   |   0.0000     0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  2004)      5.799     0.910      8.00      37.77
   OUTFLOW: ID= 1 (  3002)      5.799     0.179      8.33      37.75

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.68
                  TIME SHIFT OF PEAK FLOW        (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0868

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):      1.95   0.058     8.33    42.56
      + ID2= 2 (  3002):      5.80   0.179     8.33    37.75
        ===============================================
        ID = 3 (  2005):      7.75   0.237     8.33    38.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):      0.41   0.020     8.00    11.87
      + ID2= 2 (  2005):      7.75   0.237     8.33    38.96
        ===============================================
        ID = 3 (  2006):      8.16   0.242     8.33    37.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.13         0.12
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     40.25        40.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     78.28        15.45
                over (min)       5.00        20.00
     Storage Coeff.  (min)=      1.63 (ii)   16.53 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=      0.32         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.03         0.00          0.028 (iii)
     TIME TO PEAK    (hrs)=      8.00         8.25           8.00
     RUNOFF VOLUME    (mm)=     45.83        13.83          30.27
     TOTAL RAINFALL   (mm)=     46.83        46.83          46.83
     RUNOFF COEFFICIENT   =      0.98         0.30           0.65
```

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1400):     0.24    0.028     8.00    30.27
     + ID2= 2 (  2006):     8.16    0.242     8.33    37.60
       ===============================================
       ID = 3 (  2007):     8.40    0.249     8.33    37.39

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

     V    V   I    SSSSS  U   U    A    L
     V    V   I    SS     U   U   A A   L
      V  V    I     SS    U   U  AAAAA  L
      V  V    I      SS   U   U  A   A  L
       VV     I    SSSSS  UUUUU  A   A  LLLLL

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



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

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\df3cb0
18-fd45-4bc9-8896-a31f8218c8a3\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\df3cb0
18-fd45-4bc9-8896-a31f8218c8a3\scenar


DATE: 02/11/2020                          TIME: 01:51:22

USER:


COMMENTS: ____________________________________________________________

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



```
------------------------
 **********************************************
 ** SIMULATION : Run 08                      **
 **********************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1135.400
| Ptotal= 59.88 mm |                           B=   7.500
--------------------                           C=   0.841
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.42	6.17	1.53	12.17	1.33	18.17	0.60
0.33	0.42	6.33	1.67	12.33	1.29	18.33	0.59
0.50	0.43	6.50	1.85	12.50	1.24	18.50	0.59
0.67	0.44	6.67	2.07	12.67	1.20	18.67	0.58
0.83	0.45	6.83	2.37	12.83	1.17	18.83	0.57
1.00	0.46	7.00	2.76	13.00	1.13	19.00	0.56
1.17	0.47	7.17	3.33	13.17	1.10	19.17	0.56
1.33	0.48	7.33	4.21	13.33	1.07	19.33	0.55
1.50	0.49	7.50	5.79	13.50	1.04	19.50	0.54
1.67	0.50	7.67	9.38	13.67	1.01	19.67	0.54
1.83	0.51	7.83	24.78	13.83	0.98	19.83	0.53
2.00	0.52	8.00	102.27	14.00	0.96	20.00	0.52
2.17	0.54	8.17	33.10	14.17	0.94	20.17	0.52
2.33	0.55	8.33	16.50	14.33	0.92	20.33	0.51
2.50	0.57	8.50	10.79	14.50	0.89	20.50	0.50
2.67	0.58	8.67	7.99	14.67	0.87	20.67	0.50
2.83	0.60	8.83	6.34	14.83	0.86	20.83	0.49
3.00	0.62	9.00	5.26	15.00	0.84	21.00	0.49
3.17	0.63	9.17	4.50	15.17	0.82	21.17	0.48
3.33	0.65	9.33	3.94	15.33	0.80	21.33	0.48
3.50	0.68	9.50	3.50	15.50	0.79	21.50	0.47
3.67	0.70	9.67	3.16	15.67	0.77	21.67	0.47
3.83	0.72	9.83	2.88	15.83	0.76	21.83	0.46
4.00	0.75	10.00	2.65	16.00	0.74	22.00	0.46
4.17	0.78	10.17	2.45	16.17	0.73	22.17	0.45
4.33	0.81	10.33	2.29	16.33	0.72	22.33	0.45
4.50	0.85	10.50	2.14	16.50	0.71	22.50	0.44
4.67	0.88	10.67	2.01	16.67	0.69	22.67	0.44
4.83	0.92	10.83	1.90	16.83	0.68	22.83	0.43
5.00	0.97	11.00	1.80	17.00	0.67	23.00	0.43
5.17	1.02	11.17	1.72	17.17	0.66	23.17	0.43
5.33	1.08	11.33	1.64	17.33	0.65	23.33	0.42
5.50	1.15	11.50	1.56	17.50	0.64	23.50	0.42
5.67	1.22	11.67	1.50	17.67	0.63	23.67	0.41
5.83	1.31	11.83	1.44	17.83	0.62	23.83	0.41
6.00	1.41	12.00	1.38	18.00	0.61	24.00	0.41

```
------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.06

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


---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.42	6.083	1.53	12.083	1.33	18.08	0.60
0.167	0.42	6.167	1.53	12.167	1.33	18.17	0.60
0.250	0.42	6.250	1.67	12.250	1.29	18.25	0.59
0.333	0.42	6.333	1.67	12.333	1.29	18.33	0.59
0.417	0.43	6.417	1.85	12.417	1.24	18.42	0.59
0.500	0.43	6.500	1.85	12.500	1.24	18.50	0.59
0.583	0.44	6.583	2.07	12.583	1.20	18.58	0.58
0.667	0.44	6.667	2.07	12.667	1.20	18.67	0.58
0.750	0.45	6.750	2.37	12.750	1.17	18.75	0.57
0.833	0.45	6.833	2.37	12.833	1.17	18.83	0.57
0.917	0.46	6.917	2.76	12.917	1.13	18.92	0.56
1.000	0.46	7.000	2.76	13.000	1.13	19.00	0.56
1.083	0.47	7.083	3.33	13.083	1.10	19.08	0.56
1.167	0.47	7.167	3.33	13.167	1.10	19.17	0.56
1.250	0.48	7.250	4.21	13.250	1.07	19.25	0.55
1.333	0.48	7.333	4.21	13.333	1.07	19.33	0.55
1.417	0.49	7.417	5.79	13.417	1.04	19.42	0.54
1.500	0.49	7.500	5.79	13.500	1.04	19.50	0.54
1.583	0.50	7.583	9.38	13.583	1.01	19.58	0.54
1.667	0.50	7.667	9.38	13.667	1.01	19.67	0.54
1.750	0.51	7.750	24.78	13.750	0.98	19.75	0.53
1.833	0.51	7.833	24.79	13.833	0.98	19.83	0.53
1.917	0.52	7.917	102.27	13.917	0.96	19.92	0.52
2.000	0.52	8.000	102.27	14.000	0.96	20.00	0.52
2.083	0.54	8.083	33.10	14.083	0.94	20.08	0.52
2.167	0.54	8.167	33.10	14.167	0.94	20.17	0.52
2.250	0.55	8.250	16.50	14.250	0.92	20.25	0.51
2.333	0.55	8.333	16.50	14.333	0.92	20.33	0.51
2.417	0.57	8.417	10.79	14.417	0.89	20.42	0.50
2.500	0.57	8.500	10.79	14.500	0.89	20.50	0.50
2.583	0.58	8.583	7.99	14.583	0.87	20.58	0.50
2.667	0.58	8.667	7.99	14.667	0.87	20.67	0.50
2.750	0.60	8.750	6.34	14.750	0.86	20.75	0.49
2.833	0.60	8.833	6.34	14.833	0.86	20.83	0.49
2.917	0.62	8.917	5.26	14.917	0.84	20.92	0.49
3.000	0.62	9.000	5.26	15.000	0.84	21.00	0.49
3.083	0.63	9.083	4.50	15.083	0.82	21.08	0.48
3.167	0.63	9.167	4.50	15.167	0.82	21.17	0.48
3.250	0.65	9.250	3.94	15.250	0.80	21.25	0.48
3.333	0.65	9.333	3.94	15.333	0.80	21.33	0.48
3.417	0.68	9.417	3.50	15.417	0.79	21.42	0.47
3.500	0.68	9.500	3.50	15.500	0.79	21.50	0.47
3.583	0.70	9.583	3.16	15.583	0.77	21.58	0.47
3.667	0.70	9.667	3.16	15.667	0.77	21.67	0.47
3.750	0.72	9.750	2.88	15.750	0.76	21.75	0.46
3.833	0.72	9.833	2.88	15.833	0.76	21.83	0.46
3.917	0.75	9.917	2.65	15.917	0.74	21.92	0.46
4.000	0.75	10.000	2.65	16.000	0.74	22.00	0.46
4.083	0.78	10.083	2.45	16.083	0.73	22.08	0.45
4.167	0.78	10.167	2.45	16.167	0.73	22.17	0.45
4.250	0.81	10.250	2.29	16.250	0.72	22.25	0.45
4.333	0.81	10.333	2.29	16.333	0.72	22.33	0.45
4.417	0.85	10.417	2.14	16.417	0.71	22.42	0.44
4.500	0.85	10.500	2.14	16.500	0.71	22.50	0.44
4.583	0.88	10.583	2.01	16.583	0.69	22.58	0.44
4.667	0.88	10.667	2.01	16.667	0.69	22.67	0.44
4.750	0.92	10.750	1.90	16.750	0.68	22.75	0.43
4.833	0.92	10.833	1.90	16.833	0.68	22.83	0.43

4.917	0.97	10.917	1.80	16.917	0.67	22.92	0.43
5.000	0.97	11.000	1.80	17.000	0.67	23.00	0.43
5.083	1.02	11.083	1.72	17.083	0.66	23.08	0.43
5.167	1.02	11.167	1.72	17.167	0.66	23.17	0.43
5.250	1.08	11.250	1.64	17.250	0.65	23.25	0.42
5.333	1.08	11.333	1.64	17.333	0.65	23.33	0.42
5.417	1.15	11.417	1.56	17.417	0.64	23.42	0.42
5.500	1.15	11.500	1.56	17.500	0.64	23.50	0.42
5.583	1.22	11.583	1.50	17.583	0.63	23.58	0.41
5.667	1.22	11.667	1.50	17.667	0.63	23.67	0.41
5.750	1.31	11.750	1.44	17.750	0.62	23.75	0.41
5.833	1.31	11.833	1.44	17.833	0.62	23.83	0.41
5.917	1.41	11.917	1.38	17.917	0.61	23.92	0.41
6.000	1.41	12.000	1.38	18.000	0.61	24.00	0.41

```
     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW      (cms)=   0.034 (i)
     TIME TO PEAK   (hrs)=   8.000
     RUNOFF VOLUME   (mm)=  18.519
     TOTAL RAINFALL  (mm)=  59.879
     RUNOFF COEFFICIENT  =   0.309

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

------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=    0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     0.31         0.00
     Dep. Storage    (mm)=     1.00         5.00
     Average Slope    (%)=     1.00         2.00
     Length           (m)=    45.53        40.00
     Mannings n          =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=   102.27        31.88
               over (min)       5.00         5.00
     Storage Coeff.  (min)=     1.58 (ii)    2.69 (ii)
     Unit Hyd. Tpeak (min)=     5.00         5.00
     Unit Hyd. peak  (cms)=     0.33         0.29
                                                        *TOTALS*
     PEAK FLOW       (cms)=     0.09         0.00         0.088 (iii)
     TIME TO PEAK    (hrs)=     8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=    58.88        21.58         58.50
     TOTAL RAINFALL   (mm)=    59.88        59.88         59.88
     RUNOFF COEFFICIENT   =     0.98         0.36          0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=    0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
```

```
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.11          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       26.96         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.27         31.88
                over (min)         5.00          5.00
     Storage Coeff.  (min)=        1.15 (ii)     2.27 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.34          0.30
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.03          0.00          0.031 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00          8.00
     RUNOFF VOLUME    (mm)=       58.88         21.58         58.51
     TOTAL RAINFALL   (mm)=       59.88         59.88         59.88
     RUNOFF COEFFICIENT   =        0.98          0.36          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):    0.31   0.088     8.00    58.50
      + ID2= 2 (  1102):    0.11   0.031     8.00    58.51
        ==============================================
        ID = 3 (  2001):    0.42   0.118     8.00    58.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.97          0.14
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       86.18         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.27         31.88
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        2.32 (ii)     5.56 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.30          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.27          0.01          0.282 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.08          8.00
     RUNOFF VOLUME    (mm)=       58.88         21.58         54.10
```



```
     TOTAL RAINFALL   (mm)=       59.88         59.88         59.88
     RUNOFF COEFFICIENT   =        0.98          0.36          0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):    1.11   0.282     8.00    54.10
      + ID2= 2 (  2001):    0.42   0.118     8.00    58.51
        ==============================================
        ID = 3 (  2002):    1.53   0.400     8.00    55.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.36          0.05
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       52.54         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.27         31.88
                over (min)         5.00          5.00
     Storage Coeff.  (min)=        1.72 (ii)     4.92 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.32          0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.10          0.00          0.107 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00          8.00
     RUNOFF VOLUME    (mm)=       58.88         21.58         54.25
     TOTAL RAINFALL   (mm)=       59.88         59.88         59.88
     RUNOFF COEFFICIENT   =        0.98          0.36          0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
```



```
        ID1= 1 (  1104):    0.41   0.107     8.00    54.25
      + ID2= 2 (  2002):    1.53   0.400     8.00    55.31
        ==============================================
        ID = 3 (  2003):    1.95   0.507     8.00    55.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0801     0.0575
                         0.0012     0.0001   |   0.0965     0.0712
                         0.0013     0.0085   |   0.1106     0.0816
                         0.0238     0.0256   |   0.1230     0.0900
                         0.0593     0.0421   |   0.0000     0.0000

                              AREA     QPEAK      TPEAK        R.V.
                              (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)    1.948      0.507       8.00       55.08
   OUTFLOW: ID= 1 (  3001)    1.948      0.076       8.33       55.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.92
                  TIME SHIFT OF PEAK FLOW          (min)= 20.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0544

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        3.96          0.21
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=      166.75         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.27         31.88
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        3.44 (ii)     5.60 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.26          0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=        1.08          0.01          1.091 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.08          8.00
     RUNOFF VOLUME    (mm)=       58.88         21.58         57.01
     TOTAL RAINFALL   (mm)=       59.88         59.88         59.88
     RUNOFF COEFFICIENT   =        0.98          0.36          0.95

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.38          1.25
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=      104.18         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.27         26.02
                over (min)         5.00         15.00
     Storage Coeff.  (min)=        2.59 (ii)    14.69 (ii)
     Unit Hyd. Tpeak (min)=        5.00         15.00
     Unit Hyd. peak  (cms)=        0.29          0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.11          0.06          0.134 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.17          8.00
     RUNOFF VOLUME    (mm)=       58.88         21.58         30.19
     TOTAL RAINFALL   (mm)=       59.88         59.88         59.88
     RUNOFF COEFFICIENT   =        0.98          0.36          0.50

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):    1.63   0.134     8.00    30.19
      + ID2= 2 (  1200):    4.17   1.091     8.00    57.01
        ==============================================
        ID = 3 (  2004):    5.80   1.225     8.00    49.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950     0.1485
                         0.1800     0.0870   |   0.5750     0.1645
                         0.3000     0.1120   |   0.6650     0.1815
                         0.3750     0.1280   |   0.0000     0.0000

                              AREA     QPEAK      TPEAK        R.V.
                              (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)    5.799      1.225       8.00       49.48
   OUTFLOW: ID= 1 (  3002)    5.799      0.299       8.25       49.46

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 24.36
                  TIME SHIFT OF PEAK FLOW          (min)= 15.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.1120
```

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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.076     8.33    55.08
      + ID2= 2 (  3002):     5.80   0.299     8.25    49.46
        ==================================================
        ID = 3 (  2005):     7.75   0.374     8.25    50.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.034     8.00    18.52
      + ID2= 2 (  2005):     7.75   0.374     8.25    50.88
        ==================================================
        ID = 3 (  2006):     8.16   0.383     8.25    49.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13          0.12
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      40.25         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     102.27         26.02
               over (min)        5.00         15.00
     Storage Coeff.  (min)=       1.47 (ii)    13.56 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.33          0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04          0.01         0.038 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.17          8.00
     RUNOFF VOLUME    (mm)=      58.88         21.58         40.75
     TOTAL RAINFALL   (mm)=      59.88         59.88         59.88
     RUNOFF COEFFICIENT   =       0.98          0.36          0.68

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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```
| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     0.24   0.038     8.00    40.75
      + ID2= 2 (  2006):     8.16   0.383     8.25    49.25
        ==================================================
        ID = 3 (  2007):     8.40   0.394     8.25    49.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I       SS  U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\8a48ee
2d-6143-4711-a085-d934a1f913c8\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\8a48ee
2d-6143-4711-a085-d934a1f913c8\scenar


DATE: 02/11/2020                              TIME: 01:51:19

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------
------------------------
  **************************************************
  ** SIMULATION : Run 09                           **
  **************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1387.000
| Ptotal= 67.50 mm |                           B=   7.970
--------------------                           C=   0.852
                         used in:   INTENSITY =  A / (t + B)^C
```



```
                   Duration of storm  = 24.00 hrs
                   Storm time step    = 10.00 min
                   Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.44	6.17	1.66	12.17	1.44	18.17	0.64
0.33	0.45	6.33	1.82	12.33	1.39	18.33	0.63
0.50	0.46	6.50	2.02	12.50	1.34	18.50	0.62
0.67	0.46	6.67	2.27	12.67	1.30	18.67	0.61
0.83	0.47	6.83	2.59	12.83	1.25	18.83	0.60
1.00	0.48	7.00	3.04	13.00	1.22	19.00	0.60
1.17	0.49	7.17	3.68	13.17	1.18	19.17	0.59
1.33	0.51	7.33	4.70	13.33	1.15	19.33	0.58
1.50	0.52	7.50	6.52	13.50	1.11	19.50	0.57
1.67	0.53	7.67	10.72	13.67	1.08	19.67	0.57
1.83	0.54	7.83	28.90	13.83	1.06	19.83	0.56
2.00	0.56	8.00	118.36	14.00	1.03	20.00	0.55
2.17	0.57	8.17	38.72	14.17	1.00	20.17	0.55
2.33	0.58	8.33	19.11	14.33	0.98	20.33	0.54
2.50	0.60	8.50	12.38	14.50	0.96	20.50	0.53
2.67	0.62	8.67	9.08	14.67	0.93	20.67	0.53
2.83	0.63	8.83	7.16	14.83	0.91	20.83	0.52
3.00	0.65	9.00	5.91	15.00	0.89	21.00	0.51
3.17	0.67	9.17	5.03	15.17	0.88	21.17	0.51
3.33	0.70	9.33	4.38	15.33	0.86	21.33	0.50
3.50	0.72	9.50	3.89	15.50	0.84	21.50	0.50
3.67	0.74	9.67	3.49	15.67	0.82	21.67	0.49
3.83	0.77	9.83	3.17	15.83	0.81	21.83	0.49
4.00	0.80	10.00	2.91	16.00	0.79	22.00	0.48
4.17	0.83	10.17	2.69	16.17	0.78	22.17	0.48
4.33	0.87	10.33	2.50	16.33	0.76	22.33	0.47
4.50	0.90	10.50	2.34	16.50	0.75	22.50	0.47
4.67	0.94	10.67	2.20	16.67	0.74	22.67	0.46
4.83	0.99	10.83	2.07	16.83	0.73	22.83	0.46
5.00	1.04	11.00	1.96	17.00	0.71	23.00	0.45
5.17	1.10	11.17	1.86	17.17	0.70	23.17	0.45
5.33	1.16	11.33	1.78	17.33	0.69	23.33	0.45
5.50	1.23	11.50	1.70	17.50	0.68	23.50	0.44
5.67	1.32	11.67	1.62	17.67	0.67	23.67	0.44
5.83	1.41	11.83	1.56	17.83	0.66	23.83	0.43
6.00	1.52	12.00	1.50	18.00	0.65	24.00	0.43

```
-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.44	6.083	1.66	12.083	1.44	18.08	0.64
0.167	0.44	6.167	1.66	12.167	1.44	18.17	0.64
0.250	0.45	6.250	1.82	12.250	1.39	18.25	0.63
0.333	0.45	6.333	1.82	12.333	1.39	18.33	0.63
0.417	0.46	6.417	2.02	12.417	1.34	18.42	0.62
0.500	0.46	6.500	2.02	12.500	1.34	18.50	0.62

0.583	0.46	6.583	2.27	12.583	1.30	18.58	0.61
0.667	0.46	6.667	2.27	12.667	1.30	18.67	0.61
0.750	0.47	6.750	2.59	12.750	1.25	18.75	0.60
0.833	0.47	6.833	2.59	12.833	1.25	18.83	0.60
0.917	0.48	6.917	3.04	12.917	1.22	18.92	0.60
1.000	0.48	7.000	3.04	13.000	1.22	19.00	0.60
1.083	0.49	7.083	3.68	13.083	1.18	19.08	0.59
1.167	0.49	7.167	3.68	13.167	1.18	19.17	0.59
1.250	0.51	7.250	4.70	13.250	1.15	19.25	0.58
1.333	0.51	7.333	4.70	13.333	1.15	19.33	0.58
1.417	0.52	7.417	6.52	13.417	1.11	19.42	0.57
1.500	0.52	7.500	6.52	13.500	1.11	19.50	0.57
1.583	0.53	7.583	10.72	13.583	1.08	19.58	0.57
1.667	0.53	7.667	10.72	13.667	1.08	19.67	0.57
1.750	0.54	7.750	28.90	13.750	1.06	19.75	0.56
1.833	0.54	7.833	28.90	13.833	1.06	19.83	0.56
1.917	0.56	7.917	118.36	13.917	1.03	19.92	0.55
2.000	0.56	8.000	118.35	14.000	1.03	20.00	0.55
2.083	0.57	8.083	38.72	14.083	1.00	20.08	0.55
2.167	0.57	8.167	38.72	14.167	1.00	20.17	0.55
2.250	0.58	8.250	19.11	14.250	0.98	20.25	0.54
2.333	0.58	8.333	19.11	14.333	0.98	20.33	0.54
2.417	0.60	8.417	12.38	14.417	0.96	20.42	0.53
2.500	0.60	8.500	12.38	14.500	0.96	20.50	0.53
2.583	0.62	8.583	9.08	14.583	0.93	20.58	0.53
2.667	0.62	8.667	9.08	14.667	0.93	20.67	0.53
2.750	0.63	8.750	7.16	14.750	0.91	20.75	0.52
2.833	0.63	8.833	7.16	14.833	0.91	20.83	0.52
2.917	0.65	8.917	5.91	14.917	0.89	20.92	0.51
3.000	0.65	9.000	5.91	15.000	0.89	21.00	0.51
3.083	0.67	9.083	5.03	15.083	0.88	21.08	0.51
3.167	0.67	9.167	5.03	15.167	0.88	21.17	0.51
3.250	0.70	9.250	4.38	15.250	0.86	21.25	0.50
3.333	0.70	9.333	4.38	15.333	0.86	21.33	0.50
3.417	0.72	9.417	3.89	15.417	0.84	21.42	0.50
3.500	0.72	9.500	3.89	15.500	0.84	21.50	0.50
3.583	0.74	9.583	3.49	15.583	0.82	21.58	0.49
3.667	0.74	9.667	3.49	15.667	0.82	21.67	0.49
3.750	0.77	9.750	3.17	15.750	0.81	21.75	0.49
3.833	0.77	9.833	3.17	15.833	0.81	21.83	0.49
3.917	0.80	9.917	2.91	15.917	0.79	21.92	0.48
4.000	0.80	10.000	2.91	16.000	0.79	22.00	0.48
4.083	0.83	10.083	2.69	16.083	0.78	22.08	0.48
4.167	0.83	10.167	2.69	16.167	0.78	22.17	0.48
4.250	0.87	10.250	2.50	16.250	0.76	22.25	0.47
4.333	0.87	10.333	2.50	16.333	0.76	22.33	0.47
4.417	0.90	10.417	2.34	16.417	0.75	22.42	0.47
4.500	0.90	10.500	2.34	16.500	0.75	22.50	0.47
4.583	0.94	10.583	2.20	16.583	0.74	22.58	0.46
4.667	0.94	10.667	2.20	16.667	0.74	22.67	0.46
4.750	0.99	10.750	2.07	16.750	0.73	22.75	0.46
4.833	0.99	10.833	2.07	16.833	0.73	22.83	0.46
4.917	1.04	10.917	1.96	16.917	0.71	22.92	0.45
5.000	1.04	11.000	1.96	17.000	0.71	23.00	0.45
5.083	1.10	11.083	1.86	17.083	0.70	23.08	0.45
5.167	1.10	11.167	1.86	17.167	0.70	23.17	0.45
5.250	1.16	11.250	1.78	17.250	0.69	23.25	0.45
5.333	1.16	11.333	1.78	17.333	0.69	23.33	0.45
5.417	1.23	11.417	1.70	17.417	0.68	23.42	0.44
5.500	1.23	11.500	1.70	17.500	0.68	23.50	0.44
5.583	1.32	11.583	1.62	17.583	0.67	23.58	0.44
5.667	1.32	11.667	1.62	17.667	0.67	23.67	0.44
5.750	1.41	11.750	1.56	17.750	0.66	23.75	0.43

```
            5.833    1.41 |11.833    1.56 |17.833    0.66 | 23.83    0.43
            5.917    1.52 |11.917    1.50 |17.917    0.65 | 23.92    0.43
            6.000    1.52 |12.000    1.50 |18.000    0.65 | 24.00    0.43

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.043 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  22.776
     TOTAL RAINFALL   (mm)=  67.502
     RUNOFF COEFFICIENT   =   0.337

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

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--------------------
| CALIB              |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.31          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      45.53         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)       5.00          5.00
     Storage Coeff.  (min)=       1.49 (ii)     2.54 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.29
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.10          0.00           0.102 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           66.10
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      26.96         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)       5.00          5.00
     Storage Coeff.  (min)=       1.09 (ii)     2.14 (ii)
```



```
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.31
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.04          0.00           0.036 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           66.10
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1101):       0.31   0.102     8.00    66.10
      + ID2= 2 ( 1102):       0.11   0.036     8.00    66.10
        ===================================================
        ID = 3 ( 2001):       0.42   0.137     8.00    66.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)       5.00         10.00
     Storage Coeff.  (min)=       2.18 (ii)     5.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.31          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.32          0.01           0.328 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           61.39
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| ADD HYD  ( 2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1103):       1.11   0.328     8.00    61.39
      + ID2= 2 ( 2001):       0.42   0.137     8.00    66.10
        ===================================================
        ID = 3 ( 2002):       1.53   0.465     8.00    62.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36          0.05
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      52.54         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)       5.00          5.00
     Storage Coeff.  (min)=       1.62 (ii)     4.64 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.32          0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.12          0.01           0.125 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           61.54
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1104):       0.41   0.125     8.00    61.54
      + ID2= 2 ( 2002):       1.53   0.465     8.00    62.68
        ===================================================
        ID = 3 ( 2003):       1.95   0.590     8.00    62.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
```



```
| DT=  5.0 min     |      OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0801      0.0575
                          0.0012     0.0001    |   0.0965      0.0712
                          0.0013     0.0085    |   0.1106      0.0816
                          0.0238     0.0256    |   0.1230      0.0900
                          0.0593     0.0421    |   0.0000      0.0000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 ( 2003)      1.948      0.590       8.00       62.44
   OUTFLOW: ID= 1 ( 3001)      1.948      0.086       8.33       62.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.59
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0627

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--------------------
| CALIB              |
| STANDHYD ( 1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96          0.21
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     166.75         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)       5.00         10.00
     Storage Coeff.  (min)=       3.25 (ii)     5.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.27          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.26          0.02           1.274 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           64.50
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB              |
| STANDHYD ( 1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38          1.25
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     104.18         40.00
     Mannings n           =      0.013         0.250
```

```
    Max.Eff.Inten.(mm/hr)=    118.36        33.67
               over (min)       5.00        15.00
    Storage Coeff.  (min)=      2.45 (ii)   13.36 (ii)
    Unit Hyd. Tpeak (min)=      5.00        15.00
    Unit Hyd. peak  (cms)=      0.30         0.08
                                                      *TOTALS*
    PEAK FLOW       (cms)=      0.12         0.08       0.162 (iii)
    TIME TO PEAK    (hrs)=      8.00         8.17        8.00
    RUNOFF VOLUME    (mm)=     66.50        26.54       35.77
    TOTAL RAINFALL   (mm)=     67.50        67.50       67.50
    RUNOFF COEFFICIENT   =      0.99         0.39        0.53

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 + 2 =  3     |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1000):     1.63   0.162      8.00     35.77
      + ID2= 2 (  1200):     4.17   1.274      8.00     64.50
        ================================================
        ID = 3 (  2004):     5.80   1.436      8.00     56.44

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000   |    0.4950     0.1485
                          0.1800     0.0870   |    0.5750     0.1645
                          0.3000     0.1120   |    0.6650     0.1815
                          0.3750     0.1280   |    0.0000     0.0000

                              AREA      QPEAK      TPEAK         R.V.
                              (ha)      (cms)      (hrs)         (mm)
  INFLOW : ID= 2 (  2004)     5.799      1.436       8.00        56.44
  OUTFLOW: ID= 1 (  3002)     5.799      0.375       8.25        56.42

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.10
                TIME SHIFT OF PEAK FLOW         (min)= 15.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1280

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--------------------
| ADD HYD  (  2005)|
|   1 + 2 =  3     |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  3001):     1.95   0.086      8.33     62.43
      + ID2= 2 (  3002):     5.80   0.375      8.25     56.42
        ================================================
        ID = 3 (  2005):     7.75   0.460      8.25     57.93
```



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    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 + 2 =  3     |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1300):     0.41   0.043      8.00     22.78
      + ID2= 2 (  2005):     7.75   0.460      8.25     57.93
        ================================================
        ID = 3 (  2006):     8.16   0.472      8.25     56.16

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.13          0.12
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     40.25         40.00
    Mannings n          =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=    118.36         33.67
               over (min)       5.00         15.00
    Storage Coeff.  (min)=      1.38 (ii)    12.29 (ii)
    Unit Hyd. Tpeak (min)=      5.00         15.00
    Unit Hyd. peak  (cms)=      0.33          0.09
                                                      *TOTALS*
    PEAK FLOW       (cms)=      0.04          0.01       0.045 (iii)
    TIME TO PEAK    (hrs)=      8.00          8.17        8.00
    RUNOFF VOLUME    (mm)=     66.50         26.54       47.09
    TOTAL RAINFALL   (mm)=     67.50         67.50       67.50
    RUNOFF COEFFICIENT   =      0.99          0.39        0.70

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2007)|
|   1 + 2 =  3     |         AREA    QPEAK     TPEAK      R.V.
--------------------         (ha)    (cms)     (hrs)      (mm)
        ID1= 1 (  1400):     0.24   0.045      8.00     47.09
      + ID2= 2 (  2006):     8.16   0.472      8.25     56.16
        ================================================
        ID = 3 (  2007):     8.40   0.486      8.25     55.90

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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      V    V   I    SSSSS  U    U    A     L
      V    V   I    SS     U    U   A A    L
       V  V    I     SS    U    U  AAAAA   L
       V  V    I      SS   U    U  A   A   L
        VV     I    SSSSS  UUUUU   A   A   LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\f7f15c
8b-989f-4a74-b503-58c1421c7e8c\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\f7f15c
8b-989f-4a74-b503-58c1421c7e8c\scenar


DATE: 02/11/2020                         TIME: 01:51:22

USER:


COMMENTS: ____________________________________________________________

------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : Run 10                      **
  **********************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1676.200
| Ptotal= 78.08 mm |                           B=   8.300
--------------------                           C=   0.858
                         used in:    INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.17    0.49 |  6.17    1.87 | 12.17    1.62 | 18.17    0.72
                 0.33    0.50 |  6.33    2.06 | 12.33    1.57 | 18.33    0.70
                 0.50    0.51 |  6.50    2.29 | 12.50    1.51 | 18.50    0.69
                 0.67    0.52 |  6.67    2.58 | 12.67    1.46 | 18.67    0.69
                 0.83    0.53 |  6.83    2.95 | 12.83    1.41 | 18.83    0.68
```



```
                 1.00    0.54 |  7.00    3.47 | 13.00    1.37 | 19.00    0.67
                 1.17    0.55 |  7.17    4.22 | 13.17    1.33 | 19.17    0.66
                 1.33    0.56 |  7.33    5.41 | 13.33    1.29 | 19.33    0.65
                 1.50    0.58 |  7.50    7.56 | 13.50    1.25 | 19.50    0.64
                 1.67    0.59 |  7.67   12.52 | 13.67    1.22 | 19.67    0.63
                 1.83    0.60 |  7.83   34.10 | 13.83    1.19 | 19.83    0.62
                 2.00    0.62 |  8.00  138.40 | 14.00    1.16 | 20.00    0.62
                 2.17    0.64 |  8.17   45.75 | 14.17    1.13 | 20.17    0.61
                 2.33    0.65 |  8.33   22.49 | 14.33    1.10 | 20.33    0.60
                 2.50    0.67 |  8.50   14.49 | 14.50    1.07 | 20.50    0.59
                 2.67    0.69 |  8.67   10.58 | 14.67    1.05 | 20.67    0.59
                 2.83    0.71 |  8.83    8.31 | 14.83    1.03 | 20.83    0.58
                 3.00    0.73 |  9.00    6.83 | 15.00    1.00 | 21.00    0.57
                 3.17    0.75 |  9.17    5.80 | 15.17    0.98 | 21.17    0.57
                 3.33    0.78 |  9.33    5.04 | 15.33    0.96 | 21.33    0.56
                 3.50    0.80 |  9.50    4.46 | 15.50    0.94 | 21.50    0.56
                 3.67    0.83 |  9.67    4.00 | 15.67    0.92 | 21.67    0.55
                 3.83    0.86 |  9.83    3.63 | 15.83    0.91 | 21.83    0.54
                 4.00    0.90 | 10.00    3.32 | 16.00    0.89 | 22.00    0.54
                 4.17    0.93 | 10.17    3.07 | 16.17    0.87 | 22.17    0.53
                 4.33    0.97 | 10.33    2.85 | 16.33    0.86 | 22.33    0.53
                 4.50    1.01 | 10.50    2.66 | 16.50    0.84 | 22.50    0.52
                 4.67    1.06 | 10.67    2.50 | 16.67    0.83 | 22.67    0.52
                 4.83    1.11 | 10.83    2.35 | 16.83    0.81 | 22.83    0.51
                 5.00    1.17 | 11.00    2.23 | 17.00    0.80 | 23.00    0.51
                 5.17    1.23 | 11.17    2.11 | 17.17    0.79 | 23.17    0.50
                 5.33    1.31 | 11.33    2.01 | 17.33    0.77 | 23.33    0.50
                 5.50    1.39 | 11.50    1.92 | 17.50    0.76 | 23.50    0.49
                 5.67    1.48 | 11.67    1.84 | 17.67    0.75 | 23.67    0.49
                 5.83    1.59 | 11.83    1.76 | 17.83    0.74 | 23.83    0.48
                 6.00    1.72 | 12.00    1.69 | 18.00    0.73 | 24.00    0.48

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


                         ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.49 | 6.083    1.87 |12.083    1.62 | 18.08    0.72
               0.167    0.49 | 6.167    1.87 |12.167    1.62 | 18.17    0.72
               0.250    0.50 | 6.250    2.06 |12.250    1.57 | 18.25    0.70
               0.333    0.50 | 6.333    2.06 |12.333    1.57 | 18.33    0.70
               0.417    0.51 | 6.417    2.29 |12.417    1.51 | 18.42    0.69
               0.500    0.51 | 6.500    2.29 |12.500    1.51 | 18.50    0.69
               0.583    0.52 | 6.583    2.58 |12.583    1.46 | 18.58    0.69
               0.667    0.52 | 6.667    2.58 |12.667    1.46 | 18.67    0.69
               0.750    0.53 | 6.750    2.95 |12.750    1.41 | 18.75    0.68
               0.833    0.53 | 6.833    2.95 |12.833    1.41 | 18.83    0.68
               0.917    0.54 | 6.917    3.47 |12.917    1.37 | 18.92    0.67
               1.000    0.54 | 7.000    3.47 |13.000    1.37 | 19.00    0.67
               1.083    0.55 | 7.083    4.22 |13.083    1.33 | 19.08    0.66
               1.167    0.55 | 7.167    4.22 |13.167    1.33 | 19.17    0.66
               1.250    0.56 | 7.250    5.41 |13.250    1.29 | 19.25    0.65
               1.333    0.56 | 7.333    5.41 |13.333    1.29 | 19.33    0.65
               1.417    0.58 | 7.417    7.56 |13.417    1.25 | 19.42    0.64
```

```
         1.500    0.58 | 7.500    7.56 |13.500    1.25 | 19.50    0.64
         1.583    0.59 | 7.583   12.52 |13.583    1.22 | 19.58    0.63
         1.667    0.59 | 7.667   12.52 |13.667    1.22 | 19.67    0.63
         1.750    0.60 | 7.750   34.10 |13.750    1.19 | 19.75    0.62
         1.833    0.60 | 7.833   34.10 |13.833    1.19 | 19.83    0.62
         1.917    0.62 | 7.917  138.40 |13.917    1.16 | 19.92    0.62
         2.000    0.62 | 8.000  138.40 |14.000    1.16 | 20.00    0.62
         2.083    0.64 | 8.083   45.75 |14.083    1.13 | 20.08    0.61
         2.167    0.64 | 8.167   45.75 |14.167    1.13 | 20.17    0.61
         2.250    0.65 | 8.250   22.49 |14.250    1.10 | 20.25    0.60
         2.333    0.65 | 8.333   22.49 |14.333    1.10 | 20.33    0.60
         2.417    0.67 | 8.417   14.49 |14.417    1.07 | 20.42    0.59
         2.500    0.67 | 8.500   14.49 |14.500    1.07 | 20.50    0.59
         2.583    0.69 | 8.583   10.58 |14.583    1.05 | 20.58    0.59
         2.667    0.69 | 8.667   10.58 |14.667    1.05 | 20.67    0.59
         2.750    0.71 | 8.750    8.31 |14.750    1.03 | 20.75    0.58
         2.833    0.71 | 8.833    8.31 |14.833    1.03 | 20.83    0.58
         2.917    0.73 | 8.917    6.83 |14.917    1.00 | 20.92    0.57
         3.000    0.73 | 9.000    6.83 |15.000    1.00 | 21.00    0.57
         3.083    0.75 | 9.083    5.80 |15.083    0.98 | 21.08    0.57
         3.167    0.75 | 9.167    5.80 |15.167    0.98 | 21.17    0.57
         3.250    0.78 | 9.250    5.04 |15.250    0.96 | 21.25    0.56
         3.333    0.78 | 9.333    5.04 |15.333    0.96 | 21.33    0.56
         3.417    0.80 | 9.417    4.46 |15.417    0.94 | 21.42    0.56
         3.500    0.80 | 9.500    4.46 |15.500    0.94 | 21.50    0.56
         3.583    0.83 | 9.583    4.00 |15.583    0.92 | 21.58    0.55
         3.667    0.83 | 9.667    4.00 |15.667    0.92 | 21.67    0.55
         3.750    0.86 | 9.750    3.63 |15.750    0.91 | 21.75    0.54
         3.833    0.86 | 9.833    3.63 |15.833    0.91 | 21.83    0.54
         3.917    0.90 | 9.917    3.32 |15.917    0.89 | 21.92    0.54
         4.000    0.90 |10.000    3.32 |16.000    0.89 | 22.00    0.54
         4.083    0.93 |10.083    3.07 |16.083    0.87 | 22.08    0.53
         4.167    0.93 |10.167    3.07 |16.167    0.87 | 22.17    0.53
         4.250    0.97 |10.250    2.85 |16.250    0.86 | 22.25    0.53
         4.333    0.97 |10.333    2.85 |16.333    0.86 | 22.33    0.53
         4.417    1.01 |10.417    2.66 |16.417    0.84 | 22.42    0.52
         4.500    1.01 |10.500    2.66 |16.500    0.84 | 22.50    0.52
         4.583    1.06 |10.583    2.50 |16.583    0.83 | 22.58    0.52
         4.667    1.06 |10.667    2.50 |16.667    0.83 | 22.67    0.52
         4.750    1.11 |10.750    2.35 |16.750    0.81 | 22.75    0.51
         4.833    1.11 |10.833    2.35 |16.833    0.81 | 22.83    0.51
         4.917    1.17 |10.917    2.23 |16.917    0.80 | 22.92    0.51
         5.000    1.17 |11.000    2.23 |17.000    0.80 | 23.00    0.51
         5.083    1.23 |11.083    2.11 |17.083    0.79 | 23.08    0.50
         5.167    1.23 |11.167    2.11 |17.167    0.79 | 23.17    0.50
         5.250    1.31 |11.250    2.01 |17.250    0.77 | 23.25    0.50
         5.333    1.31 |11.333    2.01 |17.333    0.77 | 23.33    0.50
         5.417    1.39 |11.417    1.92 |17.417    0.76 | 23.42    0.49
         5.500    1.39 |11.500    1.92 |17.500    0.76 | 23.50    0.49
         5.583    1.48 |11.583    1.84 |17.583    0.75 | 23.58    0.49
         5.667    1.48 |11.667    1.84 |17.667    0.75 | 23.67    0.49
         5.750    1.59 |11.750    1.76 |17.750    0.74 | 23.75    0.48
         5.833    1.59 |11.833    1.76 |17.833    0.74 | 23.83    0.48
         5.917    1.72 |11.917    1.69 |17.917    0.73 | 23.92    0.48
         6.000    1.72 |12.000    1.69 |18.000    0.73 | 24.00    0.48

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.057 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  29.048
     TOTAL RAINFALL   (mm)=  78.076
     RUNOFF COEFFICIENT   =   0.372
```



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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.31          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     45.53         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=    138.40         54.68
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.40 (ii)     2.39 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.33          0.30
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.12          0.00          0.119 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     77.08         33.85          76.64
     TOTAL RAINFALL   (mm)=     78.08         78.08          78.08
     RUNOFF COEFFICIENT   =      0.99          0.43           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     26.96         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=    138.40         54.68
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.02 (ii)     2.01 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.34          0.31
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.04          0.00          0.042 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     77.08         33.85          76.64
     TOTAL RAINFALL   (mm)=     78.08         78.08          78.08
     RUNOFF COEFFICIENT   =      0.99          0.43           0.98

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



```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):     0.31    0.119     8.00    76.64
      + ID2= 2 (  1102):     0.11    0.042     8.00    76.64
        ================================================
        ID = 3 (  2001):     0.42    0.160     8.00    76.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.97          0.14
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     86.18         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=    138.40         54.68
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      2.05 (ii)     4.93 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.31          0.22
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.37          0.02          0.392 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     77.08         33.85          71.54
     TOTAL RAINFALL   (mm)=     78.08         78.08          78.08
     RUNOFF COEFFICIENT   =      0.99          0.43           0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2002)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11    0.392     8.00    71.54
      + ID2= 2 (  2001):     0.42    0.160     8.00    76.64
        ================================================
        ID = 3 (  2002):     1.53    0.552     8.00    72.94
```



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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.36          0.05
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     52.54         40.00
     Mannings n           =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=    138.40         54.68
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.52 (ii)     4.36 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.33          0.23
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.14          0.01          0.147 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     77.08         33.85          71.71
     TOTAL RAINFALL   (mm)=     78.08         78.08          78.08
     RUNOFF COEFFICIENT   =      0.99          0.43           0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41    0.147     8.00    71.71
      + ID2= 2 (  2002):     1.53    0.552     8.00    72.94
        ================================================
        ID = 3 (  2003):     1.95    0.699     8.00    72.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                           AREA     QPEAK      TPEAK        R.V.
                           (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)     1.948      0.699       8.00       72.68
```

```
 OUTFLOW: ID= 1 (  3001)      1.948      0.100      8.33      72.67

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.23
                 TIME SHIFT OF PEAK FLOW          (min)= 20.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0737

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96          0.21
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     166.75         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
                over (min)       5.00          5.00
     Storage Coeff.  (min)=       3.05 (ii)     4.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.27          0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.48          0.03         1.510 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00         8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85        74.91
     TOTAL RAINFALL   (mm)=      78.08         78.08        78.08
     RUNOFF COEFFICIENT   =       0.99          0.43         0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38          1.25
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     104.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
                over (min)       5.00         15.00
     Storage Coeff.  (min)=       2.30 (ii)    11.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.30          0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14          0.11         0.203 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.17         8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85        43.83
     TOTAL RAINFALL   (mm)=      78.08         78.08        78.08
     RUNOFF COEFFICIENT   =       0.99          0.43         0.56
```



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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2004)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1000):      1.63   0.203     8.00    43.83
     + ID2= 2 (  1200):      4.17   1.510     8.00    74.91
       ==================================================
       ID = 3 (  2004):      5.80   1.713     8.00    66.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.4950     0.1485
                          0.1800     0.0870    |   0.5750     0.1645
                          0.3000     0.1120    |   0.6650     0.1815
                          0.3750     0.1280    |   0.0000     0.0000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2004)      5.799      1.713      8.00       66.19
   OUTFLOW: ID= 1 (  3002)      5.799      0.491      8.25       66.17

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.64
                 TIME SHIFT OF PEAK FLOW          (min)= 15.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.1485

------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2005)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  3001):      1.95   0.100     8.33    72.67
     + ID2= 2 (  3002):      5.80   0.491     8.25    66.17
       ==================================================
       ID = 3 (  2005):      7.75   0.589     8.25    67.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1300):      0.41   0.057     8.00    29.05
     + ID2= 2 (  2005):      7.75   0.589     8.25    67.80
```



```
       ==================================================
       ID = 3 (  2006):      8.16   0.605     8.25    65.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13          0.12
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      40.25         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
                over (min)       5.00         15.00
     Storage Coeff.  (min)=       1.30 (ii)    10.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=       0.33          0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05          0.01         0.054 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.17         8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85        56.09
     TOTAL RAINFALL   (mm)=      78.08         78.08        78.08
     RUNOFF COEFFICIENT   =       0.99          0.43         0.72

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2007)|
|  1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1400):      0.24   0.054     8.00    56.09
     + ID2= 2 (  2006):      8.16   0.605     8.25    65.86
       ==================================================
       ID = 3 (  2007):      8.40   0.622     8.25    65.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

 FINISH
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      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
```



```
       V  V    I       SS   U   U  A    A  L
        VV     I    SSSSS   UUUUU  A    A  LLLLL

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

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\44af97
cf-ed55-4944-87b5-b970d5fae067\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\44af97
cf-ed55-4944-87b5-b970d5fae067\scenar


DATE: 02/11/2020                         TIME: 01:51:19

USER:


COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : Run 11                        **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1973.100
| Ptotal= 85.42 mm |                           B=   9.000
--------------------                           C=   0.868
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.17    0.50 |  6.17    1.98 | 12.17    1.71 | 18.17    0.74
                  0.33    0.51 |  6.33    2.18 | 12.33    1.64 | 18.33    0.73
                  0.50    0.52 |  6.50    2.43 | 12.50    1.58 | 18.50    0.72
                  0.67    0.53 |  6.67    2.74 | 12.67    1.53 | 18.67    0.71
                  0.83    0.54 |  6.83    3.16 | 12.83    1.48 | 18.83    0.70
                  1.00    0.55 |  7.00    3.73 | 13.00    1.43 | 19.00    0.69
                  1.17    0.57 |  7.17    4.57 | 13.17    1.39 | 19.17    0.68
                  1.33    0.58 |  7.33    5.90 | 13.33    1.35 | 19.33    0.67
                  1.50    0.59 |  7.50    8.33 | 13.50    1.31 | 19.50    0.66
                  1.67    0.61 |  7.67   13.99 | 13.67    1.27 | 19.67    0.65
                  1.83    0.62 |  7.83   38.66 | 13.83    1.24 | 19.83    0.64
```

```
                2.00    0.64 |  8.00  153.18 | 14.00    1.20 | 20.00    0.63
                2.17    0.65 |  8.17   51.95 | 14.17    1.17 | 20.17    0.63
                2.33    0.67 |  8.33   25.44 | 14.33    1.14 | 20.33    0.62
                2.50    0.69 |  8.50   16.25 | 14.50    1.12 | 20.50    0.61
                2.67    0.71 |  8.67   11.77 | 14.67    1.09 | 20.67    0.60
                2.83    0.73 |  8.83    9.18 | 14.83    1.07 | 20.83    0.60
                3.00    0.75 |  9.00    7.50 | 15.00    1.04 | 21.00    0.59
                3.17    0.78 |  9.17    6.33 | 15.17    1.02 | 21.17    0.58
                3.33    0.80 |  9.33    5.48 | 15.33    1.00 | 21.33    0.58
                3.50    0.83 |  9.50    4.83 | 15.50    0.98 | 21.50    0.57
                3.67    0.86 |  9.67    4.32 | 15.67    0.96 | 21.67    0.56
                3.83    0.89 |  9.83    3.91 | 15.83    0.94 | 21.83    0.56
                4.00    0.93 | 10.00    3.57 | 16.00    0.92 | 22.00    0.55
                4.17    0.97 | 10.17    3.28 | 16.17    0.90 | 22.17    0.55
                4.33    1.01 | 10.33    3.04 | 16.33    0.89 | 22.33    0.54
                4.50    1.05 | 10.50    2.84 | 16.50    0.87 | 22.50    0.53
                4.67    1.10 | 10.67    2.66 | 16.67    0.85 | 22.67    0.53
                4.83    1.16 | 10.83    2.50 | 16.83    0.84 | 22.83    0.52
                5.00    1.22 | 11.00    2.36 | 17.00    0.82 | 23.00    0.52
                5.17    1.29 | 11.17    2.24 | 17.17    0.81 | 23.17    0.51
                5.33    1.36 | 11.33    2.12 | 17.33    0.80 | 23.33    0.51
                5.50    1.45 | 11.50    2.02 | 17.50    0.78 | 23.50    0.50
                5.67    1.55 | 11.67    1.93 | 17.67    0.77 | 23.67    0.50
                5.83    1.67 | 11.83    1.85 | 17.83    0.76 | 23.83    0.49
                6.00    1.81 | 12.00    1.78 | 18.00    0.75 | 24.00    0.49

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.50 | 6.083    1.98 |12.083    1.71 | 18.08    0.74
               0.167    0.50 | 6.167    1.98 |12.167    1.71 | 18.17    0.74
               0.250    0.51 | 6.250    2.18 |12.250    1.64 | 18.25    0.73
               0.333    0.51 | 6.333    2.18 |12.333    1.64 | 18.33    0.73
               0.417    0.52 | 6.417    2.43 |12.417    1.58 | 18.42    0.72
               0.500    0.52 | 6.500    2.43 |12.500    1.58 | 18.50    0.72
               0.583    0.53 | 6.583    2.74 |12.583    1.53 | 18.58    0.71
               0.667    0.53 | 6.667    2.74 |12.667    1.53 | 18.67    0.71
               0.750    0.54 | 6.750    3.16 |12.750    1.48 | 18.75    0.70
               0.833    0.54 | 6.833    3.16 |12.833    1.48 | 18.83    0.70
               0.917    0.55 | 6.917    3.73 |12.917    1.43 | 18.92    0.69
               1.000    0.55 | 7.000    3.73 |13.000    1.43 | 19.00    0.69
               1.083    0.57 | 7.083    4.57 |13.083    1.39 | 19.08    0.68
               1.167    0.57 | 7.167    4.57 |13.167    1.39 | 19.17    0.68
               1.250    0.58 | 7.250    5.90 |13.250    1.35 | 19.25    0.67
               1.333    0.58 | 7.333    5.90 |13.333    1.35 | 19.33    0.67
               1.417    0.59 | 7.417    8.33 |13.417    1.31 | 19.42    0.66
               1.500    0.59 | 7.500    8.33 |13.500    1.31 | 19.50    0.66
               1.583    0.61 | 7.583   13.99 |13.583    1.27 | 19.58    0.65
               1.667    0.61 | 7.667   14.00 |13.667    1.27 | 19.67    0.65
               1.750    0.62 | 7.750   38.66 |13.750    1.24 | 19.75    0.64
               1.833    0.62 | 7.833   38.67 |13.833    1.24 | 19.83    0.64
               1.917    0.64 | 7.917  153.18 |13.917    1.20 | 19.92    0.63
```



```
               2.000    0.64 | 8.000  153.17 |14.000    1.20 | 20.00    0.63
               2.083    0.65 | 8.083   51.95 |14.083    1.17 | 20.08    0.63
               2.167    0.65 | 8.167   51.94 |14.167    1.17 | 20.17    0.63
               2.250    0.67 | 8.250   25.44 |14.250    1.14 | 20.25    0.62
               2.333    0.67 | 8.333   25.44 |14.333    1.14 | 20.33    0.62
               2.417    0.69 | 8.417   16.25 |14.417    1.12 | 20.42    0.61
               2.500    0.69 | 8.500   16.25 |14.500    1.12 | 20.50    0.61
               2.583    0.71 | 8.583   11.77 |14.583    1.09 | 20.58    0.60
               2.667    0.71 | 8.667   11.77 |14.667    1.09 | 20.67    0.60
               2.750    0.73 | 8.750    9.18 |14.750    1.07 | 20.75    0.60
               2.833    0.73 | 8.833    9.18 |14.833    1.07 | 20.83    0.60
               2.917    0.75 | 8.917    7.50 |14.917    1.04 | 20.92    0.59
               3.000    0.75 | 9.000    7.50 |15.000    1.04 | 21.00    0.59
               3.083    0.78 | 9.083    6.33 |15.083    1.02 | 21.08    0.58
               3.167    0.78 | 9.167    6.33 |15.167    1.02 | 21.17    0.58
               3.250    0.80 | 9.250    5.48 |15.250    1.00 | 21.25    0.58
               3.333    0.80 | 9.333    5.48 |15.333    1.00 | 21.33    0.58
               3.417    0.83 | 9.417    4.83 |15.417    0.98 | 21.42    0.57
               3.500    0.83 | 9.500    4.83 |15.500    0.98 | 21.50    0.57
               3.583    0.86 | 9.583    4.32 |15.583    0.96 | 21.58    0.56
               3.667    0.86 | 9.667    4.32 |15.667    0.96 | 21.67    0.56
               3.750    0.89 | 9.750    3.91 |15.750    0.94 | 21.75    0.56
               3.833    0.89 | 9.833    3.91 |15.833    0.94 | 21.83    0.56
               3.917    0.93 | 9.917    3.57 |15.917    0.92 | 21.92    0.55
               4.000    0.93 |10.000    3.57 |16.000    0.92 | 22.00    0.55
               4.083    0.97 |10.083    3.28 |16.083    0.90 | 22.08    0.55
               4.167    0.97 |10.167    3.28 |16.167    0.90 | 22.17    0.55
               4.250    1.01 |10.250    3.04 |16.250    0.89 | 22.25    0.54
               4.333    1.01 |10.333    3.04 |16.333    0.89 | 22.33    0.54
               4.417    1.05 |10.417    2.84 |16.417    0.87 | 22.42    0.53
               4.500    1.05 |10.500    2.84 |16.500    0.87 | 22.50    0.53
               4.583    1.10 |10.583    2.66 |16.583    0.85 | 22.58    0.53
               4.667    1.10 |10.667    2.66 |16.667    0.85 | 22.67    0.53
               4.750    1.16 |10.750    2.50 |16.750    0.84 | 22.75    0.52
               4.833    1.16 |10.833    2.50 |16.833    0.84 | 22.83    0.52
               4.917    1.22 |10.917    2.36 |16.917    0.82 | 22.92    0.52
               5.000    1.22 |11.000    2.36 |17.000    0.82 | 23.00    0.52
               5.083    1.29 |11.083    2.24 |17.083    0.81 | 23.08    0.51
               5.167    1.29 |11.167    2.24 |17.167    0.81 | 23.17    0.51
               5.250    1.36 |11.250    2.12 |17.250    0.80 | 23.25    0.51
               5.333    1.36 |11.333    2.12 |17.333    0.80 | 23.33    0.51
               5.417    1.45 |11.417    2.02 |17.417    0.78 | 23.42    0.50
               5.500    1.45 |11.500    2.02 |17.500    0.78 | 23.50    0.50
               5.583    1.55 |11.583    1.93 |17.583    0.77 | 23.58    0.50
               5.667    1.55 |11.667    1.93 |17.667    0.77 | 23.67    0.50
               5.750    1.67 |11.750    1.85 |17.750    0.76 | 23.75    0.49
               5.833    1.67 |11.833    1.85 |17.833    0.76 | 23.83    0.49
               5.917    1.81 |11.917    1.78 |17.917    0.75 | 23.92    0.49
               6.000    1.81 |12.000    1.78 |18.000    0.75 | 24.00    0.49

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.068 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  33.614
     TOTAL RAINFALL   (mm)=  85.418
     RUNOFF COEFFICIENT   =   0.394

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

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--------------------
| CALIB            |
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```
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=       0.31          0.00
     Dep. Storage    (mm)=       1.00          5.00
     Average Slope    (%)=       1.00          2.00
     Length           (m)=      45.53         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    153.18         65.01
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.34 (ii)     2.29 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.33          0.30
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.13          0.00          0.132 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     84.42         39.17          83.96
     TOTAL RAINFALL   (mm)=     85.42         85.42          85.42
     RUNOFF COEFFICIENT   =      0.99          0.46           0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=       0.11          0.00
     Dep. Storage    (mm)=       1.00          5.00
     Average Slope    (%)=       1.00          2.00
     Length           (m)=      26.96         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    153.18         65.01
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      0.98 (ii)     1.93 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.34          0.31
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.05          0.00          0.046 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     84.42         39.17          83.97
     TOTAL RAINFALL   (mm)=     85.42         85.42          85.42
     RUNOFF COEFFICIENT   =      0.99          0.46           0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1101):     0.31    0.132     8.00    83.96
       + ID2= 2 (  1102):     0.11    0.046     8.00    83.97
         ==========================================
         ID = 3 (  2001):     0.42    0.178     8.00    83.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=       0.97          0.14
     Dep. Storage    (mm)=       1.00          5.00
     Average Slope    (%)=       1.00          2.00
     Length           (m)=      86.18         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    153.18         65.01
                over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.97 (ii)     4.73 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.31          0.22
                                                           *TOTALS*
     PEAK FLOW       (cms)=      0.41          0.02          0.436 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     84.42         39.17          78.63
     TOTAL RAINFALL   (mm)=     85.42         85.42          85.42
     RUNOFF COEFFICIENT   =      0.99          0.46           0.92

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1103):     1.11    0.436     8.00    78.63
       + ID2= 2 (  2001):     0.42    0.178     8.00    83.96
         ==========================================
         ID = 3 (  2002):     1.53    0.614     8.00    80.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      52.54        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.46 (ii)    4.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.24
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.01        0.163 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00         8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17        78.81
     TOTAL RAINFALL   (mm)=      85.42        85.42        85.42
     RUNOFF COEFFICIENT   =       0.99         0.46         0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41   0.163     8.00    78.81
      + ID2= 2 (  2002):     1.53   0.614     8.00    80.09
        ===============================================
        ID = 3 (  2003):     1.95   0.777     8.00    79.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2003)      1.948     0.777      8.00      79.82
   OUTFLOW: ID= 1 (  3001)      1.948     0.111      8.42      79.81

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.26
                 TIME SHIFT OF PEAK FLOW         (min)= 25.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0821
```



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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96         0.21
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     166.75        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.93 (ii)    4.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.28         0.22
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.64         0.04        1.680 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00         8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17        82.16
     TOTAL RAINFALL   (mm)=      85.42        85.42        85.42
     RUNOFF COEFFICIENT   =       0.99         0.46         0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38         1.25
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     104.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.21 (ii)   10.59 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.30         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.14        0.233 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.17         8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17        49.62
     TOTAL RAINFALL   (mm)=      85.42        85.42        85.42
     RUNOFF COEFFICIENT   =       0.99         0.46         0.58

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```



```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):     1.63   0.233     8.00    49.62
      + ID2= 2 (  1200):     4.17   1.680     8.00    82.16
        ===============================================
        ID = 3 (  2004):     5.80   1.913     8.00    73.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950     0.1485
                          0.1800     0.0870   |   0.5750     0.1645
                          0.3000     0.1120   |   0.6650     0.1815
                          0.3750     0.1280   |   0.0000     0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2004)      5.799     1.913      8.00      73.02
   OUTFLOW: ID= 1 (  3002)      5.799     0.569      8.25      73.00

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.73
                 TIME SHIFT OF PEAK FLOW         (min)= 15.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.1642

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--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.111     8.42    79.81
      + ID2= 2 (  3002):     5.80   0.569     8.25    73.00
        ===============================================
        ID = 3 (  2005):     7.75   0.678     8.25    74.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.068     8.00    33.61
      + ID2= 2 (  2005):     7.75   0.678     8.25    74.71
        ===============================================
        ID = 3 (  2006):     8.16   0.697     8.25    72.65

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13         0.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.25 (ii)    9.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.11
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.01        0.064 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08         8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17        62.46
     TOTAL RAINFALL   (mm)=      85.42        85.42        85.42
     RUNOFF COEFFICIENT   =       0.99         0.46         0.73

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     0.24   0.064     8.00    62.46
      + ID2= 2 (  2006):     8.16   0.697     8.25    72.65
        ===============================================
        ID = 3 (  2007):     8.40   0.720     8.17    72.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2059ab aa-732a-456d-8c39-53851bbb2f0a\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\2059ab aa-732a-456d-8c39-53851bbb2f0a\scenar

DATE: 02/11/2020 TIME: 01:51:17

USER:

COMMENTS: ____

** SIMULATION : Run 12 **

| CHICAGO STORM |
| Ptotal= 92.89 mm |

IDF curve parameters: A=2193.100
B= 9.040
C= 0.871
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.53	6.17	2.12	12.17	1.83	18.17	0.79
0.33	0.54	6.33	2.34	12.33	1.76	18.33	0.77
0.50	0.55	6.50	2.60	12.50	1.70	18.50	0.76
0.67	0.56	6.67	2.95	12.67	1.64	18.67	0.75
0.83	0.58	6.83	3.40	12.83	1.58	18.83	0.74
1.00	0.59	7.00	4.02	13.00	1.53	19.00	0.73
1.17	0.60	7.17	4.93	13.17	1.48	19.17	0.72
1.33	0.62	7.33	6.38	13.33	1.44	19.33	0.71
1.50	0.63	7.50	9.03	13.50	1.40	19.50	0.70
1.67	0.65	7.67	15.23	13.67	1.36	19.67	0.69
1.83	0.66	7.83	42.35	13.83	1.32	19.83	0.68
2.00	0.68	8.00	168.45	14.00	1.29	20.00	0.68
2.17	0.70	8.17	56.97	14.17	1.25	20.17	0.67
2.33	0.72	8.33	27.80	14.33	1.22	20.33	0.66
2.50	0.74	8.50	17.71	14.50	1.19	20.50	0.65
2.67	0.76	8.67	12.80	14.67	1.16	20.67	0.64
2.83	0.78	8.83	9.96	14.83	1.14	20.83	0.63
3.00	0.80	9.00	8.12	15.00	1.11	21.00	0.63
3.17	0.83	9.17	6.85	15.17	1.09	21.17	0.62
3.33	0.86	9.33	5.92	15.33	1.06	21.33	0.61
3.50	0.89	9.50	5.21	15.50	1.04	21.50	0.61
3.67	0.92	9.67	4.66	15.67	1.02	21.67	0.60

3.83	0.95	9.83	4.21	15.83	1.00	21.83	0.59
4.00	0.99	10.00	3.84	16.00	0.98	22.00	0.59
4.17	1.03	10.17	3.53	16.17	0.96	22.17	0.58
4.33	1.07	10.33	3.27	16.33	0.94	22.33	0.57
4.50	1.12	10.50	3.05	16.50	0.93	22.50	0.57
4.67	1.18	10.67	2.85	16.67	0.91	22.67	0.56
4.83	1.24	10.83	2.68	16.83	0.90	22.83	0.56
5.00	1.30	11.00	2.53	17.00	0.88	23.00	0.55
5.17	1.38	11.17	2.40	17.17	0.86	23.17	0.55
5.33	1.46	11.33	2.28	17.33	0.85	23.33	0.54
5.50	1.56	11.50	2.17	17.50	0.84	23.50	0.53
5.67	1.66	11.67	2.07	17.67	0.82	23.67	0.53
5.83	1.79	11.83	1.98	17.83	0.81	23.83	0.52
6.00	1.94	12.00	1.90	18.00	0.80	24.00	0.52

| CALIB |
| NASHYD (1300)| Area (ha)= 0.41 Curve Number (CN)= 75.0
|ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	6.083	2.12	12.083	1.83	18.08	0.79
0.167	0.53	6.167	2.12	12.167	1.83	18.17	0.79
0.250	0.54	6.250	2.34	12.250	1.76	18.25	0.77
0.333	0.54	6.333	2.34	12.333	1.76	18.33	0.77
0.417	0.55	6.417	2.60	12.417	1.70	18.42	0.76
0.500	0.55	6.500	2.60	12.500	1.70	18.50	0.76
0.583	0.56	6.583	2.95	12.583	1.64	18.58	0.75
0.667	0.56	6.667	2.95	12.667	1.64	18.67	0.75
0.750	0.58	6.750	3.40	12.750	1.58	18.75	0.74
0.833	0.58	6.833	3.40	12.833	1.58	18.83	0.74
0.917	0.59	6.917	4.02	12.917	1.53	18.92	0.73
1.000	0.59	7.000	4.02	13.000	1.53	19.00	0.73
1.083	0.60	7.083	4.93	13.083	1.48	19.08	0.72
1.167	0.60	7.167	4.93	13.167	1.48	19.17	0.72
1.250	0.62	7.250	6.38	13.250	1.44	19.25	0.71
1.333	0.62	7.333	6.38	13.333	1.44	19.33	0.71
1.417	0.63	7.417	9.03	13.417	1.40	19.42	0.70
1.500	0.63	7.500	9.03	13.500	1.40	19.50	0.70
1.583	0.65	7.583	15.23	13.583	1.36	19.58	0.69
1.667	0.65	7.667	15.23	13.667	1.36	19.67	0.69
1.750	0.66	7.750	42.35	13.750	1.32	19.75	0.68
1.833	0.66	7.833	42.36	13.833	1.32	19.83	0.68
1.917	0.68	7.917	168.45	13.917	1.29	19.92	0.68
2.000	0.68	8.000	168.44	14.000	1.29	20.00	0.68
2.083	0.70	8.083	56.97	14.083	1.25	20.08	0.67
2.167	0.70	8.167	56.97	14.167	1.25	20.17	0.67
2.250	0.72	8.250	27.80	14.250	1.22	20.25	0.66
2.333	0.72	8.333	27.80	14.333	1.22	20.33	0.66
2.417	0.74	8.417	17.71	14.417	1.19	20.42	0.65
2.500	0.74	8.500	17.71	14.500	1.19	20.50	0.65
2.583	0.76	8.583	12.80	14.583	1.16	20.58	0.64
2.667	0.76	8.667	12.80	14.667	1.16	20.67	0.64
2.750	0.78	8.750	9.96	14.750	1.14	20.75	0.63
2.833	0.78	8.833	9.96	14.833	1.14	20.83	0.63

2.917	0.80	8.917	8.12	14.917	1.11	20.92	0.63
3.000	0.80	9.000	8.12	15.000	1.11	21.00	0.63
3.083	0.83	9.083	6.85	15.083	1.09	21.08	0.62
3.167	0.83	9.167	6.85	15.167	1.09	21.17	0.62
3.250	0.86	9.250	5.92	15.250	1.06	21.25	0.61
3.333	0.86	9.333	5.92	15.333	1.06	21.33	0.61
3.417	0.89	9.417	5.21	15.417	1.04	21.42	0.61
3.500	0.89	9.500	5.21	15.500	1.04	21.50	0.61
3.583	0.92	9.583	4.66	15.583	1.02	21.58	0.60
3.667	0.92	9.667	4.66	15.667	1.02	21.67	0.60
3.750	0.95	9.750	4.21	15.750	1.00	21.75	0.59
3.833	0.95	9.833	4.21	15.833	1.00	21.83	0.59
3.917	0.99	9.917	3.84	15.917	0.98	21.92	0.59
4.000	0.99	10.000	3.84	16.000	0.98	22.00	0.59
4.083	1.03	10.083	3.53	16.083	0.96	22.08	0.58
4.167	1.03	10.167	3.53	16.167	0.96	22.17	0.58
4.250	1.07	10.250	3.27	16.250	0.94	22.25	0.57
4.333	1.07	10.333	3.27	16.333	0.94	22.33	0.57
4.417	1.12	10.417	3.05	16.417	0.93	22.42	0.57
4.500	1.12	10.500	3.05	16.500	0.93	22.50	0.57
4.583	1.18	10.583	2.85	16.583	0.91	22.58	0.56
4.667	1.18	10.667	2.85	16.667	0.91	22.67	0.56
4.750	1.24	10.750	2.68	16.750	0.90	22.75	0.56
4.833	1.24	10.833	2.68	16.833	0.90	22.83	0.56
4.917	1.30	10.917	2.53	16.917	0.88	22.92	0.55
5.000	1.30	11.000	2.53	17.000	0.88	23.00	0.55
5.083	1.38	11.083	2.40	17.083	0.86	23.08	0.55
5.167	1.38	11.167	2.40	17.167	0.86	23.17	0.55
5.250	1.46	11.250	2.28	17.250	0.85	23.25	0.54
5.333	1.46	11.333	2.28	17.333	0.85	23.33	0.54
5.417	1.56	11.417	2.17	17.417	0.84	23.42	0.53
5.500	1.56	11.500	2.17	17.500	0.84	23.50	0.53
5.583	1.66	11.583	2.07	17.583	0.82	23.58	0.53
5.667	1.66	11.667	2.07	17.667	0.82	23.67	0.53
5.750	1.79	11.750	1.98	17.750	0.81	23.75	0.52
5.833	1.79	11.833	1.98	17.833	0.81	23.83	0.52
5.917	1.94	11.917	1.90	17.917	0.80	23.92	0.52
6.000	1.94	12.000	1.90	18.000	0.80	24.00	0.52

Unit Hyd Qpeak (cms)= 0.261

PEAK FLOW (cms)= 0.079 (i)
TIME TO PEAK (hrs)= 8.000
RUNOFF VOLUME (mm)= 38.412
TOTAL RAINFALL (mm)= 92.889
RUNOFF COEFFICIENT = 0.414

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

| CALIB |
| STANDHYD (1101)| Area (ha)= 0.31
|ID= 1 DT= 5.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.31	0.00
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	45.53	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	168.45	76.14

over (min)	5.00	5.00	
Storage Coeff. (min)=	1.29 (ii)	2.21 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.33	0.30	
			TOTALS
PEAK FLOW (cms)=	0.14	0.00	0.145 (iii)
TIME TO PEAK (hrs)=	8.00	8.00	8.00
RUNOFF VOLUME (mm)=	91.89	44.77	91.42
TOTAL RAINFALL (mm)=	92.89	92.89	92.89
RUNOFF COEFFICIENT =	0.99	0.48	0.98

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 75.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| STANDHYD (1102)| Area (ha)= 0.11
|ID= 1 DT= 5.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.11	0.00	
Dep. Storage (mm)=	1.00	5.00	
Average Slope (%)=	1.00	2.00	
Length (m)=	26.96	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	168.45	76.14	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.94 (ii)	1.86 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.32	
			TOTALS
PEAK FLOW (cms)=	0.05	0.00	0.051 (iii)
TIME TO PEAK (hrs)=	8.00	8.00	8.00
RUNOFF VOLUME (mm)=	91.89	44.77	91.42
TOTAL RAINFALL (mm)=	92.89	92.89	92.89
RUNOFF COEFFICIENT =	0.99	0.48	0.98

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 75.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (2001)|
| 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1101):	0.31	0.145	8.00	91.42
+ ID2= 2 (1102):	0.11	0.051	8.00	91.42
ID = 3 (2001):	0.42	0.195	8.00	91.42

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97         0.14
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.45        76.14
               over (min)       5.00         5.00
     Storage Coeff.  (min)=       1.90 (ii)    4.56 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.23
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.45         0.03         0.482 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      91.89        44.77         85.86
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11   0.482     8.00    85.86
      + ID2= 2 (  2001):     0.42   0.195     8.00    91.42
        ===============================================
        ID = 3 (  2002):     1.53   0.677     8.00    87.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      52.54        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.45        76.14
               over (min)       5.00         5.00
```



```
     Storage Coeff.  (min)=       1.41 (ii)    4.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.24
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.01         0.180 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      91.89        44.77         86.04
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.93

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41   0.180     8.00    86.04
      + ID2= 2 (  2002):     1.53   0.677     8.00    87.38
        ===============================================
        ID = 3 (  2003):     1.95   0.858     8.00    87.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0801     0.0575
                          0.0012     0.0001    |   0.0965     0.0712
                          0.0013     0.0085    |   0.1106     0.0816
                          0.0238     0.0256    |   0.1230     0.0900
                          0.0593     0.0421    |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2003)    1.948     0.858      8.00      87.10
   OUTFLOW: ID= 1 (  3001)    1.948     0.122      8.33      87.09

              PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.25
              TIME SHIFT OF PEAK FLOW         (min)= 20.00
              MAXIMUM  STORAGE   USED       (ha.m.)=  0.0898

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1200)|   Area    (ha)=   4.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  95.00   Dir. Conn.(%)=  95.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.96         0.21
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     166.75        40.00
```



```
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.45        76.14
               over (min)       5.00         5.00
     Storage Coeff.  (min)=       2.82 (ii)    4.58 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.28         0.23
                                                         *TOTALS*
     PEAK FLOW       (cms)=       1.81         0.04         1.857 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      91.89        44.76         89.53
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.96

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1000)|   Area    (ha)=   1.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.10   Dir. Conn.(%)=  23.10
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.38         1.25
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     104.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.45        76.14
               over (min)       5.00        10.00
     Storage Coeff.  (min)=       2.13 (ii)   10.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.11
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.17         0.312 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08          8.00
     RUNOFF VOLUME    (mm)=      91.89        44.77         55.65
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1000):     1.63   0.312     8.00    55.65
      + ID2= 2 (  1200):     4.17   1.857     8.00    89.53
```



```
        ===============================================
        ID = 3 (  2004):     5.80   2.169     8.00    80.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.4950     0.1485
                          0.1800     0.0870    |   0.5750     0.1645
                          0.3000     0.1120    |   0.6650     0.1815
                          0.3750     0.1280    |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2004)    5.799     2.169      8.00      80.02
   OUTFLOW: ID= 1 (  3002)    5.799     0.655      8.25      80.00

              PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.22
              TIME SHIFT OF PEAK FLOW         (min)= 15.00
              MAXIMUM  STORAGE   USED       (ha.m.)=  0.1814

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.122     8.33    87.09
      + ID2= 2 (  3002):     5.80   0.655     8.25    80.00
        ===============================================
        ID = 3 (  2005):     7.75   0.776     8.25    81.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.079     8.00    38.41
      + ID2= 2 (  2005):     7.75   0.776     8.25    81.78
        ===============================================
        ID = 3 (  2006):     8.16   0.797     8.25    79.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1400)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.50   Dir. Conn.(%)=  51.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.13         0.12
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250
```

```
     Max.Eff.Inten.(mm/hr)=     168.45        76.14
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.20 (ii)    9.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.12
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.02         0.072 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08          8.00
     RUNOFF VOLUME    (mm)=      91.89        44.77         69.02
     TOTAL RAINFALL   (mm)=      92.89        92.89         92.89
     RUNOFF COEFFICIENT   =       0.99         0.48          0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     0.24   0.072     8.00    69.02
      + ID2= 2 (  2006):     8.16   0.797     8.25    79.60
        ==================================================
        ID = 3 (  2007):     8.40   0.830     8.17    79.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

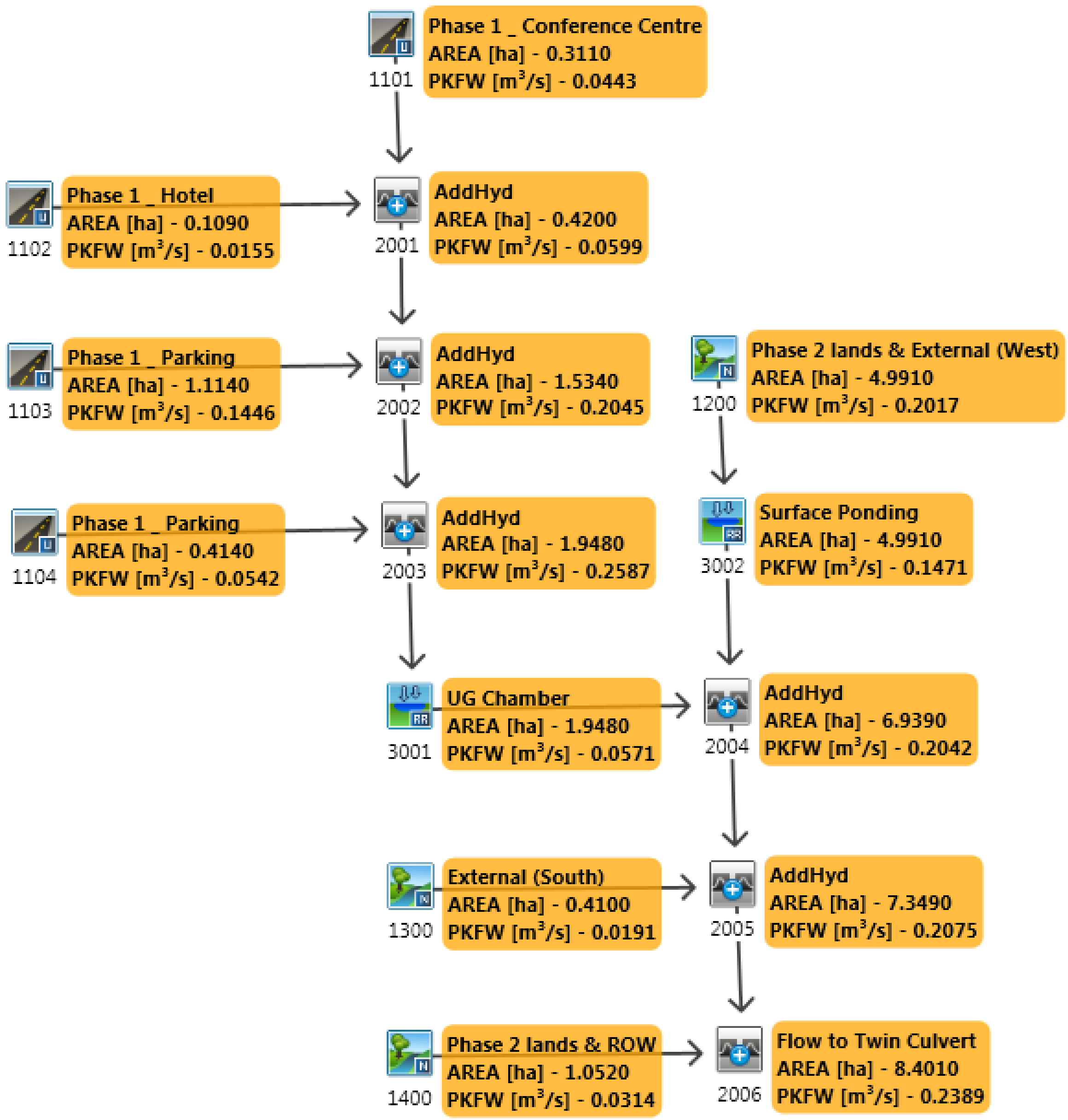

Figure B3
Visual OTTHYMO Model Schematic _ Post- Development (Interim) Conditions

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

      V    V   I    SSSSS  U    U     A     L
      V    V   I    SS     U    U    A A    L
       V  V    I     SS    U    U   AAAAA   L
        V V    I      SS   U    U   A   A   L
         VV    I    SSSSS  UUUUU   A   A   LLLLL

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

Developed and Distributed by Civica Infrastructure


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\479dc2
43-1e7d-4c7f-8b1f-a79f22d4b4d0\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\479dc2
43-1e7d-4c7f-8b1f-a79f22d4b4d0\scenar


DATE: 02/11/2020                              TIME: 01:52:42

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : Run 01                       **
  **********************************************


--------------------
|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\6d48df83
| Ptotal= 46.77 mm |     Comments: 2yr24hrSCS_Midland
--------------------
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.25     0.51 |  6.25     0.94 | 12.25     6.74 | 18.25     0.84
                 0.50     0.51 |  6.50     0.94 | 12.50     6.74 | 18.50     0.84
                 0.75     0.51 |  6.75     0.94 | 12.75     3.46 | 18.75     0.84
                 1.00     0.51 |  7.00     0.94 | 13.00     3.46 | 19.00     0.84
                 1.25     0.51 |  7.25     0.94 | 13.25     0.66 | 19.25     0.84
                 1.50     0.51 |  7.50     0.94 | 13.50     0.66 | 19.50     0.84
                 1.75     0.51 |  7.75     0.94 | 13.75     3.84 | 19.75     0.84
                 2.00     0.51 |  8.00     0.94 | 14.00     3.84 | 20.00     0.84
```



```
                 2.25     0.61 |  8.25     1.26 | 14.25     1.40 | 20.25     0.56
                 2.50     0.61 |  8.50     1.26 | 14.50     1.40 | 20.50     0.56
                 2.75     0.61 |  8.75     1.26 | 14.75     1.40 | 20.75     0.56
                 3.00     0.61 |  9.00     1.26 | 15.00     1.40 | 21.00     0.56
                 3.25     0.61 |  9.25     1.50 | 15.25     1.40 | 21.25     0.56
                 3.50     0.61 |  9.50     1.50 | 15.50     1.40 | 21.50     0.56
                 3.75     0.61 |  9.75     1.68 | 15.75     1.40 | 21.75     0.56
                 4.00     0.61 | 10.00     1.68 | 16.00     1.40 | 22.00     0.56
                 4.25     0.75 | 10.25     2.15 | 16.25     0.84 | 22.25     0.56
                 4.50     0.75 | 10.50     2.15 | 16.50     0.84 | 22.50     0.56
                 4.75     0.75 | 10.75     2.90 | 16.75     0.84 | 22.75     0.56
                 5.00     0.75 | 11.00     2.90 | 17.00     0.84 | 23.00     0.56
                 5.25     0.75 | 11.25     4.49 | 17.25     0.84 | 23.25     0.56
                 5.50     0.75 | 11.50     4.49 | 17.50     0.84 | 23.50     0.56
                 5.75     0.75 | 11.75    19.47 | 17.75     0.84 | 23.75     0.56
                 6.00     0.75 | 12.00    51.67 | 18.00     0.84 | 24.00     0.56

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

--------------------
| CALIB            |
| NASHYD   (  1300)|    Area    (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    0.06

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


                        ---- TRANSFORMED HYETOGRAPH ----
          TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
         0.083    0.51 | 6.083    0.94 |12.083    6.75 | 18.08    0.84
         0.167    0.51 | 6.167    0.94 |12.167    6.74 | 18.17    0.84
         0.250    0.51 | 6.250    0.94 |12.250    6.74 | 18.25    0.84
         0.333    0.51 | 6.333    0.94 |12.333    6.74 | 18.33    0.84
         0.417    0.51 | 6.417    0.94 |12.417    6.74 | 18.42    0.84
         0.500    0.51 | 6.500    0.94 |12.500    6.74 | 18.50    0.84
         0.583    0.51 | 6.583    0.94 |12.583    3.46 | 18.58    0.84
         0.667    0.51 | 6.667    0.94 |12.667    3.46 | 18.67    0.84
         0.750    0.51 | 6.750    0.94 |12.750    3.46 | 18.75    0.84
         0.833    0.51 | 6.833    0.94 |12.833    3.46 | 18.83    0.84
         0.917    0.51 | 6.917    0.94 |12.917    3.46 | 18.92    0.84
         1.000    0.51 | 7.000    0.94 |13.000    3.46 | 19.00    0.84
         1.083    0.51 | 7.083    0.94 |13.083    0.66 | 19.08    0.84
         1.167    0.51 | 7.167    0.94 |13.167    0.66 | 19.17    0.84
         1.250    0.51 | 7.250    0.94 |13.250    0.66 | 19.25    0.84
         1.333    0.51 | 7.333    0.94 |13.333    0.66 | 19.33    0.84
         1.417    0.51 | 7.417    0.94 |13.417    0.66 | 19.42    0.84
         1.500    0.51 | 7.500    0.94 |13.500    0.66 | 19.50    0.84
         1.583    0.51 | 7.583    0.94 |13.583    3.84 | 19.58    0.84
         1.667    0.51 | 7.667    0.94 |13.667    3.84 | 19.67    0.84
         1.750    0.51 | 7.750    0.94 |13.750    3.84 | 19.75    0.84
         1.833    0.51 | 7.833    0.94 |13.833    3.84 | 19.83    0.84
         1.917    0.51 | 7.917    0.94 |13.917    3.84 | 19.92    0.84
         2.000    0.51 | 8.000    0.94 |14.000    3.84 | 20.00    0.84
         2.083    0.61 | 8.083    1.26 |14.083    1.40 | 20.08    0.56
         2.167    0.61 | 8.167    1.26 |14.167    1.40 | 20.17    0.56
         2.250    0.61 | 8.250    1.26 |14.250    1.40 | 20.25    0.56
         2.333    0.61 | 8.333    1.26 |14.333    1.40 | 20.33    0.56
         2.417    0.61 | 8.417    1.26 |14.417    1.40 | 20.42    0.56
         2.500    0.61 | 8.500    1.26 |14.500    1.40 | 20.50    0.56
         2.583    0.61 | 8.583    1.26 |14.583    1.40 | 20.58    0.56
         2.667    0.61 | 8.667    1.26 |14.667    1.40 | 20.67    0.56
```



```
         2.750    0.61 | 8.750    1.26 |14.750    1.40 | 20.75    0.56
         2.833    0.61 | 8.833    1.26 |14.833    1.40 | 20.83    0.56
         2.917    0.61 | 8.917    1.26 |14.917    1.40 | 20.92    0.56
         3.000    0.61 | 9.000    1.26 |15.000    1.40 | 21.00    0.56
         3.083    0.61 | 9.083    1.50 |15.083    1.40 | 21.08    0.56
         3.167    0.61 | 9.167    1.50 |15.167    1.40 | 21.17    0.56
         3.250    0.61 | 9.250    1.50 |15.250    1.40 | 21.25    0.56
         3.333    0.61 | 9.333    1.50 |15.333    1.40 | 21.33    0.56
         3.417    0.61 | 9.417    1.50 |15.417    1.40 | 21.42    0.56
         3.500    0.61 | 9.500    1.50 |15.500    1.40 | 21.50    0.56
         3.583    0.61 | 9.583    1.68 |15.583    1.40 | 21.58    0.56
         3.667    0.61 | 9.667    1.68 |15.667    1.40 | 21.67    0.56
         3.750    0.61 | 9.750    1.68 |15.750    1.40 | 21.75    0.56
         3.833    0.61 | 9.833    1.68 |15.833    1.40 | 21.83    0.56
         3.917    0.61 | 9.917    1.68 |15.917    1.40 | 21.92    0.56
         4.000    0.61 |10.000    1.68 |16.000    1.40 | 22.00    0.56
         4.083    0.75 |10.083    2.15 |16.083    0.84 | 22.08    0.56
         4.167    0.75 |10.167    2.15 |16.167    0.84 | 22.17    0.56
         4.250    0.75 |10.250    2.15 |16.250    0.84 | 22.25    0.56
         4.333    0.75 |10.333    2.15 |16.333    0.84 | 22.33    0.56
         4.417    0.75 |10.417    2.15 |16.417    0.84 | 22.42    0.56
         4.500    0.75 |10.500    2.15 |16.500    0.84 | 22.50    0.56
         4.583    0.75 |10.583    2.90 |16.583    0.84 | 22.58    0.56
         4.667    0.75 |10.667    2.90 |16.667    0.84 | 22.67    0.56
         4.750    0.75 |10.750    2.90 |16.750    0.84 | 22.75    0.56
         4.833    0.75 |10.833    2.90 |16.833    0.84 | 22.83    0.56
         4.917    0.75 |10.917    2.90 |16.917    0.84 | 22.92    0.56
         5.000    0.75 |11.000    2.90 |17.000    0.84 | 23.00    0.56
         5.083    0.75 |11.083    4.49 |17.083    0.84 | 23.08    0.56
         5.167    0.75 |11.167    4.49 |17.167    0.84 | 23.17    0.56
         5.250    0.75 |11.250    4.49 |17.250    0.84 | 23.25    0.56
         5.333    0.75 |11.333    4.49 |17.333    0.84 | 23.33    0.56
         5.417    0.75 |11.417    4.49 |17.417    0.84 | 23.42    0.56
         5.500    0.75 |11.500    4.49 |17.500    0.84 | 23.50    0.56
         5.583    0.75 |11.583   19.47 |17.583    0.84 | 23.58    0.56
         5.667    0.75 |11.667   19.47 |17.667    0.84 | 23.67    0.56
         5.750    0.75 |11.750   19.47 |17.750    0.84 | 23.75    0.56
         5.833    0.75 |11.833   51.67 |17.833    0.84 | 23.83    0.56
         5.917    0.75 |11.917   51.67 |17.917    0.84 | 23.92    0.56
         6.000    0.75 |12.000   51.67 |18.000    0.84 | 24.00    0.56

    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW      (cms)=   0.019 (i)
    TIME TO PEAK   (hrs)=  12.000
    RUNOFF VOLUME   (mm)=  11.842
    TOTAL RAINFALL  (mm)=  46.775
    RUNOFF COEFFICIENT  =   0.253

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.31          0.00
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     45.53         40.00
    Mannings n          =      0.013         0.250
```



```
    Max.Eff.Inten.(mm/hr)=      51.67         18.89
               over (min)       5.00          5.00
    Storage Coeff.  (min)=      2.08 (ii)     3.54 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.31          0.26
                                                          *TOTALS*
    PEAK FLOW       (cms)=      0.04          0.00          0.044 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00         12.00
    RUNOFF VOLUME    (mm)=     45.78         13.80         45.45
    TOTAL RAINFALL   (mm)=     46.78         46.78         46.78
    RUNOFF COEFFICIENT   =      0.98          0.30          0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.11          0.00
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     26.96         40.00
    Mannings n          =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      51.67         18.89
               over (min)       5.00          5.00
    Storage Coeff.  (min)=      1.52 (ii)     2.98 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.33          0.28
                                                          *TOTALS*
    PEAK FLOW       (cms)=      0.02          0.00          0.016 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00         12.00
    RUNOFF VOLUME    (mm)=     45.78         13.80         45.45
    TOTAL RAINFALL   (mm)=     46.78         46.78         46.78
    RUNOFF COEFFICIENT   =      0.98          0.30          0.97

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1101):     0.31    0.044    12.00    45.45
       + ID2= 2 (  1102):     0.11    0.016    12.00    45.45
       ===============================================
```

```
   ID = 3 ( 2001):     0.42   0.060    12.00    45.45

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area     (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97         0.14
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      51.67        18.89
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       3.04 (ii)    7.31 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.27         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.01         0.145 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00        12.00
     RUNOFF VOLUME    (mm)=      45.78        13.80        41.68
     TOTAL RAINFALL   (mm)=      46.78        46.78        46.78
     RUNOFF COEFFICIENT   =       0.98         0.30         0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1103):     1.11   0.145    12.00    41.68
     + ID2= 2 (  2001):     0.42   0.060    12.00    45.45
       ===============================================
       ID = 3 (  2002):     1.53   0.204    12.00    42.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area     (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      52.54        40.00
     Mannings n           =      0.013        0.250
```



```
     Max.Eff.Inten.(mm/hr)=      51.67        18.89
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.26 (ii)    6.47 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00         0.054 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00        12.00
     RUNOFF VOLUME    (mm)=      45.77        13.80        41.80
     TOTAL RAINFALL   (mm)=      46.78        46.78        46.78
     RUNOFF COEFFICIENT   =       0.98         0.30         0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1104):     0.41   0.054    12.00    41.80
     + ID2= 2 (  2002):     1.53   0.204    12.00    42.71
       ===============================================
       ID = 3 (  2003):     1.95   0.259    12.00    42.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                               AREA     QPEAK      TPEAK       R.V.
                               (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  2003)     1.948      0.259      12.00       42.52
   OUTFLOW: ID= 1 (  3001)     1.948      0.057      12.17       42.51

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.07
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0413

------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1200)|   Area     (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271
```



```
     PEAK FLOW       (cms)=   0.202 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  14.224
     TOTAL RAINFALL   (mm)=  46.775
     RUNOFF COEFFICIENT   =   0.304

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

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5640     0.0375

                               AREA     QPEAK      TPEAK       R.V.
                               (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  1200)     4.991      0.202      12.00       14.22
   OUTFLOW: ID= 1 (  3002)     4.991      0.147      12.17       14.22

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 72.92
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0100

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  3001):     1.95   0.057    12.17    42.51
     + ID2= 2 (  3002):     4.99   0.147    12.17    14.22
       ===============================================
       ID = 3 (  2004):     6.94   0.204    12.17    22.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1300):     0.41   0.019    12.00    11.84
     + ID2= 2 (  2004):     6.94   0.204    12.17    22.16
       ===============================================
       ID = 3 (  2005):     7.35   0.207    12.17    21.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1400)|   Area     (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.031 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  15.379
```



```
     TOTAL RAINFALL   (mm)=  46.775
     RUNOFF COEFFICIENT   =   0.329

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

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

--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1400):     1.05   0.031    12.17    15.38
     + ID2= 2 (  2005):     7.35   0.207    12.17    21.59
       ===============================================
       ID = 3 (  2006):     8.40   0.239    12.17    20.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\399e2c
88-a738-40b6-9b60-df23d4410024\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\399e2c
88-a738-40b6-9b60-df23d4410024\scenar


DATE: 02/11/2020                          TIME: 01:52:41

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
--------------------
  ************************************************
  ** SIMULATION : Run 02                        **
```

```
  *********************************************

--------------------
|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\455ee265
| Ptotal= 59.94 mm |     Comments: 5yr24hrSCS_Midland
--------------------
                TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
                0.25    0.66 |  6.25    1.20 | 12.25    8.63 | 18.25    1.08
                0.50    0.66 |  6.50    1.20 | 12.50    8.63 | 18.50    1.08
                0.75    0.66 |  6.75    1.20 | 12.75    4.43 | 18.75    1.08
                1.00    0.66 |  7.00    1.20 | 13.00    4.43 | 19.00    1.08
                1.25    0.66 |  7.25    1.20 | 13.25    0.84 | 19.25    1.08
                1.50    0.66 |  7.50    1.20 | 13.50    0.84 | 19.50    1.08
                1.75    0.66 |  7.75    1.20 | 13.75    4.91 | 19.75    1.08
                2.00    0.66 |  8.00    1.20 | 14.00    4.91 | 20.00    1.08
                2.25    0.78 |  8.25    1.62 | 14.25    1.80 | 20.25    0.72
                2.50    0.78 |  8.50    1.62 | 14.50    1.80 | 20.50    0.72
                2.75    0.78 |  8.75    1.62 | 14.75    1.80 | 20.75    0.72
                3.00    0.78 |  9.00    1.62 | 15.00    1.80 | 21.00    0.72
                3.25    0.78 |  9.25    1.92 | 15.25    1.80 | 21.25    0.72
                3.50    0.78 |  9.50    1.92 | 15.50    1.80 | 21.50    0.72
                3.75    0.78 |  9.75    2.16 | 15.75    1.80 | 21.75    0.72
                4.00    0.78 | 10.00    2.16 | 16.00    1.80 | 22.00    0.72
                4.25    0.96 | 10.25    2.76 | 16.25    1.08 | 22.25    0.72
                4.50    0.96 | 10.50    2.76 | 16.50    1.08 | 22.50    0.72
                4.75    0.96 | 10.75    3.71 | 16.75    1.08 | 22.75    0.72
                5.00    0.96 | 11.00    3.71 | 17.00    1.08 | 23.00    0.72
                5.25    0.96 | 11.25    5.75 | 17.25    1.08 | 23.25    0.72
                5.50    0.96 | 11.50    5.75 | 17.50    1.08 | 23.50    0.72
                5.75    0.96 | 11.75   24.92 | 17.75    1.08 | 23.75    0.72
                6.00    0.96 | 12.00   66.13 | 18.00    1.08 | 24.00    0.72

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

--------------------
| CALIB            |
| NASHYD   ( 1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083    0.66 | 6.083    1.20 |12.083    8.64 | 18.08    1.08
               0.167    0.66 | 6.167    1.20 |12.167    8.63 | 18.17    1.08
               0.250    0.66 | 6.250    1.20 |12.250    8.63 | 18.25    1.08
               0.333    0.66 | 6.333    1.20 |12.333    8.63 | 18.33    1.08
               0.417    0.66 | 6.417    1.20 |12.417    8.63 | 18.42    1.08
               0.500    0.66 | 6.500    1.20 |12.500    8.63 | 18.50    1.08
               0.583    0.66 | 6.583    1.20 |12.583    4.43 | 18.58    1.08
               0.667    0.66 | 6.667    1.20 |12.667    4.43 | 18.67    1.08
               0.750    0.66 | 6.750    1.20 |12.750    4.43 | 18.75    1.08
               0.833    0.66 | 6.833    1.20 |12.833    4.43 | 18.83    1.08
               0.917    0.66 | 6.917    1.20 |12.917    4.43 | 18.92    1.08
               1.000    0.66 | 7.000    1.20 |13.000    4.43 | 19.00    1.08
               1.083    0.66 | 7.083    1.20 |13.083    0.84 | 19.08    1.08
```



```
               1.167    0.66 | 7.167    1.20 |13.167    0.84 | 19.17    1.08
               1.250    0.66 | 7.250    1.20 |13.250    0.84 | 19.25    1.08
               1.333    0.66 | 7.333    1.20 |13.333    0.84 | 19.33    1.08
               1.417    0.66 | 7.417    1.20 |13.417    0.84 | 19.42    1.08
               1.500    0.66 | 7.500    1.20 |13.500    0.84 | 19.50    1.08
               1.583    0.66 | 7.583    1.20 |13.583    4.91 | 19.58    1.08
               1.667    0.66 | 7.667    1.20 |13.667    4.91 | 19.67    1.08
               1.750    0.66 | 7.750    1.20 |13.750    4.91 | 19.75    1.08
               1.833    0.66 | 7.833    1.20 |13.833    4.91 | 19.83    1.08
               1.917    0.66 | 7.917    1.20 |13.917    4.91 | 19.92    1.08
               2.000    0.66 | 8.000    1.20 |14.000    4.91 | 20.00    1.08
               2.083    0.78 | 8.083    1.62 |14.083    1.80 | 20.08    0.72
               2.167    0.78 | 8.167    1.62 |14.167    1.80 | 20.17    0.72
               2.250    0.78 | 8.250    1.62 |14.250    1.80 | 20.25    0.72
               2.333    0.78 | 8.333    1.62 |14.333    1.80 | 20.33    0.72
               2.417    0.78 | 8.417    1.62 |14.417    1.80 | 20.42    0.72
               2.500    0.78 | 8.500    1.62 |14.500    1.80 | 20.50    0.72
               2.583    0.78 | 8.583    1.62 |14.583    1.80 | 20.58    0.72
               2.667    0.78 | 8.667    1.62 |14.667    1.80 | 20.67    0.72
               2.750    0.78 | 8.750    1.62 |14.750    1.80 | 20.75    0.72
               2.833    0.78 | 8.833    1.62 |14.833    1.80 | 20.83    0.72
               2.917    0.78 | 8.917    1.62 |14.917    1.80 | 20.92    0.72
               3.000    0.78 | 9.000    1.62 |15.000    1.80 | 21.00    0.72
               3.083    0.78 | 9.083    1.92 |15.083    1.80 | 21.08    0.72
               3.167    0.78 | 9.167    1.92 |15.167    1.80 | 21.17    0.72
               3.250    0.78 | 9.250    1.92 |15.250    1.80 | 21.25    0.72
               3.333    0.78 | 9.333    1.92 |15.333    1.80 | 21.33    0.72
               3.417    0.78 | 9.417    1.92 |15.417    1.80 | 21.42    0.72
               3.500    0.78 | 9.500    1.92 |15.500    1.80 | 21.50    0.72
               3.583    0.78 | 9.583    2.16 |15.583    1.80 | 21.58    0.72
               3.667    0.78 | 9.667    2.16 |15.667    1.80 | 21.67    0.72
               3.750    0.78 | 9.750    2.16 |15.750    1.80 | 21.75    0.72
               3.833    0.78 | 9.833    2.16 |15.833    1.80 | 21.83    0.72
               3.917    0.78 | 9.917    2.16 |15.917    1.80 | 21.92    0.72
               4.000    0.78 |10.000    2.16 |16.000    1.80 | 22.00    0.72
               4.083    0.96 |10.083    2.76 |16.083    1.08 | 22.08    0.72
               4.167    0.96 |10.167    2.76 |16.167    1.08 | 22.17    0.72
               4.250    0.96 |10.250    2.76 |16.250    1.08 | 22.25    0.72
               4.333    0.96 |10.333    2.76 |16.333    1.08 | 22.33    0.72
               4.417    0.96 |10.417    2.76 |16.417    1.08 | 22.42    0.72
               4.500    0.96 |10.500    2.76 |16.500    1.08 | 22.50    0.72
               4.583    0.96 |10.583    3.71 |16.583    1.08 | 22.58    0.72
               4.667    0.96 |10.667    3.71 |16.667    1.08 | 22.67    0.72
               4.750    0.96 |10.750    3.71 |16.750    1.08 | 22.75    0.72
               4.833    0.96 |10.833    3.71 |16.833    1.08 | 22.83    0.72
               4.917    0.96 |10.917    3.71 |16.917    1.08 | 22.92    0.72
               5.000    0.96 |11.000    3.71 |17.000    1.08 | 23.00    0.72
               5.083    0.96 |11.083    5.75 |17.083    1.08 | 23.08    0.72
               5.167    0.96 |11.167    5.75 |17.167    1.08 | 23.17    0.72
               5.250    0.96 |11.250    5.75 |17.250    1.08 | 23.25    0.72
               5.333    0.96 |11.333    5.75 |17.333    1.08 | 23.33    0.72
               5.417    0.96 |11.417    5.75 |17.417    1.08 | 23.42    0.72
               5.500    0.96 |11.500    5.75 |17.500    1.08 | 23.50    0.72
               5.583    0.96 |11.583   24.92 |17.583    1.08 | 23.58    0.72
               5.667    0.96 |11.667   24.92 |17.667    1.08 | 23.67    0.72
               5.750    0.96 |11.750   24.92 |17.750    1.08 | 23.75    0.72
               5.833    0.96 |11.833   66.13 |17.833    1.08 | 23.83    0.72
               5.917    0.96 |11.917   66.13 |17.917    1.08 | 23.92    0.72
               6.000    0.96 |12.000   66.13 |18.000    1.08 | 24.00    0.72

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.030 (i)
```



```
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  18.551
     TOTAL RAINFALL   (mm)=  59.938
     RUNOFF COEFFICIENT   =   0.310

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.31         0.00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     45.53        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     66.13        29.50
                over (min)      5.00         5.00
     Storage Coeff.  (min)=      1.88 (ii)    3.21 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.32         0.27
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.06         0.00          0.057 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     58.94        21.62          58.56
     TOTAL RAINFALL   (mm)=     59.94        59.94          59.94
     RUNOFF COEFFICIENT   =      0.98         0.36           0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11         0.00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     26.96        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     66.13        29.50
                over (min)      5.00         5.00
     Storage Coeff.  (min)=      1.37 (ii)    2.70 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.33         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.02         0.00          0.020 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     58.94        21.62          58.56
     TOTAL RAINFALL   (mm)=     59.94        59.94          59.94
```



```
     RUNOFF COEFFICIENT   =      0.98         0.36           0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):     0.31    0.057    12.00    58.56
      + ID2= 2 (  1102):     0.11    0.020    12.00    58.56
        ==================================================
        ID = 3 (  2001):     0.42    0.077    12.00    58.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.97         0.14
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     86.18        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     66.13        29.50
                over (min)      5.00        10.00
     Storage Coeff.  (min)=      2.76 (ii)    6.62 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.28         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.18         0.01          0.187 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     58.94        21.62          54.16
     TOTAL RAINFALL   (mm)=     59.94        59.94          59.94
     RUNOFF COEFFICIENT   =      0.98         0.36           0.90

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11    0.187    12.00    54.16
```

```
  + ID2= 2 ( 2001):     0.42   0.077    12.00    58.56
    ==================================================
    ID = 3 ( 2002):     1.53   0.264    12.00    55.36

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       0.36         0.05
     Dep. Storage      (mm)=       1.00         5.00
     Average Slope      (%)=       1.00         2.00
     Length             (m)=      52.54        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      66.13        29.50
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       2.05 (ii)     5.86 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.00           0.070 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=      58.94        21.62          54.31
     TOTAL RAINFALL   (mm)=      59.94        59.94          59.94
     RUNOFF COEFFICIENT   =       0.98         0.36           0.91

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN*  =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
      ID1= 1 (  1104):       0.41   0.070    12.00    54.31
    + ID2= 2 (  2002):       1.53   0.264    12.00    55.36
      ==================================================
      ID = 3 (  2003):       1.95   0.334    12.00    55.14

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)      (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |   0.0801      0.0575
                           0.0012      0.0001   |   0.0965      0.0712
                           0.0013      0.0085   |   0.1106      0.0816
                           0.0238      0.0256   |   0.1230      0.0900
                           0.0593      0.0421   |   0.0000      0.0000
```



```
                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  2003)       1.948      0.334     12.00      55.14
  OUTFLOW: ID= 1 (  3001)       1.948      0.072     12.08      55.13

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.51
                  TIME SHIFT OF PEAK FLOW          (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0517

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1200)|   Area     (ha)=    4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.319 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  22.203
     TOTAL RAINFALL   (mm)=  59.938
     RUNOFF COEFFICIENT   =   0.370

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)      (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |   0.5640      0.0375

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  1200)       4.991      0.319     12.00      22.20
  OUTFLOW: ID= 1 (  3002)       4.991      0.233     12.17      22.20

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 72.97
                  TIME SHIFT OF PEAK FLOW          (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0158

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
      ID1= 1 (  3001):       1.95   0.072    12.08    55.13
    + ID2= 2 (  3002):       4.99   0.233    12.17    22.20
      ==================================================
      ID = 3 (  2004):       6.94   0.304    12.17    31.45

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```



```
      ID1= 1 (  1300):       0.41   0.030    12.00    18.55
    + ID2= 2 (  2004):       6.94   0.304    12.17    31.45
      ==================================================
      ID = 3 (  2005):       7.35   0.309    12.17    30.73

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1400)|   Area     (ha)=    1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.049 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  23.831
     TOTAL RAINFALL   (mm)=  59.938
     RUNOFF COEFFICIENT   =   0.398

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

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

--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
      ID1= 1 (  1400):       1.05   0.049    12.17    23.83
    + ID2= 2 (  2005):       7.35   0.309    12.17    30.73
      ==================================================
      ID = 3 (  2006):       8.40   0.359    12.17    29.86

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

     V    V   I    SSSSS  U    U     A     L
     V    V   I    SS     U    U    A A    L
      V  V    I     SS    U    U   AAAAA   L
      V  V    I       SS  U    U   A   A   L
       VV     I    SSSSS  UUUUU  A     A  LLLLL

      OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
     O   O     T      T    H    H   Y  Y   MM  MM  O   O
     O   O     T      T    H    H    Y     M    M  O   O
      OOO      T      T    H    H    Y     M    M   OOO
Developed and Distributed by Civica Infrastructure
```



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


 Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

 Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\60c464
```



```
b7-ed1f-4ad0-a89b-8af91c79b8fd\scenar
 Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\60c464
b7-ed1f-4ad0-a89b-8af91c79b8fd\scenar


DATE: 02/11/2020                          TIME: 01:52:42

USER:


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  **************************************************
  ** SIMULATION : Run 03                          **
  **************************************************


--------------------
|    READ STORM      |    Filename: C:\Users\zhouj\AppD
|                    |              ata\Local\Temp\
|                    |              a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\cef3ad34
| Ptotal= 67.54 mm |    Comments: 10yr24hrSCS_Midland
--------------------
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.25     0.74 |  6.25     1.35 | 12.25     9.72 | 18.25     1.22
                 0.50     0.74 |  6.50     1.35 | 12.50     9.72 | 18.50     1.22
                 0.75     0.74 |  6.75     1.35 | 12.75     5.00 | 18.75     1.22
                 1.00     0.74 |  7.00     1.35 | 13.00     5.00 | 19.00     1.22
                 1.25     0.74 |  7.25     1.35 | 13.25     0.95 | 19.25     1.22
                 1.50     0.74 |  7.50     1.35 | 13.50     0.95 | 19.50     1.22
                 1.75     0.74 |  7.75     1.35 | 13.75     5.54 | 19.75     1.22
                 2.00     0.74 |  8.00     1.35 | 14.00     5.54 | 20.00     1.22
                 2.25     0.88 |  8.25     1.82 | 14.25     2.03 | 20.25     0.81
                 2.50     0.88 |  8.50     1.82 | 14.50     2.03 | 20.50     0.81
                 2.75     0.88 |  8.75     1.82 | 14.75     2.03 | 20.75     0.81
                 3.00     0.88 |  9.00     1.82 | 15.00     2.03 | 21.00     0.81
                 3.25     0.88 |  9.25     2.16 | 15.25     2.03 | 21.25     0.81
                 3.50     0.88 |  9.50     2.16 | 15.50     2.03 | 21.50     0.81
                 3.75     0.88 |  9.75     2.43 | 15.75     2.03 | 21.75     0.81
                 4.00     0.88 | 10.00     2.43 | 16.00     2.03 | 22.00     0.81
                 4.25     1.08 | 10.25     3.11 | 16.25     1.22 | 22.25     0.81
                 4.50     1.08 | 10.50     3.11 | 16.50     1.22 | 22.50     0.81
                 4.75     1.08 | 10.75     4.19 | 16.75     1.22 | 22.75     0.81
                 5.00     1.08 | 11.00     4.19 | 17.00     1.22 | 23.00     0.81
                 5.25     1.08 | 11.25     6.48 | 17.25     1.22 | 23.25     0.81
                 5.50     1.08 | 11.50     6.48 | 17.50     1.22 | 23.50     0.81
                 5.75     1.08 | 11.75    28.08 | 17.75     1.22 | 23.75     0.81
                 6.00     1.08 | 12.00    74.52 | 18.00     1.22 | 24.00     0.81

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

--------------------
| CALIB              |
| NASHYD   (  1300)|   Area     (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.06
```

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.74	6.083	1.35	12.083	9.73	18.08	1.22
0.167	0.74	6.167	1.35	12.167	9.72	18.17	1.22
0.250	0.74	6.250	1.35	12.250	9.72	18.25	1.22
0.333	0.74	6.333	1.35	12.333	9.72	18.33	1.22
0.417	0.74	6.417	1.35	12.417	9.72	18.42	1.22
0.500	0.74	6.500	1.35	12.500	9.72	18.50	1.22
0.583	0.74	6.583	1.35	12.583	5.00	18.58	1.22
0.667	0.74	6.667	1.35	12.667	5.00	18.67	1.22
0.750	0.74	6.750	1.35	12.750	5.00	18.75	1.22
0.833	0.74	6.833	1.35	12.833	5.00	18.83	1.22
0.917	0.74	6.917	1.35	12.917	5.00	18.92	1.22
1.000	0.74	7.000	1.35	13.000	5.00	19.00	1.22
1.083	0.74	7.083	1.35	13.083	0.95	19.08	1.22
1.167	0.74	7.167	1.35	13.167	0.95	19.17	1.22
1.250	0.74	7.250	1.35	13.250	0.95	19.25	1.22
1.333	0.74	7.333	1.35	13.333	0.95	19.33	1.22
1.417	0.74	7.417	1.35	13.417	0.95	19.42	1.22
1.500	0.74	7.500	1.35	13.500	0.95	19.50	1.22
1.583	0.74	7.583	1.35	13.583	5.54	19.58	1.22
1.667	0.74	7.667	1.35	13.667	5.54	19.67	1.22
1.750	0.74	7.750	1.35	13.750	5.54	19.75	1.22
1.833	0.74	7.833	1.35	13.833	5.54	19.83	1.22
1.917	0.74	7.917	1.35	13.917	5.54	19.92	1.22
2.000	0.74	8.000	1.35	14.000	5.54	20.00	1.22
2.083	0.88	8.083	1.82	14.083	2.03	20.08	0.81
2.167	0.88	8.167	1.82	14.167	2.03	20.17	0.81
2.250	0.88	8.250	1.82	14.250	2.03	20.25	0.81
2.333	0.88	8.333	1.82	14.333	2.03	20.33	0.81
2.417	0.88	8.417	1.82	14.417	2.03	20.42	0.81
2.500	0.88	8.500	1.82	14.500	2.03	20.50	0.81
2.583	0.88	8.583	1.82	14.583	2.03	20.58	0.81
2.667	0.88	8.667	1.82	14.667	2.03	20.67	0.81
2.750	0.88	8.750	1.82	14.750	2.03	20.75	0.81
2.833	0.88	8.833	1.82	14.833	2.03	20.83	0.81
2.917	0.88	8.917	1.82	14.917	2.03	20.92	0.81
3.000	0.88	9.000	1.82	15.000	2.03	21.00	0.81
3.083	0.88	9.083	2.16	15.083	2.03	21.08	0.81
3.167	0.88	9.167	2.16	15.167	2.03	21.17	0.81
3.250	0.88	9.250	2.16	15.250	2.03	21.25	0.81
3.333	0.88	9.333	2.16	15.333	2.03	21.33	0.81
3.417	0.88	9.417	2.16	15.417	2.03	21.42	0.81
3.500	0.88	9.500	2.16	15.500	2.03	21.50	0.81
3.583	0.88	9.583	2.43	15.583	2.03	21.58	0.81
3.667	0.88	9.667	2.43	15.667	2.03	21.67	0.81
3.750	0.88	9.750	2.43	15.750	2.03	21.75	0.81
3.833	0.88	9.833	2.43	15.833	2.03	21.83	0.81
3.917	0.88	9.917	2.43	15.917	2.03	21.92	0.81
4.000	0.88	10.000	2.43	16.000	2.03	22.00	0.81
4.083	1.08	10.083	3.11	16.083	1.22	22.08	0.81
4.167	1.08	10.167	3.11	16.167	1.22	22.17	0.81
4.250	1.08	10.250	3.11	16.250	1.22	22.25	0.81
4.333	1.08	10.333	3.11	16.333	1.22	22.33	0.81
4.417	1.08	10.417	3.11	16.417	1.22	22.42	0.81
4.500	1.08	10.500	3.11	16.500	1.22	22.50	0.81
4.583	1.08	10.583	4.19	16.583	1.22	22.58	0.81
4.667	1.08	10.667	4.19	16.667	1.22	22.67	0.81
4.750	1.08	10.750	4.19	16.750	1.22	22.75	0.81

4.833	1.08	10.833	4.19	16.833	1.22	22.83	0.81
4.917	1.08	10.917	4.19	16.917	1.22	22.92	0.81
5.000	1.08	11.000	4.19	17.000	1.22	23.00	0.81
5.083	1.08	11.083	6.48	17.083	1.22	23.08	0.81
5.167	1.08	11.167	6.48	17.167	1.22	23.17	0.81
5.250	1.08	11.250	6.48	17.250	1.22	23.25	0.81
5.333	1.08	11.333	6.48	17.333	1.22	23.33	0.81
5.417	1.08	11.417	6.48	17.417	1.22	23.42	0.81
5.500	1.08	11.500	6.48	17.500	1.22	23.50	0.81
5.583	1.08	11.583	28.08	17.583	1.22	23.58	0.81
5.667	1.08	11.667	28.08	17.667	1.22	23.67	0.81
5.750	1.08	11.750	28.08	17.750	1.22	23.75	0.81
5.833	1.08	11.833	74.51	17.833	1.22	23.83	0.81
5.917	1.08	11.917	74.52	17.917	1.22	23.92	0.81
6.000	1.08	12.000	74.52	18.000	1.22	24.00	0.81

```
     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.036 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  22.799
     TOTAL RAINFALL   (mm)=  67.540
     RUNOFF COEFFICIENT   =   0.338

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      0.31         0.00
     Dep. Storage      (mm)=      1.00         5.00
     Average Slope      (%)=      1.00         2.00
     Length             (m)=     45.53        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     74.52        36.19
               over (min)        5.00         5.00
     Storage Coeff.   (min)=      1.79 (ii)    3.06 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.32         0.27
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.06         0.00           0.064 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54        26.57          66.14
     TOTAL RAINFALL   (mm)=     67.54        67.54          67.54
     RUNOFF COEFFICIENT   =      0.99         0.39           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1102)|   Area    (ha)=   0.11
```



```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      0.11         0.00
     Dep. Storage      (mm)=      1.00         5.00
     Average Slope      (%)=      1.00         2.00
     Length             (m)=     26.96        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     74.52        36.19
               over (min)        5.00         5.00
     Storage Coeff.   (min)=      1.31 (ii)    2.57 (ii)
     Unit Hyd. Tpeak (min)=      5.00         5.00
     Unit Hyd. peak  (cms)=      0.33         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.02         0.00           0.022 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54        26.57          66.14
     TOTAL RAINFALL   (mm)=     67.54        67.54          67.54
     RUNOFF COEFFICIENT   =      0.99         0.39           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):     0.31   0.064    12.00    66.14
      + ID2= 2 (  1102):     0.11   0.022    12.00    66.14
        ===============================================
        ID = 3 (  2001):     0.42   0.086    12.00    66.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      0.97         0.14
     Dep. Storage      (mm)=      1.00         5.00
     Average Slope      (%)=      1.00         2.00
     Length             (m)=     86.18        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     74.52        36.19
               over (min)        5.00        10.00
     Storage Coeff.   (min)=      2.63 (ii)    6.31 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.29         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.20         0.01           0.213 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
```



```
     RUNOFF VOLUME    (mm)=     66.54        26.57          61.42
     TOTAL RAINFALL   (mm)=     67.54        67.54          67.54
     RUNOFF COEFFICIENT   =      0.99         0.39           0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11   0.213    12.00    61.42
      + ID2= 2 (  2001):     0.42   0.086    12.00    66.14
        ===============================================
        ID = 3 (  2002):     1.53   0.299    12.00    62.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      0.36         0.05
     Dep. Storage      (mm)=      1.00         5.00
     Average Slope      (%)=      1.00         2.00
     Length             (m)=     52.54        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     74.52        36.19
               over (min)        5.00        10.00
     Storage Coeff.   (min)=      1.95 (ii)    5.58 (ii)
     Unit Hyd. Tpeak (min)=      5.00        10.00
     Unit Hyd. peak  (cms)=      0.31         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.08         0.00           0.079 (iii)
     TIME TO PEAK    (hrs)=     12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=     66.54        26.57          61.58
     TOTAL RAINFALL   (mm)=     67.54        67.54          67.54
     RUNOFF COEFFICIENT   =      0.99         0.39           0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
 -------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1104):      0.41   0.079    12.00    61.58
       + ID2= 2 (  2002):      1.53   0.299    12.00    62.71
         ================================================
         ID = 3 (  2003):      1.95   0.379    12.00    62.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  3001)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |   0.0801     0.0575
                            0.0012     0.0001   |   0.0965     0.0712
                            0.0013     0.0085   |   0.1106     0.0816
                            0.0238     0.0256   |   0.1230     0.0900
                            0.0593     0.0421   |   0.0000     0.0000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)     1.948      0.379     12.00        62.47
   OUTFLOW: ID= 1 (  3001)     1.948      0.080     12.08        62.46

                  PEAK    FLOW   REDUCTION [Qout/Qin](%)= 21.13
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0577

 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.393 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  27.241
     TOTAL RAINFALL   (mm)=  67.540
     RUNOFF COEFFICIENT   =   0.403

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

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  3002)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |   0.5640     0.0375

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  1200)     4.991      0.393     12.00        27.24
   OUTFLOW: ID= 1 (  3002)     4.991      0.287     12.17        27.24

                  PEAK    FLOW   REDUCTION [Qout/Qin](%)= 72.99
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0195
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 --------------------
 | ADD HYD  (  2004)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  3001):      1.95   0.080    12.08    62.46
       + ID2= 2 (  3002):      4.99   0.287    12.17    27.24
         ================================================
         ID = 3 (  2004):      6.94   0.367    12.17    37.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | ADD HYD  (  2005)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1300):      0.41   0.036    12.00    22.80
       + ID2= 2 (  2004):      6.94   0.367    12.17    37.13
         ================================================
         ID = 3 (  2005):      7.35   0.373    12.17    36.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.061 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  29.134
     TOTAL RAINFALL   (mm)=  67.540
     RUNOFF COEFFICIENT   =   0.431

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

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 --------------------
 | ADD HYD  (  2006)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1400):      1.05   0.061    12.17    29.13
       + ID2= 2 (  2005):      7.35   0.373    12.17    36.33
         ================================================
         ID = 3 (  2006):      8.40   0.433    12.17    35.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
```



```
         V  V    I       SS   U   U  A   A  L
          VV     I    SSSSS  UUUUU  A    A  LLLLL

          OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
         O   O     T      T    H    H   Y Y   MM MM  O   O
         O   O     T      T    H    H    Y    M   M  O   O
          OOO      T      T    H    H    Y    M    M   OOO
 Developed and Distributed by Civica Infrastructure
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```
                  *****  D E T A I L E D    O U T P U T  *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
 C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\c67695
 1d-e254-4cdc-815e-abe8f485cb38\scenar
   Summary filename:
 C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\c67695
 1d-e254-4cdc-815e-abe8f485cb38\scenar


 DATE: 02/11/2020                          TIME: 01:52:45

 USER:


 COMMENTS: ____________________________________________________________

 **************************************************************************************
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   ***********************************************
   ** SIMULATION : Run 04                       **
   ***********************************************


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 |    READ STORM     |    Filename: C:\Users\zhouj\AppD
 |                   |              ata\Local\Temp\
 |                   |              a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\b3885e87
 | Ptotal= 78.13 mm |    Comments: 25yr24hrSCS_Midland
 --------------------
                           TIME     RAIN |  TIME     RAIN |' TIME     RAIN |  TIME     RAIN
                            hrs    mm/hr |   hrs    mm/hr |'  hrs    mm/hr |   hrs    mm/hr
                           0.25     0.86 |  6.25     1.56 | 12.25    11.25 | 18.25     1.41
                           0.50     0.86 |  6.50     1.56 | 12.50    11.25 | 18.50     1.41
                           0.75     0.86 |  6.75     1.56 | 12.75     5.78 | 18.75     1.41
                           1.00     0.86 |  7.00     1.56 | 13.00     5.78 | 19.00     1.41
                           1.25     0.86 |  7.25     1.56 | 13.25     1.09 | 19.25     1.41
                           1.50     0.86 |  7.50     1.56 | 13.50     1.09 | 19.50     1.41
                           1.75     0.86 |  7.75     1.56 | 13.75     6.40 | 19.75     1.41
                           2.00     0.86 |  8.00     1.56 | 14.00     6.40 | 20.00     1.41
                           2.25     1.02 |  8.25     2.11 | 14.25     2.34 | 20.25     0.94
                           2.50     1.02 |  8.50     2.11 | 14.50     2.34 | 20.50     0.94
                           2.75     1.02 |  8.75     2.11 | 14.75     2.34 | 20.75     0.94
                           3.00     1.02 |  9.00     2.11 | 15.00     2.34 | 21.00     0.94
                           3.25     1.02 |  9.25     2.50 | 15.25     2.34 | 21.25     0.94
                           3.50     1.02 |  9.50     2.50 | 15.50     2.34 | 21.50     0.94
```



```
                  3.75     1.02 |  9.75     2.81 | 15.75     2.34 | 21.75     0.94
                  4.00     1.02 | 10.00     2.81 | 16.00     2.34 | 22.00     0.94
                  4.25     1.25 | 10.25     3.59 | 16.25     1.41 | 22.25     0.94
                  4.50     1.25 | 10.50     3.59 | 16.50     1.41 | 22.50     0.94
                  4.75     1.25 | 10.75     4.84 | 16.75     1.41 | 22.75     0.94
                  5.00     1.25 | 11.00     4.84 | 17.00     1.41 | 23.00     0.94
                  5.25     1.25 | 11.25     7.50 | 17.25     1.41 | 23.25     0.94
                  5.50     1.25 | 11.50     7.50 | 17.50     1.41 | 23.50     0.94
                  5.75     1.25 | 11.75    32.49 | 17.75     1.41 | 23.75     0.94
                  6.00     1.25 | 12.00    86.22 | 18.00     1.41 | 24.00     0.94

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

 --------------------
 | CALIB            |
 | NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.06

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


                            ---- TRANSFORMED HYETOGRAPH ----
                  TIME     RAIN | TIME     RAIN |' TIME     RAIN |  TIME     RAIN
                   hrs    mm/hr |  hrs    mm/hr |'  hrs    mm/hr |   hrs    mm/hr
                  0.083    0.86 | 6.083    1.56 |12.083   11.26 | 18.08     1.41
                  0.167    0.86 | 6.167    1.56 |12.167   11.25 | 18.17     1.41
                  0.250    0.86 | 6.250    1.56 |12.250   11.25 | 18.25     1.41
                  0.333    0.86 | 6.333    1.56 |12.333   11.25 | 18.33     1.41
                  0.417    0.86 | 6.417    1.56 |12.417   11.25 | 18.42     1.41
                  0.500    0.86 | 6.500    1.56 |12.500   11.25 | 18.50     1.41
                  0.583    0.86 | 6.583    1.56 |12.583    5.78 | 18.58     1.41
                  0.667    0.86 | 6.667    1.56 |12.667    5.78 | 18.67     1.41
                  0.750    0.86 | 6.750    1.56 |12.750    5.78 | 18.75     1.41
                  0.833    0.86 | 6.833    1.56 |12.833    5.78 | 18.83     1.41
                  0.917    0.86 | 6.917    1.56 |12.917    5.78 | 18.92     1.41
                  1.000    0.86 | 7.000    1.56 |13.000    5.78 | 19.00     1.41
                  1.083    0.86 | 7.083    1.56 |13.083    1.09 | 19.08     1.41
                  1.167    0.86 | 7.167    1.56 |13.167    1.09 | 19.17     1.41
                  1.250    0.86 | 7.250    1.56 |13.250    1.09 | 19.25     1.41
                  1.333    0.86 | 7.333    1.56 |13.333    1.09 | 19.33     1.41
                  1.417    0.86 | 7.417    1.56 |13.417    1.09 | 19.42     1.41
                  1.500    0.86 | 7.500    1.56 |13.500    1.09 | 19.50     1.41
                  1.583    0.86 | 7.583    1.56 |13.583    6.40 | 19.58     1.41
                  1.667    0.86 | 7.667    1.56 |13.667    6.40 | 19.67     1.41
                  1.750    0.86 | 7.750    1.56 |13.750    6.40 | 19.75     1.41
                  1.833    0.86 | 7.833    1.56 |13.833    6.40 | 19.83     1.41
                  1.917    0.86 | 7.917    1.56 |13.917    6.40 | 19.92     1.41
                  2.000    0.86 | 8.000    1.56 |14.000    6.40 | 20.00     1.41
                  2.083    1.02 | 8.083    2.11 |14.083    2.34 | 20.08     0.94
                  2.167    1.02 | 8.167    2.11 |14.167    2.34 | 20.17     0.94
                  2.250    1.02 | 8.250    2.11 |14.250    2.34 | 20.25     0.94
                  2.333    1.02 | 8.333    2.11 |14.333    2.34 | 20.33     0.94
                  2.417    1.02 | 8.417    2.11 |14.417    2.34 | 20.42     0.94
                  2.500    1.02 | 8.500    2.11 |14.500    2.34 | 20.50     0.94
                  2.583    1.02 | 8.583    2.11 |14.583    2.34 | 20.58     0.94
                  2.667    1.02 | 8.667    2.11 |14.667    2.34 | 20.67     0.94
                  2.750    1.02 | 8.750    2.11 |14.750    2.34 | 20.75     0.94
                  2.833    1.02 | 8.833    2.11 |14.833    2.34 | 20.83     0.94
                  2.917    1.02 | 8.917    2.11 |14.917    2.34 | 20.92     0.94
                  3.000    1.02 | 9.000    2.11 |15.000    2.34 | 21.00     0.94
                  3.083    1.02 | 9.083    2.50 |15.083    2.34 | 21.08     0.94
                  3.167    1.02 | 9.167    2.50 |15.167    2.34 | 21.17     0.94
```

```
          3.250    1.02 | 9.250    2.50 |15.250    2.34 | 21.25    0.94
          3.333    1.02 | 9.333    2.50 |15.333    2.34 | 21.33    0.94
          3.417    1.02 | 9.417    2.50 |15.417    2.34 | 21.42    0.94
          3.500    1.02 | 9.500    2.50 |15.500    2.34 | 21.50    0.94
          3.583    1.02 | 9.583    2.81 |15.583    2.34 | 21.58    0.94
          3.667    1.02 | 9.667    2.81 |15.667    2.34 | 21.67    0.94
          3.750    1.02 | 9.750    2.81 |15.750    2.34 | 21.75    0.94
          3.833    1.02 | 9.833    2.81 |15.833    2.34 | 21.83    0.94
          3.917    1.02 | 9.917    2.81 |15.917    2.34 | 21.92    0.94
          4.000    1.02 |10.000    2.81 |16.000    2.34 | 22.00    0.94
          4.083    1.25 |10.083    3.59 |16.083    1.41 | 22.08    0.94
          4.167    1.25 |10.167    3.59 |16.167    1.41 | 22.17    0.94
          4.250    1.25 |10.250    3.59 |16.250    1.41 | 22.25    0.94
          4.333    1.25 |10.333    3.59 |16.333    1.41 | 22.33    0.94
          4.417    1.25 |10.417    3.59 |16.417    1.41 | 22.42    0.94
          4.500    1.25 |10.500    3.59 |16.500    1.41 | 22.50    0.94
          4.583    1.25 |10.583    4.84 |16.583    1.41 | 22.58    0.94
          4.667    1.25 |10.667    4.84 |16.667    1.41 | 22.67    0.94
          4.750    1.25 |10.750    4.84 |16.750    1.41 | 22.75    0.94
          4.833    1.25 |10.833    4.84 |16.833    1.41 | 22.83    0.94
          4.917    1.25 |10.917    4.84 |16.917    1.41 | 22.92    0.94
          5.000    1.25 |11.000    4.84 |17.000    1.41 | 23.00    0.94
          5.083    1.25 |11.083    7.50 |17.083    1.41 | 23.08    0.94
          5.167    1.25 |11.167    7.50 |17.167    1.41 | 23.17    0.94
          5.250    1.25 |11.250    7.50 |17.250    1.41 | 23.25    0.94
          5.333    1.25 |11.333    7.50 |17.333    1.41 | 23.33    0.94
          5.417    1.25 |11.417    7.50 |17.417    1.41 | 23.42    0.94
          5.500    1.25 |11.500    7.50 |17.500    1.41 | 23.50    0.94
          5.583    1.25 |11.583   32.49 |17.583    1.41 | 23.58    0.94
          5.667    1.25 |11.667   32.49 |17.667    1.41 | 23.67    0.94
          5.750    1.25 |11.750   32.49 |17.750    1.41 | 23.75    0.94
          5.833    1.25 |11.833   86.21 |17.833    1.41 | 23.83    0.94
          5.917    1.25 |11.917   86.22 |17.917    1.41 | 23.92    0.94
          6.000    1.25 |12.000   86.22 |18.000    1.41 | 24.00    0.94

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.046 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  29.080
     TOTAL RAINFALL   (mm)=  78.128
     RUNOFF COEFFICIENT   =   0.372

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.31          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      45.53         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      86.22         46.06
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.69 (ii)     2.88 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.32          0.28
```



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                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.07          0.00          0.074 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      77.13         33.89         76.69
     TOTAL RAINFALL   (mm)=      78.13         78.13         78.13
     RUNOFF COEFFICIENT   =       0.99          0.43          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      26.96         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      86.22         46.06
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.23 (ii)     2.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.30
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.03          0.00          0.026 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      77.13         33.89         76.69
     TOTAL RAINFALL   (mm)=      78.13         78.13         78.13
     RUNOFF COEFFICIENT   =       0.99          0.43          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1101):     0.31   0.074    12.00    76.69
     + ID2= 2 (  1102):     0.11   0.026    12.00    76.69
       ==============================================
       ID = 3 (  2001):     0.42   0.100    12.00    76.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      86.22         46.06
               over (min)        5.00         10.00
     Storage Coeff.  (min)=       2.48 (ii)     5.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.29          0.15
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.23          0.02          0.248 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      77.13         33.89         71.59
     TOTAL RAINFALL   (mm)=      78.13         78.13         78.13
     RUNOFF COEFFICIENT   =       0.99          0.43          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1103):     1.11   0.248    12.00    71.59
     + ID2= 2 (  2001):     0.42   0.100    12.00    76.69
       ==============================================
       ID = 3 (  2002):     1.53   0.348    12.00    72.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36          0.05
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      52.54         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      86.22         46.06
               over (min)        5.00         10.00
     Storage Coeff.  (min)=       1.84 (ii)     5.27 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.32          0.16
                                                              *TOTALS*
```



```
     PEAK FLOW       (cms)=       0.09          0.01          0.093 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=      77.13         33.89         71.76
     TOTAL RAINFALL   (mm)=      78.13         78.13         78.13
     RUNOFF COEFFICIENT   =       0.99          0.43          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1104):     0.41   0.093    12.00    71.76
     + ID2= 2 (  2002):     1.53   0.348    12.00    72.99
       ==============================================
       ID = 3 (  2003):     1.95   0.440    12.00    72.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0801     0.0575
                         0.0012     0.0001   |   0.0965     0.0712
                         0.0013     0.0085   |   0.1106     0.0816
                         0.0238     0.0256   |   0.1230     0.0900
                         0.0593     0.0421   |   0.0000     0.0000

                                AREA      QPEAK      TPEAK        R.V.
                                (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)     1.948      0.440      12.00       72.73
   OUTFLOW: ID= 1 (  3001)     1.948      0.090      12.08       72.72

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.44
                  TIME SHIFT OF PEAK FLOW        (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0661

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 1200)|   Area    (ha)=    4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.503 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  34.674
     TOTAL RAINFALL   (mm)=  78.128
     RUNOFF COEFFICIENT   =   0.444
```

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

-----------------------------------------------------------------------------
--------------------
| RESERVOIR( 3002)|
| IN= 2---> OUT= 1 |
| DT= 5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)  |   (cms)     (ha.m.)
                          0.0000     0.0000  |   0.5640     0.0375

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1200)      4.991     0.503     12.00      34.67
   OUTFLOW: ID= 1 (  3002)      4.991     0.367     12.17      34.67

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 73.02
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0250

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--------------------
| ADD HYD  (  2004)|
|   1 + 2 = 3     |         AREA    QPEAK     TPEAK     R.V.
--------------------        (ha)    (cms)     (hrs)     (mm)
        ID1= 1 (  3001):    1.95   0.090    12.08     72.72
      + ID2= 2 (  3002):    4.99   0.367    12.17     34.67
        ==================================================
        ID = 3 (  2004):    6.94   0.457    12.17     45.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 + 2 = 3     |         AREA    QPEAK     TPEAK     R.V.
--------------------        (ha)    (cms)     (hrs)     (mm)
        ID1= 1 (  1300):    0.41   0.046    12.00     29.08
      + ID2= 2 (  2004):    6.94   0.457    12.17     45.35
        ==================================================
        ID = 3 (  2005):    7.35   0.465    12.17     44.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  1400)|   Area    (ha)=    1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.077 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  36.920
     TOTAL RAINFALL   (mm)=  78.128
     RUNOFF COEFFICIENT   =   0.473

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

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--------------------
| ADD HYD  (  2006)|
|   1 + 2 = 3     |         AREA    QPEAK     TPEAK     R.V.
--------------------        (ha)    (cms)     (hrs)     (mm)
        ID1= 1 (  1400):    1.05   0.077    12.17     36.92
      + ID2= 2 (  2005):    7.35   0.465    12.17     44.44
        ==================================================
        ID = 3 (  2006):    8.40   0.542    12.17     43.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
      O   O     T      T    H    H   Y  Y   MM MM   O   O
      O   O     T      T    H    H    Y     M    M  O   O
       OOO      T      T    H    H    Y     M    M   OOO
Developed and Distributed by Civica Infrastructure
```



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

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\11dcfc
9c-abf8-4e40-b428-2e59dbe4eabe\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\11dcfc
9c-abf8-4e40-b428-2e59dbe4eabe\scenar


DATE: 02/11/2020                          TIME: 01:52:39

USER:


COMMENTS: ____________________________________________________________

-------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : Run 05                       **
  **********************************************
```



```
--------------------
|    READ STORM     |     Filename: C:\Users\zhouj\AppD
|                   |               ata\Local\Temp\
|                   |               a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\9cd8582c
| Ptotal= 85.40 mm |     Comments: 50yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.94	6.25	1.71	12.25	12.30	18.25	1.54
0.50	0.94	6.50	1.71	12.50	12.30	18.50	1.54
0.75	0.94	6.75	1.71	12.75	6.32	18.75	1.54
1.00	0.94	7.00	1.71	13.00	6.32	19.00	1.54
1.25	0.94	7.25	1.71	13.25	1.20	19.25	1.54
1.50	0.94	7.50	1.71	13.50	1.20	19.50	1.54
1.75	0.94	7.75	1.71	13.75	7.00	19.75	1.54
2.00	0.94	8.00	1.71	14.00	7.00	20.00	1.54
2.25	1.11	8.25	2.31	14.25	2.56	20.25	1.02
2.50	1.11	8.50	2.31	14.50	2.56	20.50	1.02
2.75	1.11	8.75	2.31	14.75	2.56	20.75	1.02
3.00	1.11	9.00	2.31	15.00	2.56	21.00	1.02
3.25	1.11	9.25	2.73	15.25	2.56	21.25	1.02
3.50	1.11	9.50	2.73	15.50	2.56	21.50	1.02
3.75	1.11	9.75	3.07	15.75	2.56	21.75	1.02
4.00	1.11	10.00	3.07	16.00	2.56	22.00	1.02
4.25	1.37	10.25	3.93	16.25	1.54	22.25	1.02
4.50	1.37	10.50	3.93	16.50	1.54	22.50	1.02
4.75	1.37	10.75	5.29	16.75	1.54	22.75	1.02
5.00	1.37	11.00	5.29	17.00	1.54	23.00	1.02
5.25	1.37	11.25	8.20	17.25	1.54	23.25	1.02
5.50	1.37	11.50	8.20	17.50	1.54	23.50	1.02
5.75	1.37	11.75	35.53	17.75	1.54	23.75	1.02
6.00	1.37	12.00	94.28	18.00	1.54	24.00	1.02

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

--------------------
| CALIB             |
| NASHYD   (  1300)|   Area    (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.94	6.083	1.71	12.083	12.31	18.08	1.54
0.167	0.94	6.167	1.71	12.167	12.30	18.17	1.54
0.250	0.94	6.250	1.71	12.250	12.30	18.25	1.54
0.333	0.94	6.333	1.71	12.333	12.30	18.33	1.54
0.417	0.94	6.417	1.71	12.417	12.30	18.42	1.54
0.500	0.94	6.500	1.71	12.500	12.30	18.50	1.54
0.583	0.94	6.583	1.71	12.583	6.32	18.58	1.54
0.667	0.94	6.667	1.71	12.667	6.32	18.67	1.54
0.750	0.94	6.750	1.71	12.750	6.32	18.75	1.54
0.833	0.94	6.833	1.71	12.833	6.32	18.83	1.54
0.917	0.94	6.917	1.71	12.917	6.32	18.92	1.54
1.000	0.94	7.000	1.71	13.000	6.32	19.00	1.54
1.083	0.94	7.083	1.71	13.083	1.20	19.08	1.54
1.167	0.94	7.167	1.71	13.167	1.20	19.17	1.54

1.250	0.94	7.250	1.71	13.250	1.20	19.25	1.54
1.333	0.94	7.333	1.71	13.333	1.20	19.33	1.54
1.417	0.94	7.417	1.71	13.417	1.20	19.42	1.54
1.500	0.94	7.500	1.71	13.500	1.20	19.50	1.54
1.583	0.94	7.583	1.71	13.583	7.00	19.58	1.54
1.667	0.94	7.667	1.71	13.667	7.00	19.67	1.54
1.750	0.94	7.750	1.71	13.750	7.00	19.75	1.54
1.833	0.94	7.833	1.71	13.833	7.00	19.83	1.54
1.917	0.94	7.917	1.71	13.917	7.00	19.92	1.54
2.000	0.94	8.000	1.71	14.000	7.00	20.00	1.54
2.083	1.11	8.083	2.31	14.083	2.56	20.08	1.02
2.167	1.11	8.167	2.31	14.167	2.56	20.17	1.02
2.250	1.11	8.250	2.31	14.250	2.56	20.25	1.02
2.333	1.11	8.333	2.31	14.333	2.56	20.33	1.02
2.417	1.11	8.417	2.31	14.417	2.56	20.42	1.02
2.500	1.11	8.500	2.31	14.500	2.56	20.50	1.02
2.583	1.11	8.583	2.31	14.583	2.56	20.58	1.02
2.667	1.11	8.667	2.31	14.667	2.56	20.67	1.02
2.750	1.11	8.750	2.31	14.750	2.56	20.75	1.02
2.833	1.11	8.833	2.31	14.833	2.56	20.83	1.02
2.917	1.11	8.917	2.31	14.917	2.56	20.92	1.02
3.000	1.11	9.000	2.31	15.000	2.56	21.00	1.02
3.083	1.11	9.083	2.73	15.083	2.56	21.08	1.02
3.167	1.11	9.167	2.73	15.167	2.56	21.17	1.02
3.250	1.11	9.250	2.73	15.250	2.56	21.25	1.02
3.333	1.11	9.333	2.73	15.333	2.56	21.33	1.02
3.417	1.11	9.417	2.73	15.417	2.56	21.42	1.02
3.500	1.11	9.500	2.73	15.500	2.56	21.50	1.02
3.583	1.11	9.583	3.07	15.583	2.56	21.58	1.02
3.667	1.11	9.667	3.07	15.667	2.56	21.67	1.02
3.750	1.11	9.750	3.07	15.750	2.56	21.75	1.02
3.833	1.11	9.833	3.07	15.833	2.56	21.83	1.02
3.917	1.11	9.917	3.07	15.917	2.56	21.92	1.02
4.000	1.11	10.000	3.07	16.000	2.56	22.00	1.02
4.083	1.37	10.083	3.93	16.083	1.54	22.08	1.02
4.167	1.37	10.167	3.93	16.167	1.54	22.17	1.02
4.250	1.37	10.250	3.93	16.250	1.54	22.25	1.02
4.333	1.37	10.333	3.93	16.333	1.54	22.33	1.02
4.417	1.37	10.417	3.93	16.417	1.54	22.42	1.02
4.500	1.37	10.500	3.93	16.500	1.54	22.50	1.02
4.583	1.37	10.583	5.29	16.583	1.54	22.58	1.02
4.667	1.37	10.667	5.29	16.667	1.54	22.67	1.02
4.750	1.37	10.750	5.29	16.750	1.54	22.75	1.02
4.833	1.37	10.833	5.29	16.833	1.54	22.83	1.02
4.917	1.37	10.917	5.29	16.917	1.54	22.92	1.02
5.000	1.37	11.000	5.29	17.000	1.54	23.00	1.02
5.083	1.37	11.083	8.20	17.083	1.54	23.08	1.02
5.167	1.37	11.167	8.20	17.167	1.54	23.17	1.02
5.250	1.37	11.250	8.20	17.250	1.54	23.25	1.02
5.333	1.37	11.333	8.20	17.333	1.54	23.33	1.02
5.417	1.37	11.417	8.20	17.417	1.54	23.42	1.02
5.500	1.37	11.500	8.20	17.500	1.54	23.50	1.02
5.583	1.37	11.583	35.53	17.583	1.54	23.58	1.02
5.667	1.37	11.667	35.53	17.667	1.54	23.67	1.02
5.750	1.37	11.750	35.53	17.750	1.54	23.75	1.02
5.833	1.37	11.833	94.27	17.833	1.54	23.83	1.02
5.917	1.37	11.917	94.28	17.917	1.54	23.92	1.02
6.000	1.37	12.000	94.28	18.000	1.54	24.00	1.02

```
     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.053 (i)
     TIME TO PEAK    (hrs)=  12.000
```

```
    RUNOFF VOLUME    (mm)=  33.604
    TOTAL RAINFALL   (mm)=  85.403
    RUNOFF COEFFICIENT   =   0.393

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.31          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      45.53         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      94.28         53.16
               over (min)       5.00          5.00
    Storage Coeff.  (min)=      1.63 (ii)     2.78 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.32          0.28
                                                           *TOTALS*
    PEAK FLOW       (cms)=      0.08          0.00           0.081 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00          12.00
    RUNOFF VOLUME    (mm)=     84.40         39.16          83.95
    TOTAL RAINFALL   (mm)=     85.40         85.40          85.40
    RUNOFF COEFFICIENT   =      0.99          0.46           0.98

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.11          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      26.96         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      94.28         53.16
               over (min)       5.00          5.00
    Storage Coeff.  (min)=      1.19 (ii)     2.34 (ii)
    Unit Hyd. Tpeak (min)=      5.00          5.00
    Unit Hyd. peak  (cms)=      0.33          0.30
                                                           *TOTALS*
    PEAK FLOW       (cms)=      0.03          0.00           0.028 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00          12.00
    RUNOFF VOLUME    (mm)=     84.40         39.16          83.95
    TOTAL RAINFALL   (mm)=     85.40         85.40          85.40
    RUNOFF COEFFICIENT   =      0.99          0.46           0.98
```



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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2001)|
|  1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 1101):     0.31   0.081    12.00    83.95
     + ID2= 2 ( 1102):     0.11   0.028    12.00    83.95
       ===============================================
       ID = 3 ( 2001):     0.42   0.110    12.00    83.95

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.97          0.14
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      86.18         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      94.28         53.16
               over (min)       5.00         10.00
    Storage Coeff.  (min)=      2.39 (ii)     5.75 (ii)
    Unit Hyd. Tpeak (min)=      5.00         10.00
    Unit Hyd. peak  (cms)=      0.30          0.15
                                                           *TOTALS*
    PEAK FLOW       (cms)=      0.25          0.02           0.272 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00          12.00
    RUNOFF VOLUME    (mm)=     84.40         39.16          78.61
    TOTAL RAINFALL   (mm)=     85.40         85.40          85.40
    RUNOFF COEFFICIENT   =      0.99          0.46           0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 2002)|
|  1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 1103):     1.11   0.272    12.00    78.61
     + ID2= 2 ( 2001):     0.42   0.110    12.00    83.95
```



```
       ===============================================
       ID = 3 ( 2002):     1.53   0.382    12.00    80.07

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.36          0.05
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      52.54         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      94.28         53.16
               over (min)       5.00         10.00
    Storage Coeff.  (min)=      1.78 (ii)     5.08 (ii)
    Unit Hyd. Tpeak (min)=      5.00         10.00
    Unit Hyd. peak  (cms)=      0.32          0.16
                                                           *TOTALS*
    PEAK FLOW       (cms)=      0.09          0.01           0.102 (iii)
    TIME TO PEAK    (hrs)=     12.00         12.00          12.00
    RUNOFF VOLUME    (mm)=     84.40         39.16          78.79
    TOTAL RAINFALL   (mm)=     85.40         85.40          85.40
    RUNOFF COEFFICIENT   =      0.99          0.46           0.92

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2003)|
|  1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 1104):     0.41   0.102    12.00    78.79
     + ID2= 2 ( 2002):     1.53   0.382    12.00    80.07
       ===============================================
       ID = 3 ( 2003):     1.95   0.483    12.00    79.80

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |  0.0801     0.0575
                         0.0012     0.0001   |  0.0965     0.0712
                         0.0013     0.0085   |  0.1106     0.0816
                         0.0238     0.0256   |  0.1230     0.0900
                         0.0593     0.0421   |  0.0000     0.0000
```



```
                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 ( 2003)     1.948     0.483     12.00      79.80
  OUTFLOW: ID= 1 ( 3001)     1.948     0.097     12.08      79.79

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.07
                TIME SHIFT OF PEAK FLOW        (min)=  5.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0719

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

    Unit Hyd Qpeak  (cms)=   1.271

    PEAK FLOW       (cms)=   0.582 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  40.017
    TOTAL RAINFALL   (mm)=  85.403
    RUNOFF COEFFICIENT   =   0.469

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |  0.5640     0.0375

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 ( 1200)     4.991     0.582     12.00      40.02
  OUTFLOW: ID= 1 ( 3002)     4.991     0.425     12.17      40.02

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 73.04
                TIME SHIFT OF PEAK FLOW        (min)= 10.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0290

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

--------------------
| ADD HYD  ( 2004)|
|  1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 3001):     1.95   0.097    12.08    79.79
     + ID2= 2 ( 3002):     4.99   0.425    12.17    40.02
       ===============================================
       ID = 3 ( 2004):     6.94   0.522    12.17    51.18

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  ( 2005)|
|  1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 1300):     0.41   0.053    12.00    33.60
```

```
 + ID2= 2 ( 2004):     6.94   0.522    12.17    51.18
 ==================================================
   ID = 3 ( 2005):     7.35   0.531    12.17    50.20

NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

    Unit Hyd Qpeak  (cms)=   0.144

    PEAK FLOW       (cms)=   0.089 (i)
    TIME TO PEAK    (hrs)=  12.167
    RUNOFF VOLUME    (mm)=  42.496
    TOTAL RAINFALL   (mm)=  85.403
    RUNOFF COEFFICIENT   =   0.498

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

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|   1 + 2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
     ID1= 1 ( 1400):        1.05   0.089    12.17    42.50
   + ID2= 2 ( 2005):        7.35   0.531    12.17    50.20
     ==================================================
     ID = 3 ( 2006):        8.40   0.620    12.17    49.24

NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

     V    V   I    SSSSS  U    U    A    L
     V    V   I    SS     U    U   A A   L
      V  V    I     SS    U    U  AAAAA  L
      V  V    I      SS   U    U  A   A  L
       VV     I    SSSSS  UUUUU  A    A  LLLLL

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

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\a5dd35
0c-bf90-4e26-a34a-8748b6c3eb60\scenar
```



```
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\a5dd35
0c-bf90-4e26-a34a-8748b6c3eb60\scenar


DATE: 02/11/2020                              TIME: 01:52:44

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
--------------------
  **********************************************
  ** SIMULATION : Run 06                      **
  **********************************************


--------------------
|    READ STORM    |     Filename: C:\Users\zhouj\AppD
|                  |               ata\Local\Temp\
|                  |               a207f9f6-f71b-489b-9d2a-f2f268ce4aa2\5db06ce4
| Ptotal= 92.89 mm |     Comments: 100yr24hrSCS_Midland
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.02	6.25	1.86	12.25	13.38	18.25	1.67
0.50	1.02	6.50	1.86	12.50	13.38	18.50	1.67
0.75	1.02	6.75	1.86	12.75	6.87	18.75	1.67
1.00	1.02	7.00	1.86	13.00	6.87	19.00	1.67
1.25	1.02	7.25	1.86	13.25	1.30	19.25	1.67
1.50	1.02	7.50	1.86	13.50	1.30	19.50	1.67
1.75	1.02	7.75	1.86	13.75	7.62	19.75	1.67
2.00	1.02	8.00	1.86	14.00	7.62	20.00	1.67
2.25	1.21	8.25	2.51	14.25	2.79	20.25	1.11
2.50	1.21	8.50	2.51	14.50	2.79	20.50	1.11
2.75	1.21	8.75	2.51	14.75	2.79	20.75	1.11
3.00	1.21	9.00	2.51	15.00	2.79	21.00	1.11
3.25	1.21	9.25	2.97	15.25	2.79	21.25	1.11
3.50	1.21	9.50	2.97	15.50	2.79	21.50	1.11
3.75	1.21	9.75	3.34	15.75	2.79	21.75	1.11
4.00	1.21	10.00	3.34	16.00	2.79	22.00	1.11
4.25	1.49	10.25	4.27	16.25	1.67	22.25	1.11
4.50	1.49	10.50	4.27	16.50	1.67	22.50	1.11
4.75	1.49	10.75	5.76	16.75	1.67	22.75	1.11
5.00	1.49	11.00	5.76	17.00	1.67	23.00	1.11
5.25	1.49	11.25	8.92	17.25	1.67	23.25	1.11
5.50	1.49	11.50	8.92	17.50	1.67	23.50	1.11
5.75	1.49	11.75	38.65	17.75	1.67	23.75	1.11
6.00	1.49	12.00	102.56	18.00	1.67	24.00	1.11

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

--------------------
| CALIB              |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.02	6.083	1.86	12.083	13.39	18.08	1.67
0.167	1.02	6.167	1.86	12.167	13.38	18.17	1.67
0.250	1.02	6.250	1.86	12.250	13.38	18.25	1.67
0.333	1.02	6.333	1.86	12.333	13.38	18.33	1.67
0.417	1.02	6.417	1.86	12.417	13.38	18.42	1.67
0.500	1.02	6.500	1.86	12.500	13.38	18.50	1.67
0.583	1.02	6.583	1.86	12.583	6.87	18.58	1.67
0.667	1.02	6.667	1.86	12.667	6.87	18.67	1.67
0.750	1.02	6.750	1.86	12.750	6.87	18.75	1.67
0.833	1.02	6.833	1.86	12.833	6.87	18.83	1.67
0.917	1.02	6.917	1.86	12.917	6.87	18.92	1.67
1.000	1.02	7.000	1.86	13.000	6.87	19.00	1.67
1.083	1.02	7.083	1.86	13.083	1.30	19.08	1.67
1.167	1.02	7.167	1.86	13.167	1.30	19.17	1.67
1.250	1.02	7.250	1.86	13.250	1.30	19.25	1.67
1.333	1.02	7.333	1.86	13.333	1.30	19.33	1.67
1.417	1.02	7.417	1.86	13.417	1.30	19.42	1.67
1.500	1.02	7.500	1.86	13.500	1.30	19.50	1.67
1.583	1.02	7.583	1.86	13.583	7.62	19.58	1.67
1.667	1.02	7.667	1.86	13.667	7.62	19.67	1.67
1.750	1.02	7.750	1.86	13.750	7.62	19.75	1.67
1.833	1.02	7.833	1.86	13.833	7.62	19.83	1.67
1.917	1.02	7.917	1.86	13.917	7.62	19.92	1.67
2.000	1.02	8.000	1.86	14.000	7.62	20.00	1.67
2.083	1.21	8.083	2.51	14.083	2.79	20.08	1.11
2.167	1.21	8.167	2.51	14.167	2.79	20.17	1.11
2.250	1.21	8.250	2.51	14.250	2.79	20.25	1.11
2.333	1.21	8.333	2.51	14.333	2.79	20.33	1.11
2.417	1.21	8.417	2.51	14.417	2.79	20.42	1.11
2.500	1.21	8.500	2.51	14.500	2.79	20.50	1.11
2.583	1.21	8.583	2.51	14.583	2.79	20.58	1.11
2.667	1.21	8.667	2.51	14.667	2.79	20.67	1.11
2.750	1.21	8.750	2.51	14.750	2.79	20.75	1.11
2.833	1.21	8.833	2.51	14.833	2.79	20.83	1.11
2.917	1.21	8.917	2.51	14.917	2.79	20.92	1.11
3.000	1.21	9.000	2.51	15.000	2.79	21.00	1.11
3.083	1.21	9.083	2.97	15.083	2.79	21.08	1.11
3.167	1.21	9.167	2.97	15.167	2.79	21.17	1.11
3.250	1.21	9.250	2.97	15.250	2.79	21.25	1.11
3.333	1.21	9.333	2.97	15.333	2.79	21.33	1.11
3.417	1.21	9.417	2.97	15.417	2.79	21.42	1.11
3.500	1.21	9.500	2.97	15.500	2.79	21.50	1.11
3.583	1.21	9.583	3.34	15.583	2.79	21.58	1.11
3.667	1.21	9.667	3.34	15.667	2.79	21.67	1.11
3.750	1.21	9.750	3.34	15.750	2.79	21.75	1.11
3.833	1.21	9.833	3.34	15.833	2.79	21.83	1.11
3.917	1.21	9.917	3.34	15.917	2.79	21.92	1.11
4.000	1.21	10.000	3.34	16.000	2.79	22.00	1.11
4.083	1.49	10.083	4.27	16.083	1.67	22.08	1.11
4.167	1.49	10.167	4.27	16.167	1.67	22.17	1.11
4.250	1.49	10.250	4.27	16.250	1.67	22.25	1.11
4.333	1.49	10.333	4.27	16.333	1.67	22.33	1.11
4.417	1.49	10.417	4.27	16.417	1.67	22.42	1.11
4.500	1.49	10.500	4.27	16.500	1.67	22.50	1.11
4.583	1.49	10.583	5.76	16.583	1.67	22.58	1.11
4.667	1.49	10.667	5.76	16.667	1.67	22.67	1.11
4.750	1.49	10.750	5.76	16.750	1.67	22.75	1.11
4.833	1.49	10.833	5.76	16.833	1.67	22.83	1.11

4.917	1.49	10.917	5.76	16.917	1.67	22.92	1.11
5.000	1.49	11.000	5.76	17.000	1.67	23.00	1.11
5.083	1.49	11.083	8.92	17.083	1.67	23.08	1.11
5.167	1.49	11.167	8.92	17.167	1.67	23.17	1.11
5.250	1.49	11.250	8.92	17.250	1.67	23.25	1.11
5.333	1.49	11.333	8.92	17.333	1.67	23.33	1.11
5.417	1.49	11.417	8.92	17.417	1.67	23.42	1.11
5.500	1.49	11.500	8.92	17.500	1.67	23.50	1.11
5.583	1.49	11.583	38.65	17.583	1.67	23.58	1.11
5.667	1.49	11.667	38.65	17.667	1.67	23.67	1.11
5.750	1.49	11.750	38.65	17.750	1.67	23.75	1.11
5.833	1.49	11.833	102.55	17.833	1.67	23.83	1.11
5.917	1.49	11.917	102.56	17.917	1.67	23.92	1.11
6.000	1.49	12.000	102.56	18.000	1.67	24.00	1.11

```
    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW       (cms)=   0.060 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  38.411
    TOTAL RAINFALL   (mm)=  92.888
    RUNOFF COEFFICIENT   =   0.414

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=     0.31         0.00
    Dep. Storage     (mm)=     1.00         5.00
    Average Slope     (%)=     1.00         2.00
    Length            (m)=    45.53        40.00
    Mannings n           =    0.013        0.250

    Max.Eff.Inten.(mm/hr)=   102.56        60.65
               over (min)      5.00         5.00
    Storage Coeff.  (min)=     1.58 (ii)    2.69 (ii)
    Unit Hyd. Tpeak (cms)=     5.00         5.00
    Unit Hyd. peak  (cms)=     0.33         0.29
                                                          *TOTALS*
    PEAK FLOW       (cms)=     0.09         0.00          0.088 (iii)
    TIME TO PEAK    (hrs)=    12.00        12.00          12.00
    RUNOFF VOLUME    (mm)=    91.89        44.76          91.41
    TOTAL RAINFALL   (mm)=    92.89        92.89          92.89
    RUNOFF COEFFICIENT   =     0.99         0.48           0.98

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

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
```

```
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.11          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       26.96         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.56         60.65
                over (min)         5.00          5.00
     Storage Coeff.  (min)=        1.15 (ii)     2.26 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.34          0.30
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.03          0.00          0.031 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       91.89         44.76         91.42
     TOTAL RAINFALL   (mm)=       92.89         92.89         92.89
     RUNOFF COEFFICIENT   =        0.99          0.48          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):     0.31   0.088    12.00    91.41
      + ID2= 2 (  1102):     0.11   0.031    12.00    91.42
        ===============================================
        ID = 3 (  2001):     0.42   0.119    12.00    91.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.97          0.14
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       86.18         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.56         60.65
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        2.31 (ii)     5.56 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.30          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.28          0.02          0.297 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       91.89         44.76         85.85
```



```
     TOTAL RAINFALL   (mm)=       92.89         92.89         92.89
     RUNOFF COEFFICIENT   =        0.99          0.48          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11   0.297    12.00    85.85
      + ID2= 2 (  2001):     0.42   0.119    12.00    91.41
        ===============================================
        ID = 3 (  2002):     1.53   0.416    12.00    87.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.36          0.05
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       52.54         40.00
     Mannings n           =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=      102.56         60.65
                over (min)         5.00          5.00
     Storage Coeff.  (min)=        1.72 (ii)     4.92 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.32          0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.10          0.01          0.112 (iii)
     TIME TO PEAK    (hrs)=       12.00         12.00         12.00
     RUNOFF VOLUME    (mm)=       91.89         44.76         86.04
     TOTAL RAINFALL   (mm)=       92.89         92.89         92.89
     RUNOFF COEFFICIENT   =        0.99          0.48          0.93

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```



```
        ID1= 1 (  1104):     0.41   0.112    12.00    86.04
      + ID2= 2 (  2002):     1.53   0.416    12.00    87.38
        ===============================================
        ID = 3 (  2003):     1.95   0.528    12.00    87.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2003)      1.948      0.528     12.00      87.09
   OUTFLOW: ID= 1 (  3001)      1.948      0.105     12.08      87.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.92
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0779

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.666 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=  45.686
     TOTAL RAINFALL   (mm)=  92.888
     RUNOFF COEFFICIENT   =   0.492

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5640     0.0375

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1200)      4.991      0.666     12.00      45.69
   OUTFLOW: ID= 1 (  3002)      4.991      0.486     12.17      45.68

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 73.06
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0332

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



```
--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.105    12.08    87.08
      + ID2= 2 (  3002):     4.99   0.486    12.17    45.68
        ===============================================
        ID = 3 (  2004):     6.94   0.591    12.17    57.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.060    12.00    38.41
      + ID2= 2 (  2004):     6.94   0.591    12.17    57.31
        ===============================================
        ID = 3 (  2005):     7.35   0.602    12.17    56.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.102 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  48.394
     TOTAL RAINFALL   (mm)=  92.888
     RUNOFF COEFFICIENT   =   0.521

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

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     1.05   0.102    12.17    48.39
      + ID2= 2 (  2005):     7.35   0.602    12.17    56.25
        ===============================================
        ID = 3 (  2006):     8.40   0.703    12.17    55.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
```

```
  VV    I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
```


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

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\215e17
0f-aa8f-427f-a4a9-229d06ce864e\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\215e17
0f-aa8f-427f-a4a9-229d06ce864e\scenar

DATE: 02/11/2020                          TIME: 01:52:40

USER:

COMMENTS: ____________________________________________________________

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--------------------
  **********************************************
  ** SIMULATION : Run 07                     **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 807.440
| Ptotal= 46.83 mm |                          B=   6.750
--------------------                          C=   0.828
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.35	6.17	1.25	12.17	1.09	18.17	0.50
0.33	0.36	6.33	1.36	12.33	1.05	18.33	0.50
0.50	0.36	6.50	1.50	12.50	1.02	18.50	0.49
0.67	0.37	6.67	1.68	12.67	0.99	18.67	0.48
0.83	0.38	6.83	1.90	12.83	0.96	18.83	0.48
1.00	0.39	7.00	2.21	13.00	0.93	19.00	0.47
1.17	0.39	7.17	2.64	13.17	0.90	19.17	0.47
1.33	0.40	7.33	3.32	13.33	0.88	19.33	0.46
1.50	0.41	7.50	4.51	13.50	0.86	19.50	0.45
1.67	0.42	7.67	7.17	13.67	0.83	19.67	0.45
1.83	0.43	7.83	18.51	13.83	0.81	19.83	0.44
2.00	0.44	8.00	78.28	14.00	0.79	20.00	0.44

2.17	0.45	8.17	24.65	14.17	0.77	20.17	0.43
2.33	0.46	8.33	12.40	14.33	0.76	20.33	0.43
2.50	0.47	8.50	8.22	14.50	0.74	20.50	0.42
2.67	0.49	8.67	6.14	14.67	0.72	20.67	0.42
2.83	0.50	8.83	4.92	14.83	0.71	20.83	0.41
3.00	0.51	9.00	4.11	15.00	0.69	21.00	0.41
3.17	0.53	9.17	3.53	15.17	0.68	21.17	0.40
3.33	0.55	9.33	3.11	15.33	0.67	21.33	0.40
3.50	0.56	9.50	2.78	15.50	0.65	21.50	0.40
3.67	0.58	9.67	2.51	15.67	0.64	21.67	0.39
3.83	0.60	9.83	2.30	15.83	0.63	21.83	0.39
4.00	0.62	10.00	2.12	16.00	0.62	22.00	0.38
4.17	0.65	10.17	1.97	16.17	0.61	22.17	0.38
4.33	0.67	10.33	1.84	16.33	0.60	22.33	0.38
4.50	0.70	10.50	1.73	16.50	0.59	22.50	0.37
4.67	0.73	10.67	1.63	16.67	0.58	22.67	0.37
4.83	0.76	10.83	1.54	16.83	0.57	22.83	0.37
5.00	0.80	11.00	1.46	17.00	0.56	23.00	0.36
5.17	0.84	11.17	1.39	17.17	0.55	23.17	0.36
5.33	0.89	11.33	1.33	17.33	0.54	23.33	0.36
5.50	0.94	11.50	1.27	17.50	0.53	23.50	0.35
5.67	1.00	11.67	1.22	17.67	0.53	23.67	0.35
5.83	1.07	11.83	1.18	17.83	0.52	23.83	0.35
6.00	1.15	12.00	1.13	18.00	0.51	24.00	0.34

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--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

                        ---- TRANSFORMED HYETOGRAPH ----
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.35	6.083	1.25	12.083	1.09	18.08	0.50
0.167	0.35	6.167	1.25	12.167	1.09	18.17	0.50
0.250	0.36	6.250	1.36	12.250	1.05	18.25	0.50
0.333	0.36	6.333	1.36	12.333	1.05	18.33	0.50
0.417	0.36	6.417	1.50	12.417	1.02	18.42	0.49
0.500	0.36	6.500	1.50	12.500	1.02	18.50	0.49
0.583	0.37	6.583	1.68	12.583	0.99	18.58	0.48
0.667	0.37	6.667	1.68	12.667	0.99	18.67	0.48
0.750	0.38	6.750	1.90	12.750	0.96	18.75	0.48
0.833	0.38	6.833	1.90	12.833	0.96	18.83	0.48
0.917	0.39	6.917	2.21	12.917	0.93	18.92	0.47
1.000	0.39	7.000	2.21	13.000	0.93	19.00	0.47
1.083	0.39	7.083	2.64	13.083	0.90	19.08	0.47
1.167	0.39	7.167	2.64	13.167	0.90	19.17	0.47
1.250	0.40	7.250	3.32	13.250	0.88	19.25	0.46
1.333	0.40	7.333	3.32	13.333	0.88	19.33	0.46
1.417	0.41	7.417	4.51	13.417	0.86	19.42	0.45
1.500	0.41	7.500	4.51	13.500	0.86	19.50	0.45
1.583	0.42	7.583	7.17	13.583	0.83	19.58	0.45
1.667	0.42	7.667	7.17	13.667	0.83	19.67	0.45
1.750	0.43	7.750	18.51	13.750	0.81	19.75	0.44
1.833	0.43	7.833	18.52	13.833	0.81	19.83	0.44
1.917	0.44	7.917	78.28	13.917	0.79	19.92	0.44
2.000	0.44	8.000	78.27	14.000	0.79	20.00	0.44

2.083	0.45	8.083	24.65	14.083	0.77	20.08	0.43
2.167	0.45	8.167	24.65	14.167	0.77	20.17	0.43
2.250	0.46	8.250	12.40	14.250	0.76	20.25	0.43
2.333	0.46	8.333	12.40	14.333	0.76	20.33	0.43
2.417	0.47	8.417	8.22	14.417	0.74	20.42	0.42
2.500	0.47	8.500	8.21	14.500	0.74	20.50	0.42
2.583	0.49	8.583	6.14	14.583	0.72	20.58	0.42
2.667	0.49	8.667	6.14	14.667	0.72	20.67	0.42
2.750	0.50	8.750	4.92	14.750	0.71	20.75	0.41
2.833	0.50	8.833	4.92	14.833	0.71	20.83	0.41
2.917	0.51	8.917	4.11	14.917	0.69	20.92	0.41
3.000	0.51	9.000	4.11	15.000	0.69	21.00	0.41
3.083	0.53	9.083	3.53	15.083	0.68	21.08	0.40
3.167	0.53	9.167	3.53	15.167	0.68	21.17	0.40
3.250	0.55	9.250	3.11	15.250	0.67	21.25	0.40
3.333	0.55	9.333	3.11	15.333	0.67	21.33	0.40
3.417	0.56	9.417	2.78	15.417	0.65	21.42	0.40
3.500	0.56	9.500	2.78	15.500	0.65	21.50	0.40
3.583	0.58	9.583	2.51	15.583	0.64	21.58	0.39
3.667	0.58	9.667	2.51	15.667	0.64	21.67	0.39
3.750	0.60	9.750	2.30	15.750	0.63	21.75	0.39
3.833	0.60	9.833	2.30	15.833	0.63	21.83	0.39
3.917	0.62	9.917	2.12	15.917	0.62	21.92	0.38
4.000	0.62	10.000	2.12	16.000	0.62	22.00	0.38
4.083	0.65	10.083	1.97	16.083	0.61	22.08	0.38
4.167	0.65	10.167	1.97	16.167	0.61	22.17	0.38
4.250	0.67	10.250	1.84	16.250	0.60	22.25	0.38
4.333	0.67	10.333	1.84	16.333	0.60	22.33	0.38
4.417	0.70	10.417	1.73	16.417	0.59	22.42	0.37
4.500	0.70	10.500	1.73	16.500	0.59	22.50	0.37
4.583	0.73	10.583	1.63	16.583	0.58	22.58	0.37
4.667	0.73	10.667	1.63	16.667	0.58	22.67	0.37
4.750	0.76	10.750	1.54	16.750	0.57	22.75	0.37
4.833	0.76	10.833	1.54	16.833	0.57	22.83	0.37
4.917	0.80	10.917	1.46	16.917	0.56	22.92	0.36
5.000	0.80	11.000	1.46	17.000	0.56	23.00	0.36
5.083	0.84	11.083	1.39	17.083	0.55	23.08	0.36
5.167	0.84	11.167	1.39	17.167	0.55	23.17	0.36
5.250	0.89	11.250	1.33	17.250	0.54	23.25	0.36
5.333	0.89	11.333	1.33	17.333	0.54	23.33	0.36
5.417	0.94	11.417	1.27	17.417	0.53	23.42	0.35
5.500	0.94	11.500	1.27	17.500	0.53	23.50	0.35
5.583	1.00	11.583	1.22	17.583	0.53	23.58	0.35
5.667	1.00	11.667	1.22	17.667	0.53	23.67	0.35
5.750	1.07	11.750	1.18	17.750	0.52	23.75	0.35
5.833	1.07	11.833	1.18	17.833	0.52	23.83	0.35
5.917	1.15	11.917	1.13	17.917	0.51	23.92	0.34
6.000	1.15	12.000	1.13	18.000	0.51	24.00	0.34

```
    Unit Hyd Qpeak  (cms)=   0.261

    PEAK FLOW       (cms)=   0.020 (i)
    TIME TO PEAK    (hrs)=   8.000
    RUNOFF VOLUME    (mm)=  11.868
    TOTAL RAINFALL   (mm)=  46.829
    RUNOFF COEFFICIENT   =   0.253

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

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
```



```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.31          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      45.53         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      78.28         18.87
              over (min)        5.00          5.00
    Storage Coeff.  (min)=       1.76 (ii)     3.00 (ii)
    Unit Hyd. Tpeak (min)=       5.00          5.00
    Unit Hyd. peak  (cms)=       0.32          0.28
                                                         *TOTALS*
    PEAK FLOW       (cms)=       0.07          0.00          0.067 (iii)
    TIME TO PEAK    (hrs)=       8.00          8.00           8.00
    RUNOFF VOLUME    (mm)=      45.83         13.83          45.51
    TOTAL RAINFALL   (mm)=      46.83         46.83          46.83
    RUNOFF COEFFICIENT   =       0.98          0.30           0.97

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.11          0.00
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       1.00          2.00
    Length            (m)=      26.96         40.00
    Mannings n           =      0.013         0.250

    Max.Eff.Inten.(mm/hr)=      78.28         18.87
              over (min)        5.00          5.00
    Storage Coeff.  (min)=       1.28 (ii)     2.52 (ii)
    Unit Hyd. Tpeak (min)=       5.00          5.00
    Unit Hyd. peak  (cms)=       0.33          0.29
                                                         *TOTALS*
    PEAK FLOW       (cms)=       0.02          0.00          0.024 (iii)
    TIME TO PEAK    (hrs)=       8.00          8.00           8.00
    RUNOFF VOLUME    (mm)=      45.83         13.83          45.51
    TOTAL RAINFALL   (mm)=      46.83         46.83          46.83
    RUNOFF COEFFICIENT   =       0.98          0.30           0.97

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

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2001)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):    0.31   0.067     8.00    45.51
      + ID2= 2 (  1102):    0.11   0.024     8.00    45.51
        =================================================
        ID = 3 (  2001):    0.42   0.090     8.00    45.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      78.28         18.87
               over (min)        5.00         10.00
     Storage Coeff.  (min)=       2.58 (ii)     6.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.29          0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.21          0.01          0.213 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08           8.00
     RUNOFF VOLUME    (mm)=      45.83         13.83          41.73
     TOTAL RAINFALL   (mm)=      46.83         46.83          46.83
     RUNOFF COEFFICIENT   =       0.98          0.30           0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2002)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):    1.11   0.213     8.00    41.73
      + ID2= 2 (  2001):    0.42   0.090     8.00    45.51
        =================================================
        ID = 3 (  2002):    1.53   0.303     8.00    42.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
```



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--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36          0.05
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      52.54         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      78.28         18.87
               over (min)        5.00         10.00
     Storage Coeff.  (min)=       1.92 (ii)     5.48 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.31          0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.08          0.00          0.080 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08           8.00
     RUNOFF VOLUME    (mm)=      45.83         13.83          41.86
     TOTAL RAINFALL   (mm)=      46.83         46.83          46.83
     RUNOFF COEFFICIENT   =       0.98          0.30           0.89

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  2003)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):    0.41   0.080     8.00    41.86
      + ID2= 2 (  2002):    1.53   0.303     8.00    42.77
        =================================================
        ID = 3 (  2003):    1.95   0.383     8.00    42.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0801     0.0575
                          0.0012     0.0001   |   0.0965     0.0712
                          0.0013     0.0085   |   0.1106     0.0816
                          0.0238     0.0256   |   0.1230     0.0900
                          0.0593     0.0421   |   0.0000     0.0000

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)      1.948     0.383       8.00       42.57
   OUTFLOW: ID= 1 (  3001)      1.948     0.058       8.33       42.56

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.11
                TIME SHIFT OF PEAK FLOW        (min)= 20.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0416

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--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.180 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  14.254
     TOTAL RAINFALL   (mm)=  46.829
     RUNOFF COEFFICIENT   =   0.304

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5640     0.0375

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  1200)      4.991     0.180       8.08       14.25
   OUTFLOW: ID= 1 (  3002)      4.991     0.135       8.25       14.25

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.24
                TIME SHIFT OF PEAK FLOW        (min)= 10.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0091

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2004)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):    1.95   0.058     8.33    42.56
      + ID2= 2 (  3002):    4.99   0.135     8.25    14.25
        =================================================
        ID = 3 (  2004):    6.94   0.192     8.25    22.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2005)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):    0.41   0.020     8.00    11.87
      + ID2= 2 (  2004):    6.94   0.192     8.25    22.20
        =================================================
        ID = 3 (  2005):    7.35   0.198     8.25    21.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
```



```
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.029 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  15.411
     TOTAL RAINFALL   (mm)=  46.829
     RUNOFF COEFFICIENT   =   0.329

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

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|  1 + 2 =  3   |         AREA    QPEAK    TPEAK     R.V.
--------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):    1.05   0.029     8.25    15.41
      + ID2= 2 (  2005):    7.35   0.198     8.25    21.62
        =================================================
        ID = 3 (  2006):    8.40   0.227     8.25    20.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U    U    A    L
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

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


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\4bcf6b
28-758b-4cf0-b949-e96c9ffcb79c\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\4bcf6b
28-758b-4cf0-b949-e96c9ffcb79c\scenar


DATE: 02/11/2020                              TIME: 01:52:42

USER:
```

```
COMMENTS: ______________________________________________________

-------------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : Run 08                        **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1135.400
| Ptotal= 59.88 mm |                           B=   7.500
--------------------                           C=   0.841
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.42	6.17	1.53	12.17	1.33	18.17	0.60
0.33	0.42	6.33	1.67	12.33	1.29	18.33	0.59
0.50	0.43	6.50	1.85	12.50	1.24	18.50	0.59
0.67	0.44	6.67	2.07	12.67	1.20	18.67	0.58
0.83	0.45	6.83	2.37	12.83	1.17	18.83	0.57
1.00	0.46	7.00	2.76	13.00	1.13	19.00	0.56
1.17	0.47	7.17	3.33	13.17	1.10	19.17	0.56
1.33	0.48	7.33	4.21	13.33	1.07	19.33	0.55
1.50	0.49	7.50	5.79	13.50	1.04	19.50	0.54
1.67	0.50	7.67	9.38	13.67	1.01	19.67	0.54
1.83	0.51	7.83	24.78	13.83	0.98	19.83	0.53
2.00	0.52	8.00	102.27	14.00	0.96	20.00	0.52
2.17	0.54	8.17	33.10	14.17	0.94	20.17	0.52
2.33	0.55	8.33	16.50	14.33	0.92	20.33	0.51
2.50	0.57	8.50	10.79	14.50	0.89	20.50	0.50
2.67	0.58	8.67	7.99	14.67	0.87	20.67	0.50
2.83	0.60	8.83	6.34	14.83	0.86	20.83	0.49
3.00	0.62	9.00	5.26	15.00	0.84	21.00	0.49
3.17	0.63	9.17	4.50	15.17	0.82	21.17	0.48
3.33	0.65	9.33	3.94	15.33	0.80	21.33	0.48
3.50	0.68	9.50	3.50	15.50	0.79	21.50	0.47
3.67	0.70	9.67	3.16	15.67	0.77	21.67	0.47
3.83	0.72	9.83	2.88	15.83	0.76	21.83	0.46
4.00	0.75	10.00	2.65	16.00	0.74	22.00	0.46
4.17	0.78	10.17	2.45	16.17	0.73	22.17	0.45
4.33	0.81	10.33	2.29	16.33	0.72	22.33	0.45
4.50	0.85	10.50	2.14	16.50	0.71	22.50	0.44
4.67	0.88	10.67	2.01	16.67	0.69	22.67	0.44
4.83	0.92	10.83	1.90	16.83	0.68	22.83	0.43
5.00	0.97	11.00	1.80	17.00	0.67	23.00	0.43
5.17	1.02	11.17	1.72	17.17	0.66	23.17	0.43
5.33	1.08	11.33	1.64	17.33	0.65	23.33	0.42
5.50	1.15	11.50	1.56	17.50	0.64	23.50	0.42
5.67	1.22	11.67	1.50	17.67	0.63	23.67	0.41
5.83	1.31	11.83	1.44	17.83	0.62	23.83	0.41
6.00	1.41	12.00	1.38	18.00	0.61	24.00	0.41

```
-----------------------------------------------------------------------------------
--------------------
| CALIB            |
```



```
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.42	6.083	1.53	12.083	1.33	18.08	0.60
0.167	0.42	6.167	1.53	12.167	1.33	18.17	0.60
0.250	0.42	6.250	1.67	12.250	1.29	18.25	0.59
0.333	0.42	6.333	1.67	12.333	1.29	18.33	0.59
0.417	0.43	6.417	1.85	12.417	1.24	18.42	0.59
0.500	0.43	6.500	1.85	12.500	1.24	18.50	0.59
0.583	0.44	6.583	2.07	12.583	1.20	18.58	0.58
0.667	0.44	6.667	2.07	12.667	1.20	18.67	0.58
0.750	0.45	6.750	2.37	12.750	1.17	18.75	0.57
0.833	0.45	6.833	2.37	12.833	1.17	18.83	0.57
0.917	0.46	6.917	2.76	12.917	1.13	18.92	0.56
1.000	0.46	7.000	2.76	13.000	1.13	19.00	0.56
1.083	0.47	7.083	3.33	13.083	1.10	19.08	0.56
1.167	0.47	7.167	3.33	13.167	1.10	19.17	0.56
1.250	0.48	7.250	4.21	13.250	1.07	19.25	0.55
1.333	0.48	7.333	4.21	13.333	1.07	19.33	0.55
1.417	0.49	7.417	5.79	13.417	1.04	19.42	0.54
1.500	0.49	7.500	5.79	13.500	1.04	19.50	0.54
1.583	0.50	7.583	9.38	13.583	1.01	19.58	0.54
1.667	0.50	7.667	9.38	13.667	1.01	19.67	0.54
1.750	0.51	7.750	24.78	13.750	0.98	19.75	0.53
1.833	0.51	7.833	24.79	13.833	0.98	19.83	0.53
1.917	0.52	7.917	102.27	13.917	0.96	19.92	0.52
2.000	0.52	8.000	102.27	14.000	0.96	20.00	0.52
2.083	0.54	8.083	33.10	14.083	0.94	20.08	0.52
2.167	0.54	8.167	33.10	14.167	0.94	20.17	0.52
2.250	0.55	8.250	16.50	14.250	0.92	20.25	0.51
2.333	0.55	8.333	16.50	14.333	0.92	20.33	0.51
2.417	0.57	8.417	10.79	14.417	0.89	20.42	0.50
2.500	0.57	8.500	10.79	14.500	0.89	20.50	0.50
2.583	0.58	8.583	7.99	14.583	0.87	20.58	0.50
2.667	0.58	8.667	7.99	14.667	0.87	20.67	0.50
2.750	0.60	8.750	6.34	14.750	0.86	20.75	0.49
2.833	0.60	8.833	6.34	14.833	0.86	20.83	0.49
2.917	0.62	8.917	5.26	14.917	0.84	20.92	0.49
3.000	0.62	9.000	5.26	15.000	0.84	21.00	0.49
3.083	0.63	9.083	4.50	15.083	0.82	21.08	0.48
3.167	0.63	9.167	4.50	15.167	0.82	21.17	0.48
3.250	0.65	9.250	3.94	15.250	0.80	21.25	0.48
3.333	0.65	9.333	3.94	15.333	0.80	21.33	0.48
3.417	0.68	9.417	3.50	15.417	0.79	21.42	0.47
3.500	0.68	9.500	3.50	15.500	0.79	21.50	0.47
3.583	0.70	9.583	3.16	15.583	0.77	21.58	0.47
3.667	0.70	9.667	3.16	15.667	0.77	21.67	0.47
3.750	0.72	9.750	2.88	15.750	0.76	21.75	0.46
3.833	0.72	9.833	2.88	15.833	0.76	21.83	0.46
3.917	0.75	9.917	2.65	15.917	0.74	21.92	0.46
4.000	0.75	10.000	2.65	16.000	0.74	22.00	0.46
4.083	0.78	10.083	2.45	16.083	0.73	22.08	0.45
4.167	0.78	10.167	2.45	16.167	0.73	22.17	0.45
4.250	0.81	10.250	2.29	16.250	0.72	22.25	0.45
4.333	0.81	10.333	2.29	16.333	0.72	22.33	0.45
4.417	0.85	10.417	2.14	16.417	0.71	22.42	0.44

4.500	0.85	10.500	2.14	16.500	0.71	22.50	0.44
4.583	0.88	10.583	2.01	16.583	0.69	22.58	0.44
4.667	0.88	10.667	2.01	16.667	0.69	22.67	0.44
4.750	0.92	10.750	1.90	16.750	0.68	22.75	0.43
4.833	0.92	10.833	1.90	16.833	0.68	22.83	0.43
4.917	0.97	10.917	1.80	16.917	0.67	22.92	0.43
5.000	0.97	11.000	1.80	17.000	0.67	23.00	0.43
5.083	1.02	11.083	1.72	17.083	0.66	23.08	0.43
5.167	1.02	11.167	1.72	17.167	0.66	23.17	0.43
5.250	1.08	11.250	1.64	17.250	0.65	23.25	0.42
5.333	1.08	11.333	1.64	17.333	0.65	23.33	0.42
5.417	1.15	11.417	1.56	17.417	0.64	23.42	0.42
5.500	1.15	11.500	1.56	17.500	0.64	23.50	0.42
5.583	1.22	11.583	1.50	17.583	0.63	23.58	0.41
5.667	1.22	11.667	1.50	17.667	0.63	23.67	0.41
5.750	1.31	11.750	1.44	17.750	0.62	23.75	0.41
5.833	1.31	11.833	1.44	17.833	0.62	23.83	0.41
5.917	1.41	11.917	1.38	17.917	0.61	23.92	0.41
6.000	1.41	12.000	1.38	18.000	0.61	24.00	0.41

```
     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.034 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  18.519
     TOTAL RAINFALL   (mm)=  59.879
     RUNOFF COEFFICIENT   =   0.309

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

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.31          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     45.53         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    102.27         31.88
               over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.58 (ii)     2.69 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.33          0.29
                                                         *TOTALS*
     PEAK FLOW       (cms)=      0.09          0.00        0.088 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00         8.00
     RUNOFF VOLUME    (mm)=     58.88         21.58        58.50
     TOTAL RAINFALL   (mm)=     59.88         59.88        59.88
     RUNOFF COEFFICIENT   =      0.98          0.36         0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
             THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



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-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.11          0.00
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     26.96         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    102.27         31.88
               over (min)       5.00          5.00
     Storage Coeff.  (min)=      1.15 (ii)     2.27 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.34          0.30
                                                         *TOTALS*
     PEAK FLOW       (cms)=      0.03          0.00        0.031 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00         8.00
     RUNOFF VOLUME    (mm)=     58.88         21.58        58.51
     TOTAL RAINFALL   (mm)=     59.88         59.88        59.88
     RUNOFF COEFFICIENT   =      0.98          0.36         0.98

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  75.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
             THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):    0.31    0.088     8.00    58.50
      + ID2= 2 (  1102):    0.11    0.031     8.00    58.51
        ===============================================
        ID = 3 (  2001):    0.42    0.118     8.00    58.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.97          0.14
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=     86.18         40.00
     Mannings n          =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=    102.27         31.88
               over (min)       5.00         10.00
     Storage Coeff.  (min)=      2.32 (ii)     5.56 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
```

```
     Unit Hyd. peak  (cms)=       0.30         0.16
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.27         0.01           0.282 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08            8.00
     RUNOFF VOLUME    (mm)=      58.88        21.58           54.10
     TOTAL RAINFALL   (mm)=      59.88        59.88           59.88
     RUNOFF COEFFICIENT   =       0.98         0.36            0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11   0.282     8.00    54.10
      + ID2= 2 (  2001):     0.42   0.118     8.00    58.51
        ==================================================
        ID = 3 (  2002):     1.53   0.400     8.00    55.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      52.54        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     102.27        31.88
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.72 (ii)    4.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.22
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.00           0.107 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00            8.00
     RUNOFF VOLUME    (mm)=      58.88        21.58           54.25
     TOTAL RAINFALL   (mm)=      59.88        59.88           59.88
     RUNOFF COEFFICIENT   =       0.98         0.36            0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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



```
--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41   0.107     8.00    54.25
      + ID2= 2 (  2002):     1.53   0.400     8.00    55.31
        ==================================================
        ID = 3 (  2003):     1.95   0.507     8.00    55.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.0801     0.0575
                           0.0012     0.0001   |   0.0965     0.0712
                           0.0013     0.0085   |   0.1106     0.0816
                           0.0238     0.0256   |   0.1230     0.0900
                           0.0593     0.0421   |   0.0000     0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  2003)        1.948      0.507      8.00      55.08
   OUTFLOW: ID= 1 (  3001)        1.948      0.076      8.33      55.08

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.92
                TIME SHIFT OF PEAK FLOW         (min)= 20.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0544

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.302 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  22.166
     TOTAL RAINFALL   (mm)=  59.879
     RUNOFF COEFFICIENT   =   0.370

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.5640     0.0375

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1200)        4.991      0.302      8.08      22.17
   OUTFLOW: ID= 1 (  3002)        4.991      0.227      8.25      22.16
```



```
                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.24
                TIME SHIFT OF PEAK FLOW         (min)= 10.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0152

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.076     8.33    55.08
      + ID2= 2 (  3002):     4.99   0.227     8.25    22.16
        ==================================================
        ID = 3 (  2004):     6.94   0.303     8.25    31.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.034     8.00    18.52
      + ID2= 2 (  2004):     6.94   0.303     8.25    31.40
        ==================================================
        ID = 3 (  2005):     7.35   0.312     8.25    30.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.049 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  23.792
     TOTAL RAINFALL   (mm)=  59.879
     RUNOFF COEFFICIENT   =   0.397

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

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

--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     1.05   0.049     8.25    23.79
      + ID2= 2 (  2005):     7.35   0.312     8.25    30.68
        ==================================================
        ID = 3 (  2006):     8.40   0.361     8.25    29.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```
      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

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



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


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\02032f
ee-4f2f-4060-869b-79157d673feb\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\02032f
ee-4f2f-4060-869b-79157d673feb\scenar


DATE: 02/11/2020                         TIME: 01:52:39

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
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  ***********************************************
  ** SIMULATION : Run 09                        **
  ***********************************************

--------------------
| CHICAGO STORM    |       IDF curve parameters: A=1387.000
| Ptotal= 67.50 mm |                             B=   7.970
--------------------                             C=   0.852
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.17    0.44 |  6.17    1.66 | 12.17    1.44 | 18.17    0.64
                 0.33    0.45 |  6.33    1.82 | 12.33    1.39 | 18.33    0.63
                 0.50    0.46 |  6.50    2.02 | 12.50    1.34 | 18.50    0.62
                 0.67    0.46 |  6.67    2.27 | 12.67    1.30 | 18.67    0.61
                 0.83    0.47 |  6.83    2.59 | 12.83    1.25 | 18.83    0.60
                 1.00    0.48 |  7.00    3.04 | 13.00    1.22 | 19.00    0.60
                 1.17    0.49 |  7.17    3.68 | 13.17    1.18 | 19.17    0.59
```

```
             1.33     0.51 |  7.33     4.70 | 13.33     1.15 | 19.33     0.58
             1.50     0.52 |  7.50     6.52 | 13.50     1.11 | 19.50     0.57
             1.67     0.53 |  7.67    10.72 | 13.67     1.08 | 19.67     0.57
             1.83     0.54 |  7.83    28.90 | 13.83     1.06 | 19.83     0.56
             2.00     0.56 |  8.00   118.36 | 14.00     1.03 | 20.00     0.55
             2.17     0.57 |  8.17    38.72 | 14.17     1.00 | 20.17     0.55
             2.33     0.58 |  8.33    19.11 | 14.33     0.98 | 20.33     0.54
             2.50     0.60 |  8.50    12.38 | 14.50     0.96 | 20.50     0.53
             2.67     0.62 |  8.67     9.08 | 14.67     0.93 | 20.67     0.53
             2.83     0.63 |  8.83     7.16 | 14.83     0.91 | 20.83     0.52
             3.00     0.65 |  9.00     5.91 | 15.00     0.89 | 21.00     0.51
             3.17     0.67 |  9.17     5.03 | 15.17     0.88 | 21.17     0.51
             3.33     0.70 |  9.33     4.38 | 15.33     0.86 | 21.33     0.50
             3.50     0.72 |  9.50     3.89 | 15.50     0.84 | 21.50     0.50
             3.67     0.74 |  9.67     3.49 | 15.67     0.82 | 21.67     0.49
             3.83     0.77 |  9.83     3.17 | 15.83     0.81 | 21.83     0.49
             4.00     0.80 | 10.00     2.91 | 16.00     0.79 | 22.00     0.48
             4.17     0.83 | 10.17     2.69 | 16.17     0.78 | 22.17     0.48
             4.33     0.87 | 10.33     2.50 | 16.33     0.76 | 22.33     0.47
             4.50     0.90 | 10.50     2.34 | 16.50     0.75 | 22.50     0.47
             4.67     0.94 | 10.67     2.20 | 16.67     0.74 | 22.67     0.46
             4.83     0.99 | 10.83     2.07 | 16.83     0.73 | 22.83     0.46
             5.00     1.04 | 11.00     1.96 | 17.00     0.71 | 23.00     0.45
             5.17     1.10 | 11.17     1.86 | 17.17     0.70 | 23.17     0.45
             5.33     1.16 | 11.33     1.78 | 17.33     0.69 | 23.33     0.45
             5.50     1.23 | 11.50     1.70 | 17.50     0.68 | 23.50     0.44
             5.67     1.32 | 11.67     1.62 | 17.67     0.67 | 23.67     0.44
             5.83     1.41 | 11.83     1.56 | 17.83     0.66 | 23.83     0.43
             6.00     1.52 | 12.00     1.50 | 18.00     0.65 | 24.00     0.43


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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


                                ---- TRANSFORMED HYETOGRAPH ----
             TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
            0.083    0.44 | 6.083    1.66 |12.083    1.44 | 18.08    0.64
            0.167    0.44 | 6.167    1.66 |12.167    1.44 | 18.17    0.64
            0.250    0.45 | 6.250    1.82 |12.250    1.39 | 18.25    0.63
            0.333    0.45 | 6.333    1.82 |12.333    1.39 | 18.33    0.63
            0.417    0.46 | 6.417    2.02 |12.417    1.34 | 18.42    0.62
            0.500    0.46 | 6.500    2.02 |12.500    1.34 | 18.50    0.62
            0.583    0.46 | 6.583    2.27 |12.583    1.30 | 18.58    0.61
            0.667    0.46 | 6.667    2.27 |12.667    1.30 | 18.67    0.61
            0.750    0.47 | 6.750    2.59 |12.750    1.25 | 18.75    0.60
            0.833    0.47 | 6.833    2.59 |12.833    1.25 | 18.83    0.60
            0.917    0.48 | 6.917    3.04 |12.917    1.22 | 18.92    0.60
            1.000    0.48 | 7.000    3.04 |13.000    1.22 | 19.00    0.60
            1.083    0.49 | 7.083    3.68 |13.083    1.18 | 19.08    0.59
            1.167    0.49 | 7.167    3.68 |13.167    1.18 | 19.17    0.59
            1.250    0.51 | 7.250    4.70 |13.250    1.15 | 19.25    0.58
            1.333    0.51 | 7.333    4.70 |13.333    1.15 | 19.33    0.58
            1.417    0.52 | 7.417    6.52 |13.417    1.11 | 19.42    0.57
            1.500    0.52 | 7.500    6.52 |13.500    1.11 | 19.50    0.57
            1.583    0.53 | 7.583   10.72 |13.583    1.08 | 19.58    0.57
```



```
            1.667    0.53 | 7.667   10.72 |13.667    1.08 | 19.67    0.57
            1.750    0.54 | 7.750   28.90 |13.750    1.06 | 19.75    0.56
            1.833    0.54 | 7.833   28.90 |13.833    1.06 | 19.83    0.56
            1.917    0.56 | 7.917  118.36 |13.917    1.03 | 19.92    0.55
            2.000    0.56 | 8.000  118.35 |14.000    1.03 | 20.00    0.55
            2.083    0.57 | 8.083   38.72 |14.083    1.00 | 20.08    0.55
            2.167    0.57 | 8.167   38.72 |14.167    1.00 | 20.17    0.55
            2.250    0.58 | 8.250   19.11 |14.250    0.98 | 20.25    0.54
            2.333    0.58 | 8.333   19.11 |14.333    0.98 | 20.33    0.54
            2.417    0.60 | 8.417   12.38 |14.417    0.96 | 20.42    0.53
            2.500    0.60 | 8.500   12.38 |14.500    0.96 | 20.50    0.53
            2.583    0.62 | 8.583    9.08 |14.583    0.93 | 20.58    0.53
            2.667    0.62 | 8.667    9.08 |14.667    0.93 | 20.67    0.53
            2.750    0.63 | 8.750    7.16 |14.750    0.91 | 20.75    0.52
            2.833    0.63 | 8.833    7.16 |14.833    0.91 | 20.83    0.52
            2.917    0.65 | 8.917    5.91 |14.917    0.89 | 20.92    0.51
            3.000    0.65 | 9.000    5.91 |15.000    0.89 | 21.00    0.51
            3.083    0.67 | 9.083    5.03 |15.083    0.88 | 21.08    0.51
            3.167    0.67 | 9.167    5.03 |15.167    0.88 | 21.17    0.51
            3.250    0.70 | 9.250    4.38 |15.250    0.86 | 21.25    0.50
            3.333    0.70 | 9.333    4.38 |15.333    0.86 | 21.33    0.50
            3.417    0.72 | 9.417    3.89 |15.417    0.84 | 21.42    0.50
            3.500    0.72 | 9.500    3.89 |15.500    0.84 | 21.50    0.50
            3.583    0.74 | 9.583    3.49 |15.583    0.82 | 21.58    0.49
            3.667    0.74 | 9.667    3.49 |15.667    0.82 | 21.67    0.49
            3.750    0.77 | 9.750    3.17 |15.750    0.81 | 21.75    0.49
            3.833    0.77 | 9.833    3.17 |15.833    0.81 | 21.83    0.49
            3.917    0.80 | 9.917    2.91 |15.917    0.79 | 21.92    0.48
            4.000    0.80 |10.000    2.91 |16.000    0.79 | 22.00    0.48
            4.083    0.83 |10.083    2.69 |16.083    0.78 | 22.08    0.48
            4.167    0.83 |10.167    2.69 |16.167    0.78 | 22.17    0.48
            4.250    0.87 |10.250    2.50 |16.250    0.76 | 22.25    0.47
            4.333    0.87 |10.333    2.50 |16.333    0.76 | 22.33    0.47
            4.417    0.90 |10.417    2.34 |16.417    0.75 | 22.42    0.47
            4.500    0.90 |10.500    2.34 |16.500    0.75 | 22.50    0.47
            4.583    0.94 |10.583    2.20 |16.583    0.74 | 22.58    0.46
            4.667    0.94 |10.667    2.20 |16.667    0.74 | 22.67    0.46
            4.750    0.99 |10.750    2.07 |16.750    0.73 | 22.75    0.46
            4.833    0.99 |10.833    2.07 |16.833    0.73 | 22.83    0.46
            4.917    1.04 |10.917    1.96 |16.917    0.71 | 22.92    0.45
            5.000    1.04 |11.000    1.96 |17.000    0.71 | 23.00    0.45
            5.083    1.10 |11.083    1.86 |17.083    0.70 | 23.08    0.45
            5.167    1.10 |11.167    1.86 |17.167    0.70 | 23.17    0.45
            5.250    1.16 |11.250    1.78 |17.250    0.69 | 23.25    0.45
            5.333    1.16 |11.333    1.78 |17.333    0.69 | 23.33    0.45
            5.417    1.23 |11.417    1.70 |17.417    0.68 | 23.42    0.44
            5.500    1.23 |11.500    1.70 |17.500    0.68 | 23.50    0.44
            5.583    1.32 |11.583    1.62 |17.583    0.67 | 23.58    0.44
            5.667    1.32 |11.667    1.62 |17.667    0.67 | 23.67    0.44
            5.750    1.41 |11.750    1.56 |17.750    0.66 | 23.75    0.43
            5.833    1.41 |11.833    1.56 |17.833    0.66 | 23.83    0.43
            5.917    1.52 |11.917    1.50 |17.917    0.65 | 23.92    0.43
            6.000    1.52 |12.000    1.50 |18.000    0.65 | 24.00    0.43

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.043 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  22.776
     TOTAL RAINFALL   (mm)=  67.502
     RUNOFF COEFFICIENT   =   0.337

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



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-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.31          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      45.53         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.49 (ii)     2.54 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.29
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.10          0.00           0.102 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           66.10
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      26.96         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.09 (ii)     2.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.31
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.04          0.00           0.036 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           66.10
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
```



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

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--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1101):     0.31   0.102     8.00    66.10
      + ID2= 2 (  1102):     0.11   0.036     8.00    66.10
        ===============================================
        ID = 3 (  2001):     0.42   0.137     8.00    66.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     118.36         41.30
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       2.18 (ii)     5.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.31          0.16
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.32          0.01           0.328 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08            8.00
     RUNOFF VOLUME    (mm)=      66.50         26.54           61.39
     TOTAL RAINFALL   (mm)=      67.50         67.50           67.50
     RUNOFF COEFFICIENT   =       0.99          0.39            0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1103):     1.11   0.328     8.00    61.39
      + ID2= 2 (  2001):     0.42   0.137     8.00    66.10
        ===============================================
        ID = 3 (  2002):     1.53   0.465     8.00    62.68

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=     0.36          0.05
     Dep. Storage      (mm)=     1.00          5.00
     Average Slope      (%)=     1.00          2.00
     Length             (m)=    52.54         40.00
     Mannings n            =    0.013         0.250

     Max.Eff.Inten.(mm/hr)=    118.36         41.30
              over (min)         5.00          5.00
     Storage Coeff.  (min)=      1.62 (ii)     4.64 (ii)
     Unit Hyd. Tpeak (min)=      5.00          5.00
     Unit Hyd. peak  (cms)=      0.32          0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.12          0.01         0.125 (iii)
     TIME TO PEAK    (hrs)=      8.00          8.00          8.00
     RUNOFF VOLUME    (mm)=     66.50         26.54         61.54
     TOTAL RAINFALL   (mm)=     67.50         67.50         67.50
     RUNOFF COEFFICIENT   =      0.99          0.39          0.91

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1104):     0.41   0.125     8.00    61.54
      + ID2= 2 (  2002):     1.53   0.465     8.00    62.68
        ==================================================
        ID = 3 (  2003):     1.95   0.590     8.00    62.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0801     0.0575
                          0.0012     0.0001    |   0.0965     0.0712
                          0.0013     0.0085    |   0.1106     0.0816
                          0.0238     0.0256    |   0.1230     0.0900
                          0.0593     0.0421    |   0.0000     0.0000

                                 AREA      QPEAK       TPEAK        R.V.
                                 (ha)      (cms)       (hrs)        (mm)
   INFLOW : ID= 2 (  2003)      1.948       0.590       8.00       62.44
   OUTFLOW: ID= 1 (  3001)      1.948       0.086       8.33       62.43
```



```
                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.59
                TIME SHIFT OF PEAK FLOW          (min)= 20.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0627

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW      (cms)=   0.391 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  27.215
     TOTAL RAINFALL   (mm)=  67.502
     RUNOFF COEFFICIENT   =   0.403

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.5640     0.0375

                                 AREA      QPEAK       TPEAK        R.V.
                                 (ha)      (cms)       (hrs)        (mm)
   INFLOW : ID= 2 (  1200)      4.991       0.391       8.08       27.22
   OUTFLOW: ID= 1 (  3002)      4.991       0.294       8.25       27.21

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.21
                TIME SHIFT OF PEAK FLOW          (min)= 10.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0196

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

--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.086     8.33    62.43
      + ID2= 2 (  3002):     4.99   0.294     8.25    27.21
        ==================================================
        ID = 3 (  2004):     6.94   0.379     8.25    37.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.043     8.00    22.78
      + ID2= 2 (  2004):     6.94   0.379     8.25    37.10
        ==================================================
        ID = 3 (  2005):     7.35   0.391     8.25    36.30

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



```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW      (cms)=   0.063 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  29.107
     TOTAL RAINFALL   (mm)=  67.502
     RUNOFF COEFFICIENT   =   0.431

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

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1400):     1.05   0.063     8.25    29.11
      + ID2= 2 (  2005):     7.35   0.391     8.25    36.30
        ==================================================
        ID = 3 (  2006):     8.40   0.454     8.25    35.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U    U    A    L
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

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


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

   Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\198759
57-45e3-4350-bcb7-dbe7da97fe00\scenar
   Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\198759
57-45e3-4350-bcb7-dbe7da97fe00\scenar
```



```
DATE: 02/11/2020                               TIME: 01:52:40

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
------------------------
  *********************************************
  ** SIMULATION : Run 10                      **
  *********************************************

--------------------
| CHICAGO STORM      |     IDF curve parameters: A=1676.200
| Ptotal= 78.08 mm |                              B=   8.300
--------------------                              C=   0.858
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  = 24.00 hrs
                          Storm time step    = 10.00 min
                          Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.49	6.17	1.87	12.17	1.62	18.17	0.72
0.33	0.50	6.33	2.06	12.33	1.57	18.33	0.70
0.50	0.51	6.50	2.29	12.50	1.51	18.50	0.69
0.67	0.52	6.67	2.58	12.67	1.46	18.67	0.69
0.83	0.53	6.83	2.95	12.83	1.41	18.83	0.68
1.00	0.54	7.00	3.47	13.00	1.37	19.00	0.67
1.17	0.55	7.17	4.22	13.17	1.33	19.17	0.66
1.33	0.56	7.33	5.41	13.33	1.29	19.33	0.65
1.50	0.58	7.50	7.56	13.50	1.25	19.50	0.64
1.67	0.59	7.67	12.52	13.67	1.22	19.67	0.63
1.83	0.60	7.83	34.10	13.83	1.19	19.83	0.62
2.00	0.62	8.00	138.40	14.00	1.16	20.00	0.62
2.17	0.64	8.17	45.75	14.17	1.13	20.17	0.61
2.33	0.65	8.33	22.49	14.33	1.10	20.33	0.60
2.50	0.67	8.50	14.49	14.50	1.07	20.50	0.59
2.67	0.69	8.67	10.58	14.67	1.05	20.67	0.59
2.83	0.71	8.83	8.31	14.83	1.03	20.83	0.58
3.00	0.73	9.00	6.83	15.00	1.00	21.00	0.57
3.17	0.75	9.17	5.80	15.17	0.98	21.17	0.57
3.33	0.78	9.33	5.04	15.33	0.96	21.33	0.56
3.50	0.80	9.50	4.46	15.50	0.94	21.50	0.56
3.67	0.83	9.67	4.00	15.67	0.92	21.67	0.55
3.83	0.86	9.83	3.63	15.83	0.91	21.83	0.54
4.00	0.90	10.00	3.32	16.00	0.89	22.00	0.54
4.17	0.93	10.17	3.07	16.17	0.87	22.17	0.53
4.33	0.97	10.33	2.85	16.33	0.86	22.33	0.53
4.50	1.01	10.50	2.66	16.50	0.84	22.50	0.52
4.67	1.06	10.67	2.50	16.67	0.83	22.67	0.52
4.83	1.11	10.83	2.35	16.83	0.81	22.83	0.51
5.00	1.17	11.00	2.23	17.00	0.80	23.00	0.51
5.17	1.23	11.17	2.11	17.17	0.79	23.17	0.50
5.33	1.31	11.33	2.01	17.33	0.77	23.33	0.50
5.50	1.39	11.50	1.92	17.50	0.76	23.50	0.49
5.67	1.48	11.67	1.84	17.67	0.75	23.67	0.49
5.83	1.59	11.83	1.76	17.83	0.74	23.83	0.48
6.00	1.72	12.00	1.69	18.00	0.73	24.00	0.48

```
-----------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.49	6.083	1.87	12.083	1.62	18.08	0.72
0.167	0.49	6.167	1.87	12.167	1.62	18.17	0.72
0.250	0.50	6.250	2.06	12.250	1.57	18.25	0.70
0.333	0.50	6.333	2.06	12.333	1.57	18.33	0.70
0.417	0.51	6.417	2.29	12.417	1.51	18.42	0.69
0.500	0.51	6.500	2.29	12.500	1.51	18.50	0.69
0.583	0.52	6.583	2.58	12.583	1.46	18.58	0.69
0.667	0.52	6.667	2.58	12.667	1.46	18.67	0.69
0.750	0.53	6.750	2.95	12.750	1.41	18.75	0.68
0.833	0.53	6.833	2.95	12.833	1.41	18.83	0.68
0.917	0.54	6.917	3.47	12.917	1.37	18.92	0.67
1.000	0.54	7.000	3.47	13.000	1.37	19.00	0.67
1.083	0.55	7.083	4.22	13.083	1.33	19.08	0.66
1.167	0.55	7.167	4.22	13.167	1.33	19.17	0.66
1.250	0.56	7.250	5.41	13.250	1.29	19.25	0.65
1.333	0.56	7.333	5.41	13.333	1.29	19.33	0.65
1.417	0.58	7.417	7.56	13.417	1.25	19.42	0.64
1.500	0.58	7.500	7.56	13.500	1.25	19.50	0.64
1.583	0.59	7.583	12.52	13.583	1.22	19.58	0.63
1.667	0.59	7.667	12.52	13.667	1.22	19.67	0.63
1.750	0.60	7.750	34.10	13.750	1.19	19.75	0.62
1.833	0.60	7.833	34.10	13.833	1.19	19.83	0.62
1.917	0.62	7.917	138.40	13.917	1.16	19.92	0.62
2.000	0.62	8.000	138.40	14.000	1.16	20.00	0.62
2.083	0.64	8.083	45.75	14.083	1.13	20.08	0.61
2.167	0.64	8.167	45.75	14.167	1.13	20.17	0.61
2.250	0.65	8.250	22.49	14.250	1.10	20.25	0.60
2.333	0.65	8.333	22.49	14.333	1.10	20.33	0.60
2.417	0.67	8.417	14.49	14.417	1.07	20.42	0.59
2.500	0.67	8.500	14.49	14.500	1.07	20.50	0.59
2.583	0.69	8.583	10.58	14.583	1.05	20.58	0.59
2.667	0.69	8.667	10.58	14.667	1.05	20.67	0.59
2.750	0.71	8.750	8.31	14.750	1.03	20.75	0.58
2.833	0.71	8.833	8.31	14.833	1.03	20.83	0.58
2.917	0.73	8.917	6.83	14.917	1.00	20.92	0.57
3.000	0.73	9.000	6.83	15.000	1.00	21.00	0.57
3.083	0.75	9.083	5.80	15.083	0.98	21.08	0.57
3.167	0.75	9.167	5.80	15.167	0.98	21.17	0.57
3.250	0.78	9.250	5.04	15.250	0.96	21.25	0.56
3.333	0.78	9.333	5.04	15.333	0.96	21.33	0.56
3.417	0.80	9.417	4.46	15.417	0.94	21.42	0.56
3.500	0.80	9.500	4.46	15.500	0.94	21.50	0.56
3.583	0.83	9.583	4.00	15.583	0.92	21.58	0.55
3.667	0.83	9.667	4.00	15.667	0.92	21.67	0.55
3.750	0.86	9.750	3.63	15.750	0.91	21.75	0.54
3.833	0.86	9.833	3.63	15.833	0.91	21.83	0.54
3.917	0.90	9.917	3.32	15.917	0.89	21.92	0.54
4.000	0.90	10.000	3.32	16.000	0.89	22.00	0.54

4.083	0.93	10.083	3.07	16.083	0.87	22.08	0.53
4.167	0.93	10.167	3.07	16.167	0.87	22.17	0.53
4.250	0.97	10.250	2.85	16.250	0.86	22.25	0.53
4.333	0.97	10.333	2.85	16.333	0.86	22.33	0.53
4.417	1.01	10.417	2.66	16.417	0.84	22.42	0.52
4.500	1.01	10.500	2.66	16.500	0.84	22.50	0.52
4.583	1.06	10.583	2.50	16.583	0.83	22.58	0.52
4.667	1.06	10.667	2.50	16.667	0.83	22.67	0.52
4.750	1.11	10.750	2.35	16.750	0.81	22.75	0.51
4.833	1.11	10.833	2.35	16.833	0.81	22.83	0.51
4.917	1.17	10.917	2.23	16.917	0.80	22.92	0.51
5.000	1.17	11.000	2.23	17.000	0.80	23.00	0.51
5.083	1.23	11.083	2.11	17.083	0.79	23.08	0.50
5.167	1.23	11.167	2.11	17.167	0.79	23.17	0.50
5.250	1.31	11.250	2.01	17.250	0.77	23.25	0.50
5.333	1.31	11.333	2.01	17.333	0.77	23.33	0.50
5.417	1.39	11.417	1.92	17.417	0.76	23.42	0.49
5.500	1.39	11.500	1.92	17.500	0.76	23.50	0.49
5.583	1.48	11.583	1.84	17.583	0.75	23.58	0.49
5.667	1.48	11.667	1.84	17.667	0.75	23.67	0.49
5.750	1.59	11.750	1.76	17.750	0.74	23.75	0.48
5.833	1.59	11.833	1.76	17.833	0.74	23.83	0.48
5.917	1.72	11.917	1.69	17.917	0.73	23.92	0.48
6.000	1.72	12.000	1.69	18.000	0.73	24.00	0.48

```
     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.057 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  29.048
     TOTAL RAINFALL   (mm)=  78.076
     RUNOFF COEFFICIENT   =   0.372

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

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.31          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      45.53         40.00
     Mannings n          =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.40 (ii)     2.39 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.30
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.12          0.00          0.119 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85          76.64
     TOTAL RAINFALL   (mm)=      78.08         78.08          78.08
     RUNOFF COEFFICIENT   =       0.99          0.43           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```



```
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      26.96         40.00
     Mannings n          =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.02 (ii)     2.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.31
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04          0.00          0.042 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85          76.64
     TOTAL RAINFALL   (mm)=      78.08         78.08          78.08
     RUNOFF COEFFICIENT   =       0.99          0.43           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2001)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1101):    0.31   0.119     8.00    76.64
       + ID2= 2 (  1102):    0.11   0.042     8.00    76.64
         ==================================================
         ID = 3 (  2001):    0.42   0.160     8.00    76.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97          0.14
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.18         40.00
     Mannings n          =       0.013         0.250
```



```
     Max.Eff.Inten.(mm/hr)=     138.40         54.68
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       2.05 (ii)     4.93 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.31          0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.37          0.02          0.392 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85          71.54
     TOTAL RAINFALL   (mm)=      78.08         78.08          78.08
     RUNOFF COEFFICIENT   =       0.99          0.43           0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  2002)|
|   1 + 2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1103):    1.11   0.392     8.00    71.54
       + ID2= 2 (  2001):    0.42   0.160     8.00    76.64
         ==================================================
         ID = 3 (  2002):    1.53   0.552     8.00    72.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36          0.05
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      52.54         40.00
     Mannings n          =       0.013         0.250

     Max.Eff.Inten.(mm/hr)=     138.40         54.68
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.52 (ii)     4.36 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14          0.01          0.147 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=      77.08         33.85          71.71
     TOTAL RAINFALL   (mm)=      78.08         78.08          78.08
     RUNOFF COEFFICIENT   =       0.99          0.43           0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
```

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

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

--------------------
| ADD HYD  (  2003)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1104):     0.41   0.147     8.00    71.71
     + ID2= 2 (  2002):     1.53   0.552     8.00    72.94
       ===================================================
       ID = 3 (  2003):     1.95   0.699     8.00    72.68

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0801     0.0575
                         0.0012     0.0001   |   0.0965     0.0712
                         0.0013     0.0085   |   0.1106     0.0816
                         0.0238     0.0256   |   0.1230     0.0900
                         0.0593     0.0421   |   0.0000     0.0000

                               AREA     QPEAK     TPEAK        R.V.
                               (ha)     (cms)     (hrs)        (mm)
  INFLOW : ID= 2 (  2003)      1.948      0.699      8.00       72.68
  OUTFLOW: ID= 1 (  3001)      1.948      0.100      8.33       72.67

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.23
                 TIME SHIFT OF PEAK FLOW         (min)= 20.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0737

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=    4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.15

   Unit Hyd Qpeak  (cms)=   1.271

   PEAK FLOW       (cms)=   0.516 (i)
   TIME TO PEAK    (hrs)=   8.083
   RUNOFF VOLUME    (mm)=  34.636
   TOTAL RAINFALL   (mm)=  78.076
   RUNOFF COEFFICIENT   =   0.444

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.5640     0.0375
```



```
                               AREA     QPEAK     TPEAK        R.V.
                               (ha)     (cms)     (hrs)        (mm)
  INFLOW : ID= 2 (  1200)      4.991      0.516      8.08       34.64
  OUTFLOW: ID= 1 (  3002)      4.991      0.388      8.25       34.63

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.15
                 TIME SHIFT OF PEAK FLOW         (min)= 10.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0258

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--------------------
| ADD HYD  (  2004)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  3001):     1.95   0.100     8.33    72.67
     + ID2= 2 (  3002):     4.99   0.388     8.25    34.63
       ===================================================
       ID = 3 (  2004):     6.94   0.486     8.25    45.31

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1300):     0.41   0.057     8.00    29.05
     + ID2= 2 (  2004):     6.94   0.486     8.25    45.31
       ===================================================
       ID = 3 (  2005):     7.35   0.502     8.25    44.40

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=    1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

   Unit Hyd Qpeak  (cms)=   0.144

   PEAK FLOW       (cms)=   0.082 (i)
   TIME TO PEAK    (hrs)=   8.250
   RUNOFF VOLUME    (mm)=  36.881
   TOTAL RAINFALL   (mm)=  78.076
   RUNOFF COEFFICIENT   =   0.472

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

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--------------------
| ADD HYD  (  2006)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  1400):     1.05   0.082     8.25    36.88
     + ID2= 2 (  2005):     7.35   0.502     8.25    44.40
       ===================================================
       ID = 3 (  2006):     8.40   0.584     8.25    43.46
```



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

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

     V    V   I   SSSSS  U   U    A    L
     V    V   I   SS     U   U   A A   L
      V  V    I     SS   U   U  AAAAA  L
      V  V    I      SS  U   U  A   A  L
       VV     I   SSSSS  UUUUU  A   A  LLLLL

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

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\8c5f56
d9-5ce3-4551-b682-1afb73caecdd\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\8c5f56
d9-5ce3-4551-b682-1afb73caecdd\scenar

DATE: 02/11/2020                          TIME: 01:52:44

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
-----------------------
  ***********************************************
  ** SIMULATION : Run 11                       **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1973.100
| Ptotal= 85.42 mm |                          B=   9.000
--------------------                          C=   0.868
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                  TIME     RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME     RAIN
                   hrs    mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                  0.17     0.50 |  6.17    1.98 | 12.17    1.71 | 18.17    0.74
                  0.33     0.51 |  6.33    2.18 | 12.33    1.64 | 18.33    0.73
```



```
                   0.50     0.52 |  6.50    2.43 | 12.50    1.58 | 18.50    0.72
                   0.67     0.53 |  6.67    2.74 | 12.67    1.53 | 18.67    0.71
                   0.83     0.54 |  6.83    3.16 | 12.83    1.48 | 18.83    0.70
                   1.00     0.55 |  7.00    3.73 | 13.00    1.43 | 19.00    0.69
                   1.17     0.57 |  7.17    4.57 | 13.17    1.39 | 19.17    0.68
                   1.33     0.58 |  7.33    5.90 | 13.33    1.35 | 19.33    0.67
                   1.50     0.59 |  7.50    8.33 | 13.50    1.31 | 19.50    0.66
                   1.67     0.61 |  7.67   13.99 | 13.67    1.27 | 19.67    0.65
                   1.83     0.62 |  7.83   38.66 | 13.83    1.24 | 19.83    0.64
                   2.00     0.64 |  8.00  153.18 | 14.00    1.20 | 20.00    0.63
                   2.17     0.65 |  8.17   51.95 | 14.17    1.17 | 20.17    0.63
                   2.33     0.67 |  8.33   25.44 | 14.33    1.14 | 20.33    0.62
                   2.50     0.69 |  8.50   16.25 | 14.50    1.12 | 20.50    0.61
                   2.67     0.71 |  8.67   11.77 | 14.67    1.09 | 20.67    0.60
                   2.83     0.73 |  8.83    9.18 | 14.83    1.07 | 20.83    0.60
                   3.00     0.75 |  9.00    7.50 | 15.00    1.04 | 21.00    0.59
                   3.17     0.78 |  9.17    6.33 | 15.17    1.02 | 21.17    0.58
                   3.33     0.80 |  9.33    5.48 | 15.33    1.00 | 21.33    0.58
                   3.50     0.83 |  9.50    4.83 | 15.50    0.98 | 21.50    0.57
                   3.67     0.86 |  9.67    4.32 | 15.67    0.96 | 21.67    0.56
                   3.83     0.89 |  9.83    3.91 | 15.83    0.94 | 21.83    0.56
                   4.00     0.93 | 10.00    3.57 | 16.00    0.92 | 22.00    0.55
                   4.17     0.97 | 10.17    3.28 | 16.17    0.90 | 22.17    0.55
                   4.33     1.01 | 10.33    3.04 | 16.33    0.89 | 22.33    0.54
                   4.50     1.05 | 10.50    2.84 | 16.50    0.87 | 22.50    0.53
                   4.67     1.10 | 10.67    2.66 | 16.67    0.85 | 22.67    0.53
                   4.83     1.16 | 10.83    2.50 | 16.83    0.84 | 22.83    0.52
                   5.00     1.22 | 11.00    2.36 | 17.00    0.82 | 23.00    0.52
                   5.17     1.29 | 11.17    2.24 | 17.17    0.81 | 23.17    0.51
                   5.33     1.36 | 11.33    2.12 | 17.33    0.80 | 23.33    0.51
                   5.50     1.45 | 11.50    2.02 | 17.50    0.78 | 23.50    0.50
                   5.67     1.55 | 11.67    1.93 | 17.67    0.77 | 23.67    0.50
                   5.83     1.67 | 11.83    1.85 | 17.83    0.76 | 23.83    0.49
                   6.00     1.81 | 12.00    1.78 | 18.00    0.75 | 24.00    0.49

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=    0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.06

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

                          ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    0.50 | 6.083    1.98 |12.083    1.71 | 18.08    0.74
                0.167    0.50 | 6.167    1.98 |12.167    1.71 | 18.17    0.74
                0.250    0.51 | 6.250    2.18 |12.250    1.64 | 18.25    0.73
                0.333    0.51 | 6.333    2.18 |12.333    1.64 | 18.33    0.73
                0.417    0.52 | 6.417    2.43 |12.417    1.58 | 18.42    0.72
                0.500    0.52 | 6.500    2.43 |12.500    1.58 | 18.50    0.72
                0.583    0.53 | 6.583    2.74 |12.583    1.53 | 18.58    0.71
                0.667    0.53 | 6.667    2.74 |12.667    1.53 | 18.67    0.71
                0.750    0.54 | 6.750    3.16 |12.750    1.48 | 18.75    0.70
                0.833    0.54 | 6.833    3.16 |12.833    1.48 | 18.83    0.70
                0.917    0.55 | 6.917    3.73 |12.917    1.43 | 18.92    0.69
                1.000    0.55 | 7.000    3.73 |13.000    1.43 | 19.00    0.69
                1.083    0.57 | 7.083    4.57 |13.083    1.39 | 19.08    0.68
                1.167    0.57 | 7.167    4.57 |13.167    1.39 | 19.17    0.68
```

```
          1.250    0.58 | 7.250    5.90 |13.250    1.35 | 19.25    0.67
          1.333    0.58 | 7.333    5.90 |13.333    1.35 | 19.33    0.67
          1.417    0.59 | 7.417    8.33 |13.417    1.31 | 19.42    0.66
          1.500    0.59 | 7.500    8.33 |13.500    1.31 | 19.50    0.66
          1.583    0.61 | 7.583   13.99 |13.583    1.27 | 19.58    0.65
          1.667    0.61 | 7.667   14.00 |13.667    1.27 | 19.67    0.65
          1.750    0.62 | 7.750   38.66 |13.750    1.24 | 19.75    0.64
          1.833    0.62 | 7.833   38.67 |13.833    1.24 | 19.83    0.64
          1.917    0.64 | 7.917  153.18 |13.917    1.20 | 19.92    0.63
          2.000    0.64 | 8.000  153.17 |14.000    1.20 | 20.00    0.63
          2.083    0.65 | 8.083   51.95 |14.083    1.17 | 20.08    0.63
          2.167    0.65 | 8.167   51.94 |14.167    1.17 | 20.17    0.63
          2.250    0.67 | 8.250   25.44 |14.250    1.14 | 20.25    0.62
          2.333    0.67 | 8.333   25.44 |14.333    1.14 | 20.33    0.62
          2.417    0.69 | 8.417   16.25 |14.417    1.12 | 20.42    0.61
          2.500    0.69 | 8.500   16.25 |14.500    1.12 | 20.50    0.61
          2.583    0.71 | 8.583   11.77 |14.583    1.09 | 20.58    0.60
          2.667    0.71 | 8.667   11.77 |14.667    1.09 | 20.67    0.60
          2.750    0.73 | 8.750    9.18 |14.750    1.07 | 20.75    0.60
          2.833    0.73 | 8.833    9.18 |14.833    1.07 | 20.83    0.60
          2.917    0.75 | 8.917    7.50 |14.917    1.04 | 20.92    0.59
          3.000    0.75 | 9.000    7.50 |15.000    1.04 | 21.00    0.59
          3.083    0.78 | 9.083    6.33 |15.083    1.02 | 21.08    0.58
          3.167    0.78 | 9.167    6.33 |15.167    1.02 | 21.17    0.58
          3.250    0.80 | 9.250    5.48 |15.250    1.00 | 21.25    0.58
          3.333    0.80 | 9.333    5.48 |15.333    1.00 | 21.33    0.58
          3.417    0.83 | 9.417    4.83 |15.417    0.98 | 21.42    0.57
          3.500    0.83 | 9.500    4.83 |15.500    0.98 | 21.50    0.57
          3.583    0.86 | 9.583    4.32 |15.583    0.96 | 21.58    0.56
          3.667    0.86 | 9.667    4.32 |15.667    0.96 | 21.67    0.56
          3.750    0.89 | 9.750    3.91 |15.750    0.94 | 21.75    0.56
          3.833    0.89 | 9.833    3.91 |15.833    0.94 | 21.83    0.56
          3.917    0.93 | 9.917    3.57 |15.917    0.92 | 21.92    0.55
          4.000    0.93 |10.000    3.57 |16.000    0.92 | 22.00    0.55
          4.083    0.97 |10.083    3.28 |16.083    0.90 | 22.08    0.55
          4.167    0.97 |10.167    3.28 |16.167    0.90 | 22.17    0.55
          4.250    1.01 |10.250    3.04 |16.250    0.89 | 22.25    0.54
          4.333    1.01 |10.333    3.04 |16.333    0.89 | 22.33    0.54
          4.417    1.05 |10.417    2.84 |16.417    0.87 | 22.42    0.53
          4.500    1.05 |10.500    2.84 |16.500    0.87 | 22.50    0.53
          4.583    1.10 |10.583    2.66 |16.583    0.85 | 22.58    0.53
          4.667    1.10 |10.667    2.66 |16.667    0.85 | 22.67    0.53
          4.750    1.16 |10.750    2.50 |16.750    0.84 | 22.75    0.52
          4.833    1.16 |10.833    2.50 |16.833    0.84 | 22.83    0.52
          4.917    1.22 |10.917    2.36 |16.917    0.82 | 22.92    0.52
          5.000    1.22 |11.000    2.36 |17.000    0.82 | 23.00    0.52
          5.083    1.29 |11.083    2.24 |17.083    0.81 | 23.08    0.51
          5.167    1.29 |11.167    2.24 |17.167    0.81 | 23.17    0.51
          5.250    1.36 |11.250    2.12 |17.250    0.80 | 23.25    0.51
          5.333    1.36 |11.333    2.12 |17.333    0.80 | 23.33    0.51
          5.417    1.45 |11.417    2.02 |17.417    0.78 | 23.42    0.50
          5.500    1.45 |11.500    2.02 |17.500    0.78 | 23.50    0.50
          5.583    1.55 |11.583    1.93 |17.583    0.77 | 23.58    0.50
          5.667    1.55 |11.667    1.93 |17.667    0.77 | 23.67    0.50
          5.750    1.67 |11.750    1.85 |17.750    0.76 | 23.75    0.49
          5.833    1.67 |11.833    1.85 |17.833    0.76 | 23.83    0.49
          5.917    1.81 |11.917    1.78 |17.917    0.75 | 23.92    0.49
          6.000    1.81 |12.000    1.78 |18.000    0.75 | 24.00    0.49

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.068 (i)
     TIME TO PEAK    (hrs)=   8.000
```



```
     RUNOFF VOLUME    (mm)=  33.614
     TOTAL RAINFALL   (mm)=  85.418
     RUNOFF COEFFICIENT   =   0.394

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.31         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      45.53        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.34 (ii)    2.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.30
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.00         0.132 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17         83.96
     TOTAL RAINFALL   (mm)=      85.42        85.42         85.42
     RUNOFF COEFFICIENT   =       0.99         0.46          0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      26.96        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.98 (ii)    1.93 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.31
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00         0.046 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17         83.97
     TOTAL RAINFALL   (mm)=      85.42        85.42         85.42
     RUNOFF COEFFICIENT   =       0.99         0.46          0.98
```



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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2001)|
|   1 + 2 = 3      |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1101):       0.31   0.132     8.00    83.96
      + ID2= 2 ( 1102):       0.11   0.046     8.00    83.97
        ===================================================
        ID = 3 ( 2001):       0.42   0.178     8.00    83.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.97         0.14
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.18        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.97 (ii)    4.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.22
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.41         0.02         0.436 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17         78.63
     TOTAL RAINFALL   (mm)=      85.42        85.42         85.42
     RUNOFF COEFFICIENT   =       0.99         0.46          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2002)|
|   1 + 2 = 3      |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1103):       1.11   0.436     8.00    78.63
      + ID2= 2 ( 2001):       0.42   0.178     8.00    83.96
```



```
        ===================================================
        ID = 3 ( 2002):       1.53   0.614     8.00    80.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      52.54        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.18        65.01
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.46 (ii)    4.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.24
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.01         0.163 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.00          8.00
     RUNOFF VOLUME    (mm)=      84.42        39.17         78.81
     TOTAL RAINFALL   (mm)=      85.42        85.42         85.42
     RUNOFF COEFFICIENT   =       0.99         0.46          0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  ( 2003)|
|   1 + 2 = 3      |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 1104):       0.41   0.163     8.00    78.81
      + ID2= 2 ( 2002):       1.53   0.614     8.00    80.09
        ===================================================
        ID = 3 ( 2003):       1.95   0.777     8.00    79.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| RESERVOIR( 3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |       OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
--------------------        (cms)      (ha.m.)   |    (cms)      (ha.m.)
                           0.0000      0.0000    |   0.0801      0.0575
                           0.0012      0.0001    |   0.0965      0.0712
                           0.0013      0.0085    |   0.1106      0.0816
                           0.0238      0.0256    |   0.1230      0.0900
                           0.0593      0.0421    |   0.0000      0.0000
```

```
                              AREA      QPEAK      TPEAK        R.V.
                              (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)    1.948     0.777       8.00        79.82
   OUTFLOW: ID= 1 (  3001)    1.948     0.111       8.42        79.81

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.26
                 TIME SHIFT OF PEAK FLOW          (min)= 25.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0821

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=   4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW      (cms)=   0.614 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  40.029
     TOTAL RAINFALL   (mm)=  85.418
     RUNOFF COEFFICIENT   =   0.469

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5640     0.0375

                              AREA      QPEAK      TPEAK        R.V.
                              (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  1200)    4.991     0.614       8.08        40.03
   OUTFLOW: ID= 1 (  3002)    4.991     0.463       8.25        40.03

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.34
                 TIME SHIFT OF PEAK FLOW          (min)= 10.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0308

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2004)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK      R.V.
--------------------        (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  3001):    1.95   0.111     8.42     79.81
      + ID2= 2 (  3002):    4.99   0.463     8.25     40.03
        ===================================================
        ID = 3 (  2004):    6.94   0.572     8.25     51.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2005)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK      R.V.
--------------------        (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  1300):    0.41   0.068     8.00     33.61
```



```
      + ID2= 2 (  2004):    6.94   0.572     8.25     51.19
        ===================================================
        ID = 3 (  2005):    7.35   0.591     8.25     50.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW      (cms)=   0.098 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  42.508
     TOTAL RAINFALL   (mm)=  85.418
     RUNOFF COEFFICIENT   =   0.498

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

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2006)|
|   1 + 2 = 3      |        AREA    QPEAK    TPEAK      R.V.
--------------------        (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  1400):    1.05   0.098     8.25     42.51
      + ID2= 2 (  2005):    7.35   0.591     8.25     50.21
        ===================================================
        ID = 3 (  2006):    8.40   0.689     8.25     49.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

     V    V   I    SSSSS  U    U    A    L
     V    V   I    SS     U    U   A A   L
      V  V    I     SS    U    U  AAAAA  L
      V  V    I      SS   U    U  A   A  L
       VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\681ddb
8d-7b8a-475a-b923-cd51efa46f0d\scenar
```



```
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\642fa701-08f9-4281-a674-e9ad409f1aac\681ddb
8d-7b8a-475a-b923-cd51efa46f0d\scenar


DATE: 02/11/2020                              TIME: 01:52:43

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
------------------------
  **************************************************
  ** SIMULATION : Run 12                          **
  **************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=2193.100
| Ptotal= 92.89 mm |                           B=   9.040
--------------------                           C=   0.871
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.53	6.17	2.12	12.17	1.83	18.17	0.79
0.33	0.54	6.33	2.34	12.33	1.76	18.33	0.77
0.50	0.55	6.50	2.60	12.50	1.70	18.50	0.76
0.67	0.56	6.67	2.95	12.67	1.64	18.67	0.75
0.83	0.58	6.83	3.40	12.83	1.58	18.83	0.74
1.00	0.59	7.00	4.02	13.00	1.53	19.00	0.73
1.17	0.60	7.17	4.93	13.17	1.48	19.17	0.72
1.33	0.62	7.33	6.38	13.33	1.44	19.33	0.71
1.50	0.63	7.50	9.03	13.50	1.40	19.50	0.70
1.67	0.65	7.67	15.23	13.67	1.36	19.67	0.69
1.83	0.66	7.83	42.35	13.83	1.32	19.83	0.68
2.00	0.68	8.00	168.45	14.00	1.29	20.00	0.68
2.17	0.70	8.17	56.97	14.17	1.25	20.17	0.67
2.33	0.72	8.33	27.80	14.33	1.22	20.33	0.66
2.50	0.74	8.50	17.71	14.50	1.19	20.50	0.65
2.67	0.76	8.67	12.80	14.67	1.16	20.67	0.64
2.83	0.78	8.83	9.96	14.83	1.14	20.83	0.63
3.00	0.80	9.00	8.12	15.00	1.11	21.00	0.63
3.17	0.83	9.17	6.85	15.17	1.09	21.17	0.62
3.33	0.86	9.33	5.92	15.33	1.06	21.33	0.61
3.50	0.89	9.50	5.21	15.50	1.04	21.50	0.61
3.67	0.92	9.67	4.66	15.67	1.02	21.67	0.60
3.83	0.95	9.83	4.21	15.83	1.00	21.83	0.59
4.00	0.99	10.00	3.84	16.00	0.98	22.00	0.59
4.17	1.03	10.17	3.53	16.17	0.96	22.17	0.58
4.33	1.07	10.33	3.27	16.33	0.94	22.33	0.57
4.50	1.12	10.50	3.05	16.50	0.93	22.50	0.57
4.67	1.18	10.67	2.85	16.67	0.91	22.67	0.56
4.83	1.24	10.83	2.68	16.83	0.90	22.83	0.56
5.00	1.30	11.00	2.53	17.00	0.88	23.00	0.55
5.17	1.38	11.17	2.40	17.17	0.86	23.17	0.55

5.33	1.46	11.33	2.28	17.33	0.85	23.33	0.54
5.50	1.56	11.50	2.17	17.50	0.84	23.50	0.53
5.67	1.66	11.67	2.07	17.67	0.82	23.67	0.53
5.83	1.79	11.83	1.98	17.83	0.81	23.83	0.52
6.00	1.94	12.00	1.90	18.00	0.80	24.00	0.52

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1300)|   Area    (ha)=   0.41   Curve Number   (CN)= 75.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.06

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	6.083	2.12	12.083	1.83	18.08	0.79
0.167	0.53	6.167	2.12	12.167	1.83	18.17	0.79
0.250	0.54	6.250	2.34	12.250	1.76	18.25	0.77
0.333	0.54	6.333	2.34	12.333	1.76	18.33	0.77
0.417	0.55	6.417	2.60	12.417	1.70	18.42	0.76
0.500	0.55	6.500	2.60	12.500	1.70	18.50	0.76
0.583	0.56	6.583	2.95	12.583	1.64	18.58	0.75
0.667	0.56	6.667	2.95	12.667	1.64	18.67	0.75
0.750	0.58	6.750	3.40	12.750	1.58	18.75	0.74
0.833	0.58	6.833	3.40	12.833	1.58	18.83	0.74
0.917	0.59	6.917	4.02	12.917	1.53	18.92	0.73
1.000	0.59	7.000	4.02	13.000	1.53	19.00	0.73
1.083	0.60	7.083	4.93	13.083	1.48	19.08	0.72
1.167	0.60	7.167	4.93	13.167	1.48	19.17	0.72
1.250	0.62	7.250	6.38	13.250	1.44	19.25	0.71
1.333	0.62	7.333	6.38	13.333	1.44	19.33	0.71
1.417	0.63	7.417	9.03	13.417	1.40	19.42	0.70
1.500	0.63	7.500	9.03	13.500	1.40	19.50	0.70
1.583	0.65	7.583	15.23	13.583	1.36	19.58	0.69
1.667	0.65	7.667	15.23	13.667	1.36	19.67	0.69
1.750	0.66	7.750	42.35	13.750	1.32	19.75	0.68
1.833	0.66	7.833	42.36	13.833	1.32	19.83	0.68
1.917	0.68	7.917	168.45	13.917	1.29	19.92	0.68
2.000	0.68	8.000	168.44	14.000	1.29	20.00	0.68
2.083	0.70	8.083	56.97	14.083	1.25	20.08	0.67
2.167	0.70	8.167	56.97	14.167	1.25	20.17	0.67
2.250	0.72	8.250	27.80	14.250	1.22	20.25	0.66
2.333	0.72	8.333	27.80	14.333	1.22	20.33	0.66
2.417	0.74	8.417	17.71	14.417	1.19	20.42	0.65
2.500	0.74	8.500	17.71	14.500	1.19	20.50	0.65
2.583	0.76	8.583	12.80	14.583	1.16	20.58	0.64
2.667	0.76	8.667	12.80	14.667	1.16	20.67	0.64
2.750	0.78	8.750	9.96	14.750	1.14	20.75	0.63
2.833	0.78	8.833	9.96	14.833	1.14	20.83	0.63
2.917	0.80	8.917	8.12	14.917	1.11	20.92	0.63
3.000	0.80	9.000	8.12	15.000	1.11	21.00	0.63
3.083	0.83	9.083	6.85	15.083	1.09	21.08	0.62
3.167	0.83	9.167	6.85	15.167	1.09	21.17	0.62
3.250	0.86	9.250	5.92	15.250	1.06	21.25	0.61
3.333	0.86	9.333	5.92	15.333	1.06	21.33	0.61
3.417	0.89	9.417	5.21	15.417	1.04	21.42	0.61
3.500	0.89	9.500	5.21	15.500	1.04	21.50	0.61
3.583	0.92	9.583	4.66	15.583	1.02	21.58	0.60

```
          3.667    0.92 | 9.667    4.66 |15.667    1.02 | 21.67    0.60
          3.750    0.95 | 9.750    4.21 |15.750    1.00 | 21.75    0.59
          3.833    0.95 | 9.833    4.21 |15.833    1.00 | 21.83    0.59
          3.917    0.99 | 9.917    3.84 |15.917    0.98 | 21.92    0.59
          4.000    0.99 |10.000    3.84 |16.000    0.98 | 22.00    0.59
          4.083    1.03 |10.083    3.53 |16.083    0.96 | 22.08    0.58
          4.167    1.03 |10.167    3.53 |16.167    0.96 | 22.17    0.58
          4.250    1.07 |10.250    3.27 |16.250    0.94 | 22.25    0.57
          4.333    1.07 |10.333    3.27 |16.333    0.94 | 22.33    0.57
          4.417    1.12 |10.417    3.05 |16.417    0.93 | 22.42    0.57
          4.500    1.12 |10.500    3.05 |16.500    0.93 | 22.50    0.57
          4.583    1.18 |10.583    2.85 |16.583    0.91 | 22.58    0.56
          4.667    1.18 |10.667    2.85 |16.667    0.91 | 22.67    0.56
          4.750    1.24 |10.750    2.68 |16.750    0.90 | 22.75    0.56
          4.833    1.24 |10.833    2.68 |16.833    0.90 | 22.83    0.56
          4.917    1.30 |10.917    2.53 |16.917    0.88 | 22.92    0.55
          5.000    1.30 |11.000    2.53 |17.000    0.88 | 23.00    0.55
          5.083    1.38 |11.083    2.40 |17.083    0.86 | 23.08    0.55
          5.167    1.38 |11.167    2.40 |17.167    0.86 | 23.17    0.55
          5.250    1.46 |11.250    2.28 |17.250    0.85 | 23.25    0.54
          5.333    1.46 |11.333    2.28 |17.333    0.85 | 23.33    0.54
          5.417    1.56 |11.417    2.17 |17.417    0.84 | 23.42    0.53
          5.500    1.56 |11.500    2.17 |17.500    0.84 | 23.50    0.53
          5.583    1.66 |11.583    2.07 |17.583    0.82 | 23.58    0.53
          5.667    1.66 |11.667    2.07 |17.667    0.82 | 23.67    0.53
          5.750    1.79 |11.750    1.98 |17.750    0.81 | 23.75    0.52
          5.833    1.79 |11.833    1.98 |17.833    0.81 | 23.83    0.52
          5.917    1.94 |11.917    1.90 |17.917    0.80 | 23.92    0.52
          6.000    1.94 |12.000    1.90 |18.000    0.80 | 24.00    0.52

     Unit Hyd Qpeak  (cms)=   0.261

     PEAK FLOW       (cms)=   0.079 (i)
     TIME TO PEAK    (hrs)=   8.000
     RUNOFF VOLUME    (mm)=  38.412
     TOTAL RAINFALL   (mm)=  92.889
     RUNOFF COEFFICIENT   =   0.414

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1101)|   Area    (ha)=   0.31
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.31          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       45.53         40.00
     Mannings n          =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=      168.45         76.14
                over (min)        5.00          5.00
     Storage Coeff.  (min)=        1.29 (ii)     2.21 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.33          0.30
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.14          0.00          0.145 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=       91.89         44.77          91.42
     TOTAL RAINFALL   (mm)=       92.89         92.89          92.89
```



```
     RUNOFF COEFFICIENT   =        0.99          0.48           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1102)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.11          0.00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       26.96         40.00
     Mannings n          =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=      168.45         76.14
                over (min)        5.00          5.00
     Storage Coeff.  (min)=        0.94 (ii)     1.86 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.34          0.32
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.05          0.00          0.051 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=       91.89         44.77          91.42
     TOTAL RAINFALL   (mm)=       92.89         92.89          92.89
     RUNOFF COEFFICIENT   =        0.99          0.48           0.98

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1101):     0.31   0.145     8.00    91.42
       + ID2= 2 (  1102):     0.11   0.051     8.00    91.42
         ===============================================
         ID = 3 (  2001):     0.42   0.195     8.00    91.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1103)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.20   Dir. Conn.(%)=  87.20
--------------------
                             IMPERVIOUS    PERVIOUS (i)
```



```
     Surface Area     (ha)=        0.97          0.14
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       86.18         40.00
     Mannings n          =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=      168.45         76.14
                over (min)        5.00          5.00
     Storage Coeff.  (min)=        1.90 (ii)     4.56 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.32          0.23
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.45          0.03          0.482 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=       91.89         44.77          85.86
     TOTAL RAINFALL   (mm)=       92.89         92.89          92.89
     RUNOFF COEFFICIENT   =        0.99          0.48           0.92

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1103):     1.11   0.482     8.00    85.86
       + ID2= 2 (  2001):     0.42   0.195     8.00    91.42
         ===============================================
         ID = 3 (  2002):     1.53   0.677     8.00    87.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  1104)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  87.60   Dir. Conn.(%)=  87.60
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.36          0.05
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          2.00
     Length            (m)=       52.54         40.00
     Mannings n          =        0.013         0.250

     Max.Eff.Inten.(mm/hr)=      168.45         76.14
                over (min)        5.00          5.00
     Storage Coeff.  (min)=        1.41 (ii)     4.03 (ii)
     Unit Hyd. Tpeak (min)=        5.00          5.00
     Unit Hyd. peak  (cms)=        0.33          0.24
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.17          0.01          0.180 (iii)
     TIME TO PEAK    (hrs)=        8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=       91.89         44.77          86.04
     TOTAL RAINFALL   (mm)=       92.89         92.89          92.89
     RUNOFF COEFFICIENT   =        0.99          0.48           0.93
```



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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  2003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  1104):     0.41   0.180     8.00    86.04
       + ID2= 2 (  2002):     1.53   0.677     8.00    87.38
         ===============================================
         ID = 3 (  2003):     1.95   0.858     8.00    87.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3001)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.0801     0.0575
                          0.0012     0.0001    |  0.0965     0.0712
                          0.0013     0.0085    |  0.1106     0.0816
                          0.0238     0.0256    |  0.1230     0.0900
                          0.0593     0.0421    |  0.0000     0.0000

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  2003)      1.948     0.858       8.00       87.10
   OUTFLOW: ID= 1 (  3001)      1.948     0.122       8.33       87.09

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.25
                   TIME SHIFT OF PEAK FLOW        (min)= 20.00
                   MAXIMUM  STORAGE   USED      (ha.m.)=  0.0898

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1200)|   Area    (ha)=    4.99   Curve Number   (CN)= 76.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.15

     Unit Hyd Qpeak  (cms)=   1.271

     PEAK FLOW       (cms)=   0.717 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  45.687
     TOTAL RAINFALL   (mm)=  92.889
     RUNOFF COEFFICIENT   =   0.492

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  3002)|
```

```
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5640      0.0375

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1200)      4.991      0.717      8.08      45.69
   OUTFLOW: ID= 1 (  3002)      4.991      0.539      8.25      45.68

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.20
                   TIME SHIFT OF PEAK FLOW        (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0358

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--------------------
| ADD HYD  (  2004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  3001):     1.95   0.122     8.33    87.09
      + ID2= 2 (  3002):     4.99   0.539     8.25    45.68
        ====================================================
        ID = 3 (  2004):     6.94   0.660     8.25    57.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  2005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1300):     0.41   0.079     8.00    38.41
      + ID2= 2 (  2004):     6.94   0.660     8.25    57.31
        ====================================================
        ID = 3 (  2005):     7.35   0.681     8.25    56.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  1400)|   Area    (ha)=   1.05   Curve Number   (CN)= 78.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   0.144

     PEAK FLOW       (cms)=   0.114 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  48.395
     TOTAL RAINFALL   (mm)=  92.889
     RUNOFF COEFFICIENT   =   0.521

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

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--------------------
| ADD HYD  (  2006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```



```
        ID1= 1 (  1400):     1.05   0.114     8.25    48.40
      + ID2= 2 (  2005):     7.35   0.681     8.25    56.25
        ====================================================
        ID = 3 (  2006):     8.40   0.795     8.25    55.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
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APPENDIX

C

HY-8 CULVERT ANALYSIS REPORTS

HY-8 Culvert Analysis Report

Site Data - Existing Twin Culvert

Site Data Option:	Culvert Invert Data
Inlet Station:	0.00 m
Inlet Elevation:	211.24 m
Outlet Station:	22.00 m
Outlet Elevation:	211.19 m
Number of Barrels:	2

Culvert Data Summary - Existing Twin Culvert

Barrel Shape:	Circular
Barrel Diameter:	900.00 mm
Barrel Material:	PVC
Embedment:	0.00 mm
Barrel Manning's n:	0.0110
Culvert Type:	Straight
Inlet Configuration:	Square Edge with Headwall
Inlet Depression:	None

Tailwater Channel Data - Existing Twin Culvert

Tailwater Channel Option:	Triangular Channel
Side Slope:	3.00 :1
Channel Slope:	0.0068
Channel Manning's n:	0.0350
Channel Invert Elevation:	211.19 m

Table 1 - Summary of Culvert Flows at Crossing: Existing Twin Culvert

Discharge Names	Total Discharge (m^3/s)	Culvert Discharge (m^3/s)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
2-yr	0.25	0.25	211.57	0.274	0.332	3-M1t	0.212	0.201	0.344	0.344	0.559	0.704
5-yr	0.39	0.39	211.65	0.347	0.412	3-M1t	0.266	0.253	0.407	0.407	0.699	0.786
10-yr	0.49	0.49	211.70	0.391	0.460	3-M1t	0.300	0.284	0.443	0.443	0.786	0.833
25-yr	0.62	0.62	211.76	0.444	0.517	3-M1t	0.340	0.321	0.484	0.484	0.890	0.883
50-yr	0.72	0.72	211.80	0.487	0.557	3-M1t	0.369	0.347	0.512	0.512	0.964	0.917
100-yr	0.83	0.83	211.84	0.533	0.599	3-M1t	0.399	0.374	0.540	0.540	1.042	0.950

****

Straight Culvert

Inlet Elevation (invert): 211.24 m, Outlet Elevation (invert): 211.19 m

Culvert Length: 22.00 m, Culvert Slope: 0.0023

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Table 2 - Downstream Channel Rating Curve (Crossing: Existing Twin Culvert)

Flow (m^3/s)	Water Surface Elevation (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.25	211.53	0.34	0.70	22.94	0.54
0.39	211.60	0.41	0.79	27.10	0.56
0.49	211.63	0.44	0.83	29.52	0.56
0.62	211.67	0.48	0.88	32.24	0.57
0.72	211.70	0.51	0.92	34.10	0.58
0.83	211.73	0.54	0.95	35.97	0.58

HY-8 Culvert Analysis Report

Site Data - Entrance #1 (S)

Site Data Option:	Culvert Invert Data
Inlet Station:	0.00 m
Inlet Elevation:	211.90 m
Outlet Station:	16.00 m
Outlet Elevation:	211.74 m
Number of Barrels:	1

Culvert Data Summary - Entrance #1 (S)

Barrel Shape:	Circular
Barrel Diameter:	450.00 mm
Barrel Material:	Concrete
Embedment:	0.00 mm
Barrel Manning's n:	0.0120
Culvert Type:	Straight
Inlet Configuration:	Square Edge with Headwall
Inlet Depression:	None

Tailwater Channel Data - Entrance #1 (S)

Tailwater Channel Option:	Triangular Channel
Side Slope:	3.00 :1
Channel Slope:	0.0100
Channel Manning's n:	0.0350
Channel Invert Elevation:	211.74 m

Table 1 - Summary of Culvert Flows at Crossing: Entrance #1 (S)

Discharge Names	Total Discharge (m^3/s)	Culvert Discharge (m^3/s)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
2-yr	0.03	0.03	212.06	0.160	0.0*	1-S2n	0.095	0.118	0.095	0.145	1.234	0.479
5-yr	0.05	0.05	212.11	0.210	0.027	1-S2n	0.122	0.153	0.122	0.175	1.431	0.544
10-yr	0.06	0.06	212.13	0.233	0.044	1-S2n	0.134	0.168	0.134	0.187	1.507	0.569
25-yr	0.08	0.08	212.18	0.279	0.079	1-S2n	0.156	0.195	0.157	0.209	1.615	0.612
50-yr	0.10	0.10	212.22	0.321	0.114	1-S2n	0.176	0.220	0.177	0.227	1.717	0.647
100-yr	0.11	0.11	212.24	0.340	0.132	1-S2n	0.185	0.231	0.187	0.235	1.757	0.662

****

Straight Culvert

Inlet Elevation (invert): 211.90 m, Outlet Elevation (invert): 211.74 m

Culvert Length: 16.00 m, Culvert Slope: 0.0100

****

Table 2 - Downstream Channel Rating Curve (Crossing: Entrance #1 (S))

Flow (m^3/s)	Water Surface Elevation (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.03	211.88	0.14	0.48	14.17	0.57
0.05	211.92	0.18	0.54	17.16	0.59
0.06	211.93	0.19	0.57	18.37	0.59
0.08	211.95	0.21	0.61	20.47	0.60
0.10	211.97	0.23	0.65	22.25	0.61
0.11	211.98	0.24	0.66	23.06	0.62

HY-8 Culvert Analysis Report

Site Data - Entrance #2 (N)

Site Data Option:	Culvert Invert Data
Inlet Station:	0.00 m
Inlet Elevation:	212.62 m
Outlet Station:	17.00 m
Outlet Elevation:	212.40 m
Number of Barrels:	1

Culvert Data Summary - Entrance #2 (N)

Barrel Shape:	Circular
Barrel Diameter:	450.00 mm
Barrel Material:	Concrete
Embedment:	0.00 mm
Barrel Manning's n:	0.0120
Culvert Type:	Straight
Inlet Configuration:	Square Edge with Headwall
Inlet Depression:	None

Tailwater Channel Data - Entrance #2 (N)

Tailwater Channel Option:	Triangular Channel
Side Slope:	3.00 :1
Channel Slope:	0.0130
Channel Manning's n:	0.0350
Channel Invert Elevation:	212.40 m

Table 1 - Summary of Culvert Flows at Crossing: Entrance #2 (N)

Discharge Names	Total Discharge (m^3/s)	Culvert Discharge (m^3/s)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
2-yr	0.03	0.03	212.78	0.160	0.0*	1-S2n	0.089	0.118	0.089	0.138	1.353	0.528
5-yr	0.05	0.05	212.83	0.209	0.0*	1-S2n	0.115	0.153	0.115	0.167	1.568	0.600
10-yr	0.06	0.06	212.85	0.232	0.0*	1-S2n	0.126	0.168	0.126	0.178	1.652	0.628
25-yr	0.08	0.08	212.90	0.279	0.009	1-S2n	0.146	0.195	0.146	0.199	1.793	0.675
50-yr	0.10	0.10	212.94	0.320	0.048	1-S2n	0.164	0.220	0.166	0.216	1.875	0.714
100-yr	0.11	0.11	212.96	0.339	0.069	1-S2n	0.173	0.231	0.175	0.224	1.922	0.731

****

Straight Culvert
Inlet Elevation (invert): 212.62 m, Outlet Elevation (invert): 212.40 m
Culvert Length: 17.00 m, Culvert Slope: 0.0129

****

Table 2 - Downstream Channel Rating Curve (Crossing: Entrance #2 (N))

Flow (m^3/s)	Water Surface Elevation (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.03	212.54	0.14	0.53	17.53	0.64
0.05	212.57	0.17	0.60	21.24	0.66
0.06	212.58	0.18	0.63	22.74	0.67
0.08	212.60	0.20	0.67	25.33	0.68
0.10	212.62	0.22	0.71	27.54	0.69
0.11	212.62	0.22	0.73	28.54	0.70

HY-8 Culvert Analysis Report

Site Data - N. Access Road

Site Data Option:	Culvert Invert Data
Inlet Station:	0.00 m
Inlet Elevation:	213.11 m
Outlet Station:	22.50 m
Outlet Elevation:	212.99 m
Number of Barrels:	1

Culvert Data Summary - N. Access Road

Barrel Shape:	Circular
Barrel Diameter:	525.00 mm
Barrel Material:	Concrete
Embedment:	0.00 mm
Barrel Manning's n:	0.0120
Culvert Type:	Straight
Inlet Configuration:	Square Edge with Headwall
Inlet Depression:	None

Tailwater Channel Data - N. Access Road

Tailwater Channel Option:	Triangular Channel
Side Slope:	4.00 :1
Channel Slope:	0.0050
Channel Manning's n:	0.0350
Channel Invert Elevation:	212.99 m

Table 1 - Summary of Culvert Flows at Crossing: N. Access Road

Discharge Names	Total Discharge (m^3/s)	Culvert Discharge (m^3/s)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
2-yr	0.20	0.20	213.56	0.454	0.287	1-S2n	0.289	0.301	0.289	0.299	1.638	0.558
5-yr	0.32	0.32	213.76	0.638	0.649	7-M2c	0.404	0.383	0.383	0.357	1.889	0.628
10-yr	0.39	0.39	213.88	0.772	0.753	7-M2c	0.525	0.422	0.422	0.384	2.093	0.660
25-yr	0.52	0.52	214.21	1.098	1.101	7-M2c	0.525	0.473	0.473	0.428	2.533	0.709
50-yr	0.61	0.61	214.49	1.384	1.384	7-M2c	0.525	0.494	0.494	0.455	2.888	0.738
100-yr	0.72	0.72	214.92	1.808	1.778	7-M2c	0.525	0.510	0.510	0.484	3.353	0.769

****

Straight Culvert

Inlet Elevation (invert): 213.11 m, Outlet Elevation (invert): 212.99 m

Culvert Length: 22.50 m, Culvert Slope: 0.0053

****

Table 2 - Downstream Channel Rating Curve (Crossing: N. Access Road)

Flow (m^3/s)	Water Surface Elevation (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.20	213.29	0.30	0.56	14.67	0.46
0.32	213.35	0.36	0.63	17.50	0.47
0.39	213.37	0.38	0.66	18.84	0.48
0.52	213.42	0.43	0.71	20.99	0.49
0.61	213.44	0.45	0.74	22.29	0.49
0.72	213.47	0.48	0.77	23.72	0.50

APPENDIX

D

STORMCEPTOR EF SIZING REPORTS

Stormceptor® EF Sizing Report

ESTIMATED NET ANNNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

Province:	Ontario
City:	Midland
Nearest Rainfall Station:	ORILLIA TS
NCDC Rainfall Station Id:	5820
Years of Rainfall Data:	28

Site Name:	Catchment 1103

Drainage Area (ha):	1.114
Runoff Coefficient 'c':	0.81

Project Name:	16928 Hwy 12
Project Number:	18M-01620
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	(905) 630-0359
EOR Name:	Ellie Fazeli
EOR Company:	WSP Canada Group Ltd.
EOR Email/Phone:	

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0
Required Water Quality Runoff Volume Capture (%):	90.0
Require Hydrocarbon Spill Capture?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	50
EFO6	58
EFO8	62
EFO10	65
EFO12	66

Recommended Stormceptor EFO Model:	**EFO8**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**62**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

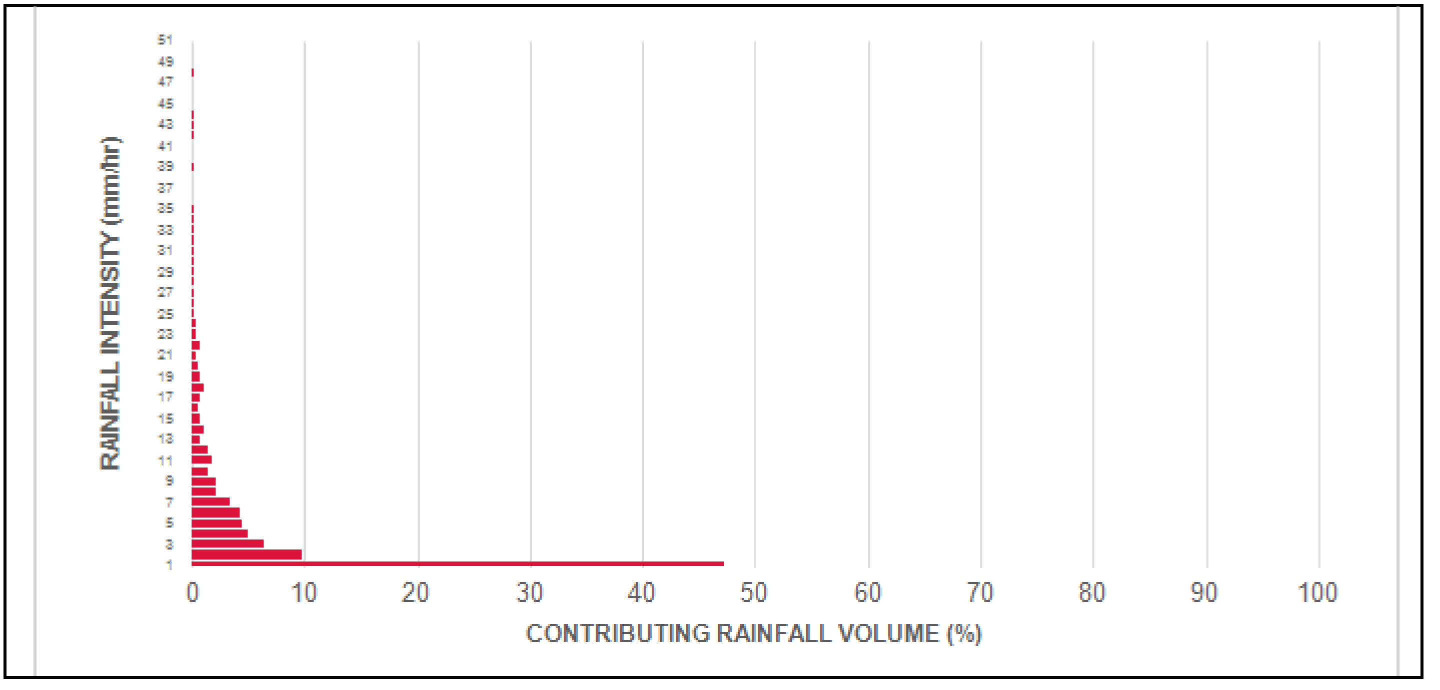
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

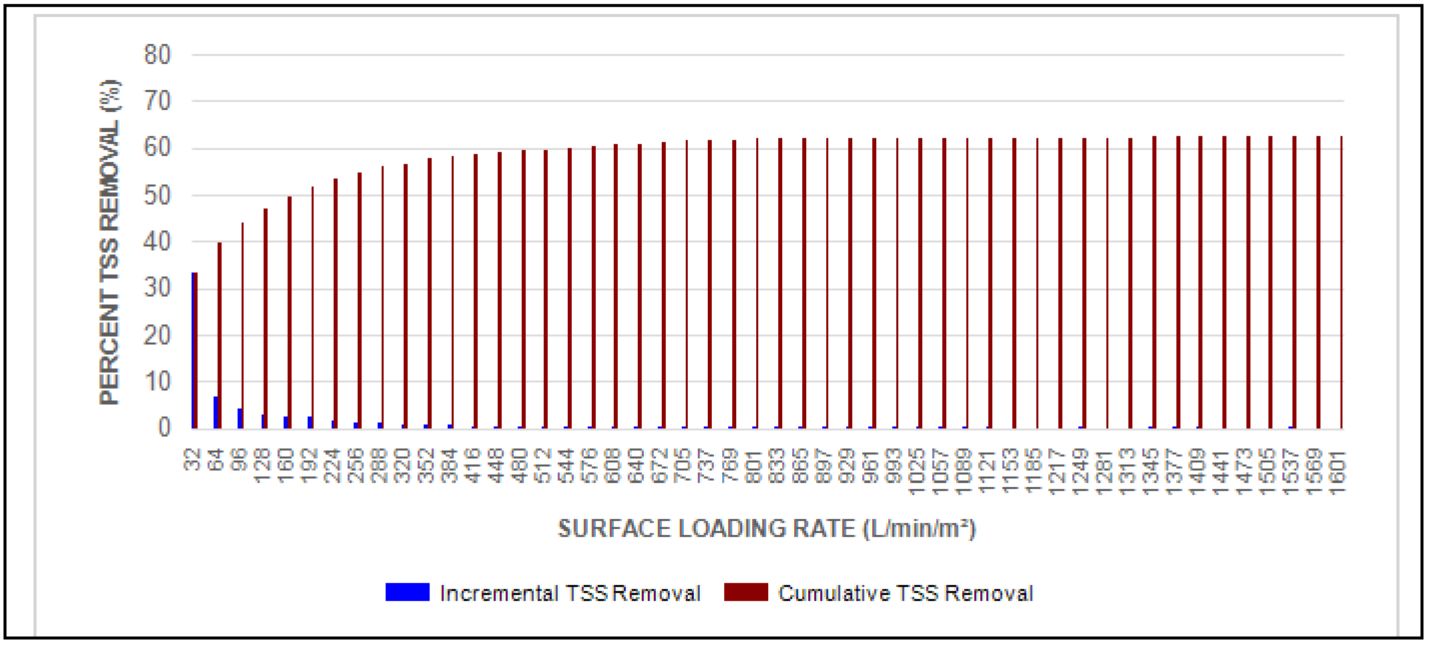
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	47.3	47.3	2.51	151.0	32.0	70	33.3	33.3
2	9.8	57.1	5.02	301.0	64.0	67	6.6	39.9
3	6.4	63.5	7.53	452.0	96.0	63	4.0	43.9
4	5.0	68.5	10.03	602.0	128.0	61	3.0	47.0
5	4.5	73.0	12.54	753.0	160.0	57	2.6	49.5
6	4.2	77.2	15.05	903.0	192.0	55	2.3	51.8
7	3.3	80.5	17.56	1054.0	224.0	53	1.8	53.6
8	2.2	82.7	20.07	1204.0	256.0	53	1.2	54.8
9	2.1	84.8	22.58	1355.0	288.0	52	1.1	55.8
10	1.5	86.3	25.09	1505.0	320.0	50	0.8	56.6
11	1.8	88.1	27.59	1656.0	352.0	50	0.9	57.5
12	1.4	89.5	30.10	1806.0	384.0	49	0.7	58.2
13	0.8	90.3	32.61	1957.0	416.0	48	0.4	58.6
14	1.0	91.3	35.12	2107.0	448.0	47	0.5	59.0
15	0.7	92.0	37.63	2258.0	480.0	46	0.3	59.3
16	0.6	92.6	40.14	2408.0	512.0	45	0.3	59.6
17	0.8	93.4	42.64	2559.0	544.0	44	0.4	60.0
18	1.0	94.4	45.15	2709.0	576.0	43	0.4	60.4
19	0.7	95.1	47.66	2860.0	608.0	42	0.3	60.7
20	0.6	95.7	50.17	3010.0	640.0	42	0.3	60.9
21	0.4	96.1	52.68	3161.0	672.0	42	0.2	61.1
22	0.7	96.8	55.19	3311.0	705.0	42	0.3	61.4
23	0.4	97.2	57.70	3462.0	737.0	41	0.2	61.6
24	0.3	97.5	60.20	3612.0	769.0	41	0.1	61.7
25	0.2	97.7	62.71	3763.0	801.0	41	0.1	61.8

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.1	97.8	65.22	3913.0	833.0	41	0.0	61.8
27	0.1	97.9	67.73	4064.0	865.0	41	0.0	61.8
28	0.1	98.0	70.24	4214.0	897.0	41	0.0	61.9
29	0.1	98.1	72.75	4365.0	929.0	40	0.0	61.9
30	0.1	98.2	75.26	4515.0	961.0	40	0.0	62.0
31	0.1	98.3	77.76	4666.0	993.0	40	0.0	62.0
32	0.1	98.4	80.27	4816.0	1025.0	40	0.0	62.0
33	0.1	98.5	82.78	4967.0	1057.0	39	0.0	62.1
34	0.2	98.7	85.29	5117.0	1089.0	39	0.1	62.2
35	0.1	98.8	87.80	5268.0	1121.0	38	0.0	62.2
36	0.0	98.8	90.31	5418.0	1153.0	38	0.0	62.2
37	0.0	98.8	92.81	5569.0	1185.0	37	0.0	62.2
38	0.0	98.8	95.32	5719.0	1217.0	37	0.0	62.2
39	0.1	98.9	97.83	5870.0	1249.0	36	0.0	62.2
40	0.0	98.9	100.34	6020.0	1281.0	36	0.0	62.2
41	0.0	98.9	102.85	6171.0	1313.0	35	0.0	62.2
42	0.1	99.0	105.36	6321.0	1345.0	35	0.0	62.3
43	0.1	99.1	107.87	6472.0	1377.0	34	0.0	62.3
44	0.1	99.2	110.37	6622.0	1409.0	34	0.0	62.3
45	0.0	99.2	112.88	6773.0	1441.0	33	0.0	62.3
46	0.0	99.2	115.39	6923.0	1473.0	32	0.0	62.3
47	0.0	99.2	117.90	7074.0	1505.0	32	0.0	62.3
48	0.1	99.3	120.41	7224.0	1537.0	31	0.0	62.4
49	0.0	99.3	122.92	7375.0	1569.0	30	0.0	62.4
50	0.0	99.3	125.43	7526.0	1601.0	30	0.0	62.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**62 %**

RAINFALL DATA FROM ORILLIA TS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	Model Diameter (ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	Max Inlet Pipe Diameter (in)	Max Outlet Pipe Diameter (mm)	Max Outlet Pipe Diameter (in)	Peak Conveyance Flow Rate (L/s)	Peak Conveyance Flow Rate (cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

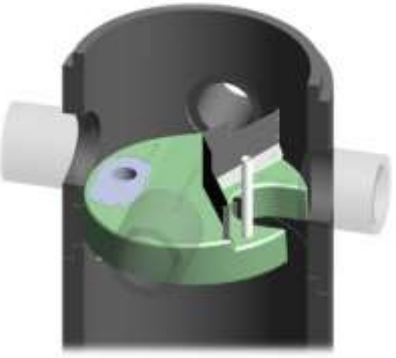
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

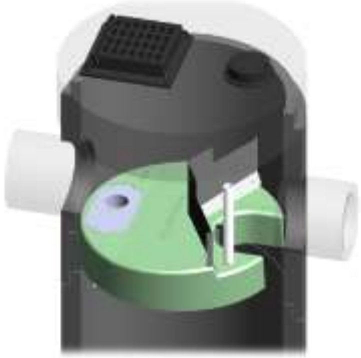
DESIGN FLEXIBILITY

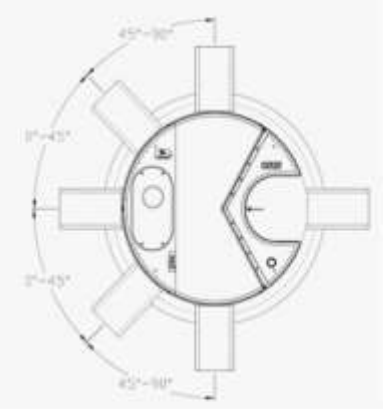
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34
60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35		

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ESTIMATED NET ANNNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

Province:	Ontario
City:	Midland
Nearest Rainfall Station:	ORILLIA TS
NCDC Rainfall Station Id:	5820
Years of Rainfall Data:	28

Site Name:	Catchment 1104

Drainage Area (ha):	0.414
Runoff Coefficient 'c':	0.81

Project Name:	16928 Hwy 12
Project Number:	18M-01620
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	(905) 630-0359
EOR Name:	Ellie Fazeli
EOR Company:	WSP Canada Group Ltd.
EOR Email/Phone:	

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0
Required Water Quality Runoff Volume Capture (%):	90.0
Require Hydrocarbon Spill Capture?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	60
EFO6	65
EFO8	67
EFO10	68
EFO12	69

Recommended Stormceptor EFO Model:	**EFO4**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**60**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

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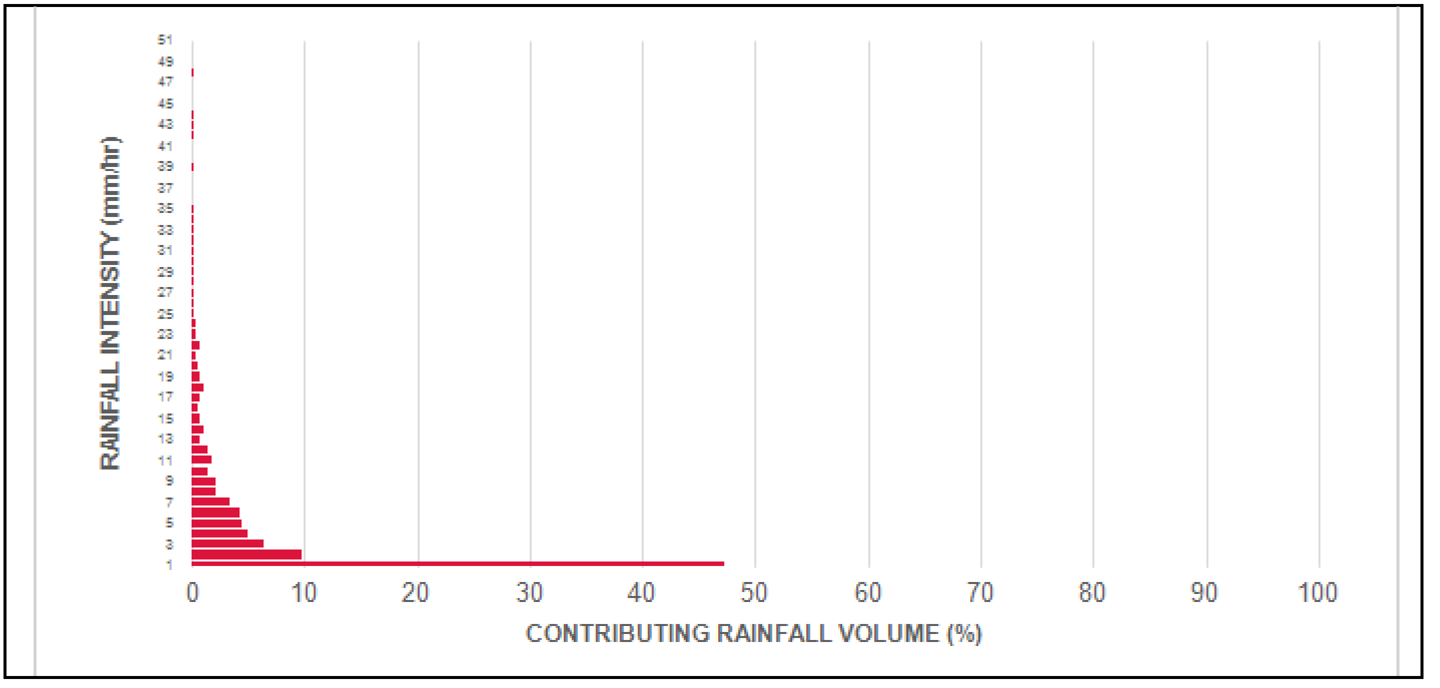
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

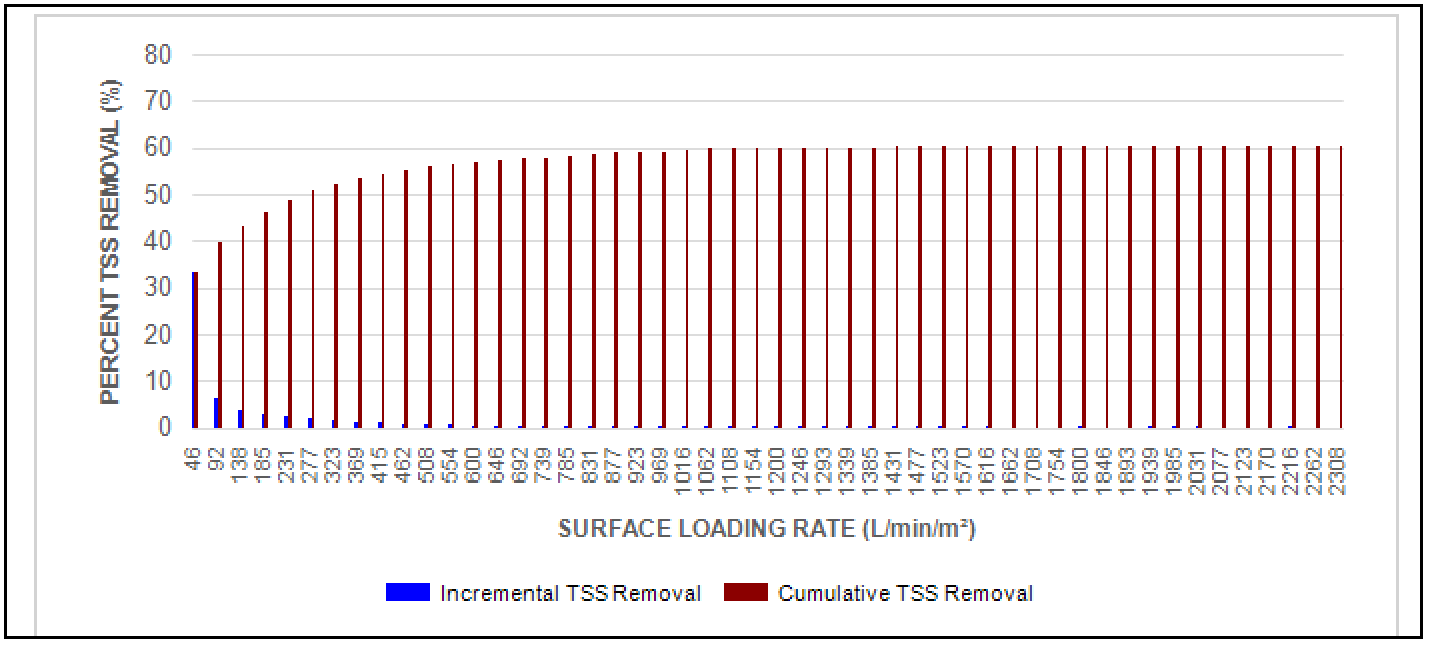
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	47.3	47.3	0.92	55.0	46.0	70	33.3	33.3
2	9.8	57.1	1.85	111.0	92.0	63	6.2	39.5
3	6.4	63.5	2.77	166.0	138.0	60	3.8	43.3
4	5.0	68.5	3.69	222.0	185.0	56	2.8	46.1
5	4.5	73.0	4.62	277.0	231.0	53	2.4	48.5
6	4.2	77.2	5.54	332.0	277.0	52	2.2	50.7
7	3.3	80.5	6.46	388.0	323.0	50	1.7	52.3
8	2.2	82.7	7.39	443.0	369.0	49	1.1	53.4
9	2.1	84.8	8.31	499.0	415.0	48	1.0	54.4
10	1.5	86.3	9.23	554.0	462.0	46	0.7	55.1
11	1.8	88.1	10.16	609.0	508.0	45	0.8	55.9
12	1.4	89.5	11.08	665.0	554.0	44	0.6	56.5
13	0.8	90.3	12.00	720.0	600.0	42	0.3	56.9
14	1.0	91.3	12.93	776.0	646.0	42	0.4	57.3
15	0.7	92.0	13.85	831.0	692.0	42	0.3	57.6
16	0.6	92.6	14.77	886.0	739.0	41	0.2	57.8
17	0.8	93.4	15.70	942.0	785.0	41	0.3	58.1
18	1.0	94.4	16.62	997.0	831.0	41	0.4	58.6
19	0.7	95.1	17.54	1052.0	877.0	41	0.3	58.8
20	0.6	95.7	18.46	1108.0	923.0	40	0.2	59.1
21	0.4	96.1	19.39	1163.0	969.0	40	0.2	59.2
22	0.7	96.8	20.31	1219.0	1016.0	40	0.3	59.5
23	0.4	97.2	21.23	1274.0	1062.0	39	0.2	59.7
24	0.3	97.5	22.16	1329.0	1108.0	39	0.1	59.8
25	0.2	97.7	23.08	1385.0	1154.0	38	0.1	59.9

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.1	97.8	24.00	1440.0	1200.0	37	0.0	59.9
27	0.1	97.9	24.93	1496.0	1246.0	36	0.0	59.9
28	0.1	98.0	25.85	1551.0	1293.0	36	0.0	60.0
29	0.1	98.1	26.77	1606.0	1339.0	35	0.0	60.0
30	0.1	98.2	27.70	1662.0	1385.0	34	0.0	60.0
31	0.1	98.3	28.62	1717.0	1431.0	33	0.0	60.1
32	0.1	98.4	29.54	1773.0	1477.0	32	0.0	60.1
33	0.1	98.5	30.47	1828.0	1523.0	31	0.0	60.1
34	0.2	98.7	31.39	1883.0	1570.0	30	0.1	60.2
35	0.1	98.8	32.31	1939.0	1616.0	30	0.0	60.2
36	0.0	98.8	33.24	1994.0	1662.0	29	0.0	60.2
37	0.0	98.8	34.16	2050.0	1708.0	28	0.0	60.2
38	0.0	98.8	35.08	2105.0	1754.0	27	0.0	60.2
39	0.1	98.9	36.01	2160.0	1800.0	26	0.0	60.3
40	0.0	98.9	36.93	2216.0	1846.0	26	0.0	60.3
41	0.0	98.9	37.85	2271.0	1893.0	25	0.0	60.3
42	0.1	99.0	38.78	2327.0	1939.0	25	0.0	60.3
43	0.1	99.1	39.70	2382.0	1985.0	24	0.0	60.3
44	0.1	99.2	40.62	2437.0	2031.0	23	0.0	60.3
45	0.0	99.2	41.55	2493.0	2077.0	23	0.0	60.3
46	0.0	99.2	42.47	2548.0	2123.0	22	0.0	60.3
47	0.0	99.2	43.39	2604.0	2170.0	22	0.0	60.3
48	0.1	99.3	44.32	2659.0	2216.0	22	0.0	60.4
49	0.0	99.3	45.24	2714.0	2262.0	21	0.0	60.4
50	0.0	99.3	46.16	2770.0	2308.0	21	0.0	60.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**60 %**

RAINFALL DATA FROM ORILLIA TS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

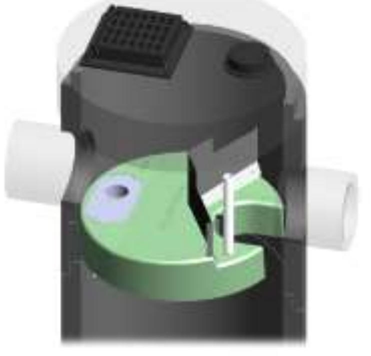
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

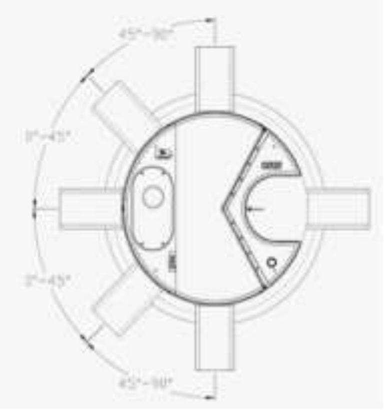
DESIGN FLEXIBILITY

►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.





INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

**Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO**

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34
60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35		

APPENDIX

E

ADS STORMTECH SC-740 CHAMBER SYSTEM DESIGN PACKAGE

Project: **Hotel and Conference Ctr Rev1**

StormTech®
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	395	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	212.27	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

1387.3 sq.meters Min. Area - . sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	14.10	14.10	900.378	213.33
1041	0.00	0.00	14.10	14.10	886.283	213.31
1016	0.00	0.00	14.10	14.10	872.188	213.28
991	0.00	0.00	14.10	14.10	858.093	213.26
965	0.00	0.00	14.10	14.10	843.997	213.23
940	0.00	0.00	14.10	14.10	829.902	213.20
914	0.00	0.62	13.85	14.46	815.807	213.18
889	0.00	1.82	13.37	15.19	801.343	213.15
864	0.01	3.15	12.83	15.99	786.154	213.13
838	0.02	6.76	11.39	18.15	770.167	213.10
813	0.02	8.97	10.51	19.48	752.018	213.08
787	0.03	10.63	9.84	20.48	732.543	213.05
762	0.03	12.02	9.29	21.31	712.068	213.03
737	0.03	13.20	8.81	22.02	690.761	213.00
711	0.04	14.16	8.43	22.59	668.744	212.98
686	0.04	15.16	8.03	23.19	646.155	212.95
660	0.04	16.26	7.59	23.85	622.966	212.93
635	0.04	17.05	7.27	24.33	599.112	212.90
610	0.04	17.70	7.02	24.71	574.784	212.87
584	0.05	18.37	6.75	25.12	550.070	212.85
559	0.05	19.01	6.49	25.50	524.953	212.82
533	0.05	19.61	6.25	25.86	499.452	212.80
508	0.05	20.16	6.03	26.19	473.593	212.77
483	0.05	20.75	5.80	26.54	447.399	212.75
457	0.05	21.17	5.63	26.80	420.855	212.72
432	0.05	21.63	5.44	27.07	394.055	212.70
406	0.06	22.09	5.26	27.35	366.981	212.67
381	0.06	22.48	5.10	27.58	339.631	212.65
356	0.06	22.87	4.95	27.82	312.047	212.62
330	0.06	23.21	4.81	28.02	284.228	212.60
305	0.06	23.54	4.68	28.22	256.207	212.57
279	0.06	23.84	4.56	28.40	227.986	212.54
254	0.06	24.09	4.46	28.55	199.584	212.52
229	0.06	24.35	4.35	28.71	171.034	212.49
203	0.06	24.59	4.26	28.85	142.328	212.47
178	0.06	24.69	4.22	28.91	113.480	212.44
152	0.00	0.00	14.10	14.10	84.571	212.42
127	0.00	0.00	14.10	14.10	70.476	212.39
102	0.00	0.00	14.10	14.10	56.381	212.37
76	0.00	0.00	14.10	14.10	42.286	212.34
51	0.00	0.00	14.10	14.10	28.190	212.32
25	0.00	0.00	14.10	14.10	14.095	212.29

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	CODY NEATH 519-465-9958 CODY.NEATH@ADS-PIPE.COM
ADS SALES REP:	RYAN MARTIN 705-207-3059 RYAN.MARTIN@ADS-PIPE.COM
PROJECT NO:	S120734

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST by StormTech

FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

HOTEL AND CONFERENCE CTR.

MIDLAND, ON.

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

395	STORMTECH SC-740 CHAMBERS
38	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
900.3	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
1,387.3	SYSTEM AREA (m²)
157.0	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS

215.617	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):
213.789	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):
213.636	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):
213.636	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):
213.636	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT):
213.331	TOP OF STONE:
213.179	TOP OF SC-740 CHAMBER:
212.646	375 mm TOP MANIFOLD INVERT:
212.545	450 mm TOP MANIFOLD INVERT:
212.447	300 mm BOTTOM MANIFOLD/CONNECTION INVERT:
212.420	600 mm ISOLATOR ROW INVERT:
212.417	BOTTOM OF SC-740 CHAMBER:
212.265	BOTTOM OF STONE:

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.

HOTEL AND CONFERENCE CTR.
MIDLAND, ON.

DATE: 02/24/19 DRAWN: RCT
PROJECT #: S120734 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION
02-06-20	RCT	NPB	REVISED PER NEW PLAN/VOLUME

StormTech® Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

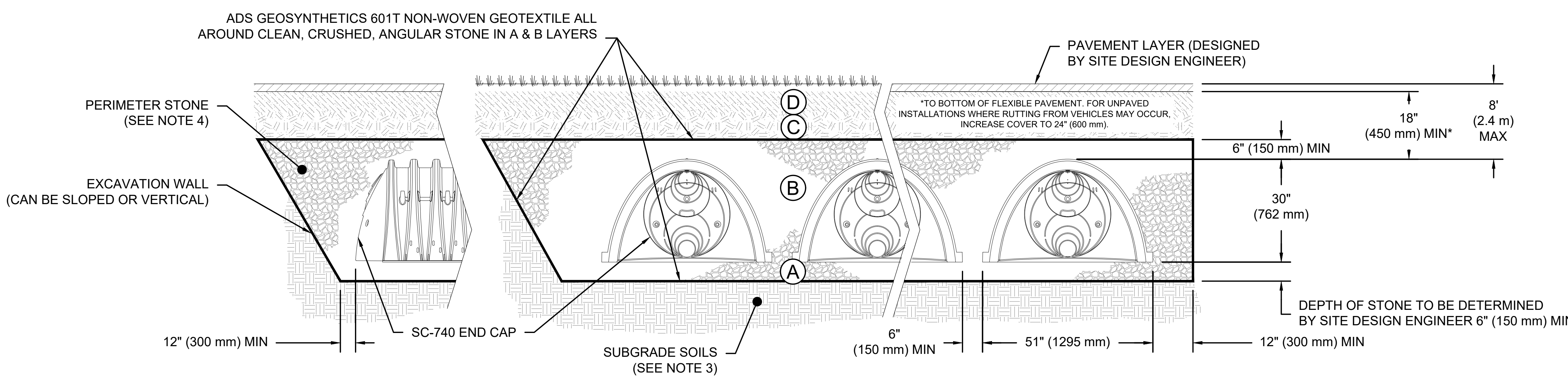
ADS® ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 250

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

HOTEL AND CONFERENCE CTR.
MIDLAND, ON.

DATE: 02/24/19 DRAWN: RCT
PROJECT #: S120734 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION
02-06-20	RCT	NPB	REVISED PER NEW PLAN/VOLUME

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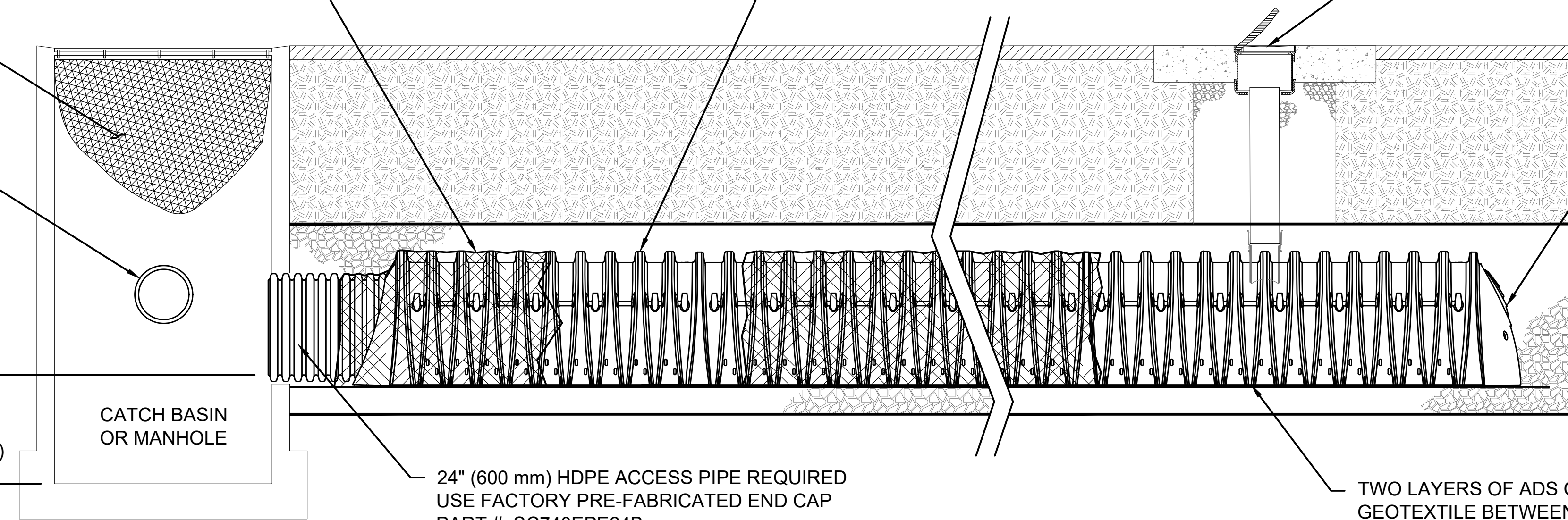


SC-740 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

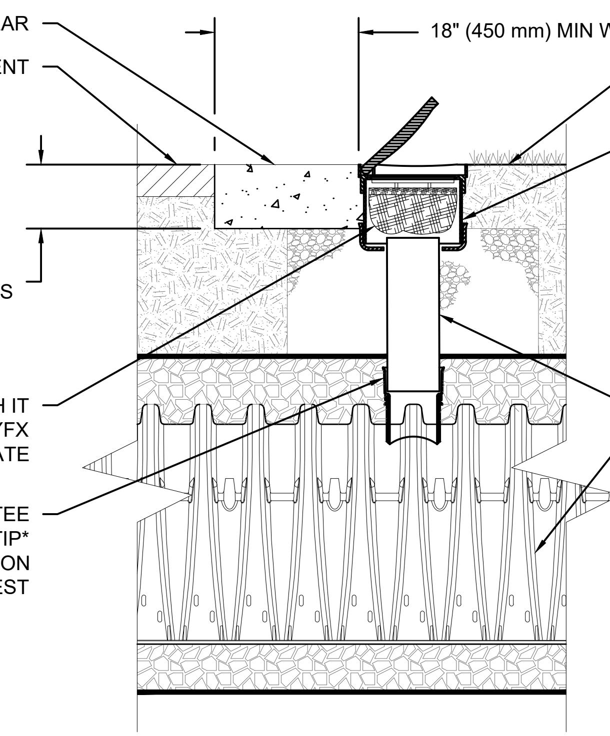
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

SC-740 6" (150 mm) INSPECTION PORT DETAIL

NTS

HOTEL AND CONFERENCE CTR.
MIDLAND, ON.

DATE: 02/24/19 | DRAWN: RCT
PROJECT #: S120734 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION
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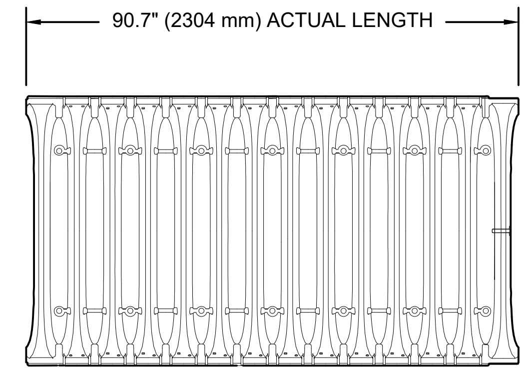
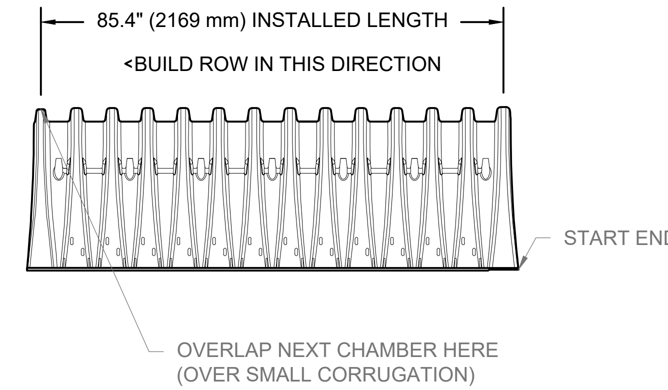
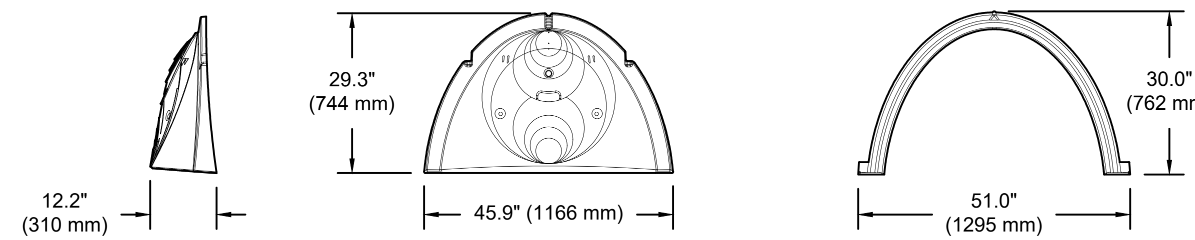
SC-740 TECHNICAL SPECIFICATION

NTS



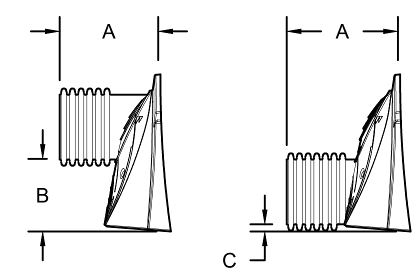




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

HOTEL AND CONFERENCE CTR.
MIDLAND, ON.

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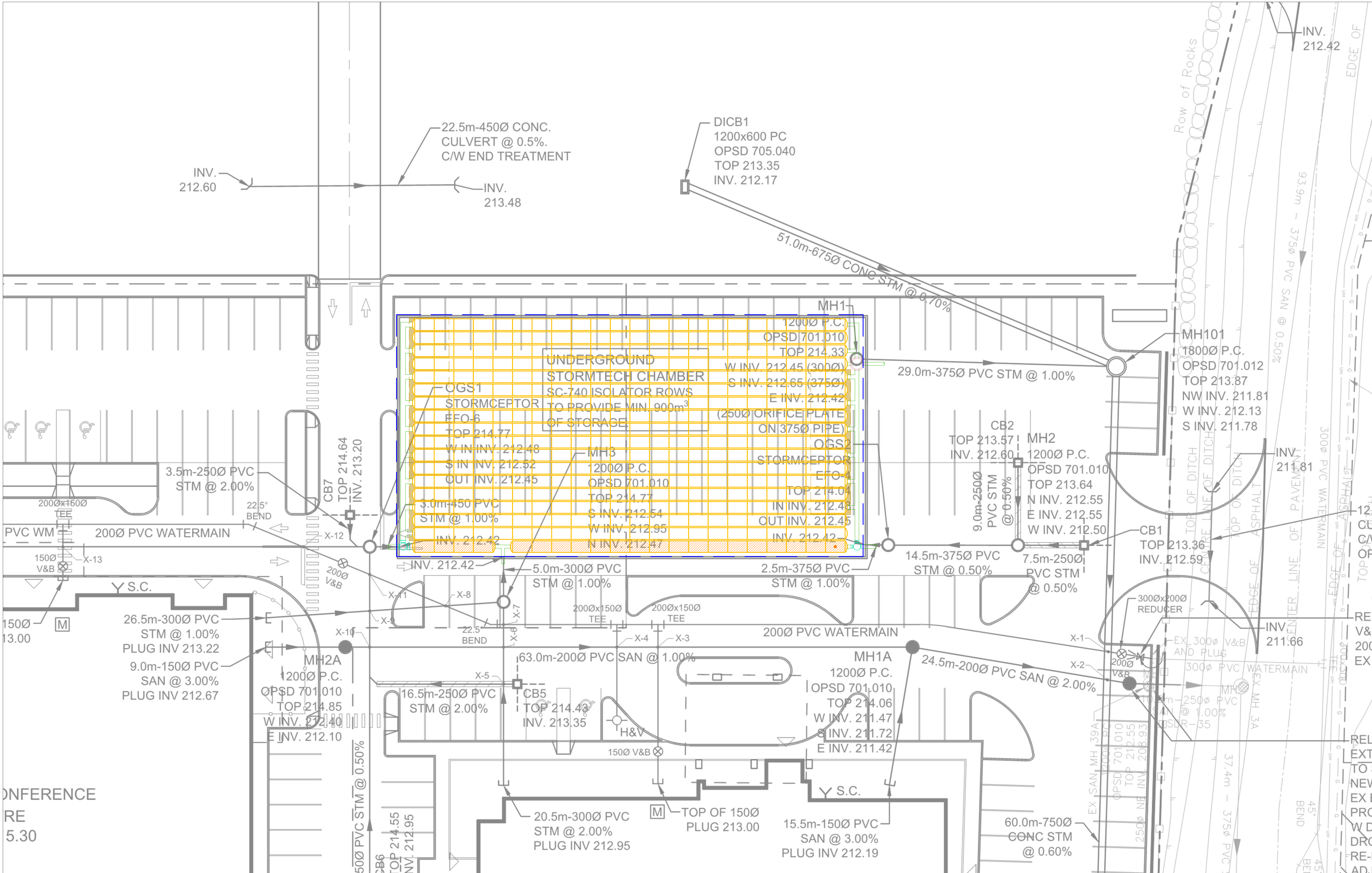

22.5m-450Ø CONC.
CULVERT @ 0.5%.
C/W END TREATMENT
INV.
212.60
INV.
213.48
DICB1
1200x600 PC
OPSD 705.040
TOP 213.35
INV. 212.17
51.0m-675Ø CONC STM @ 0.70%
INV.
212.42
Row of Rocks
93.9m - 375Ø PVC SAN @ 0.50%
MH1
1200Ø P.C.
OPSD 701.010
TOP 214.33
W INV. 212.45 (300Ø)
S INV. 212.65 (375Ø)
E INV. 212.42
(250Ø ORIFICE PLATE
ON 375Ø PIPE)
29.0m-375Ø PVC STM @ 1.00%
MH101
1800Ø P.C.
OPSD 701.012
TOP 213.87
NW INV. 211.81
W INV. 212.13
S INV. 211.78
UNDERGROUND
STORMTECH CHAMBER
SC-740 ISOLATOR ROWS
TO PROVIDE MIN. 900m³
OF STORAGE
OGS1
STORMCEPTOR
EFO-6
TOP 214.77
W IN INV. 212.48
S IN INV. 212.52
OUT INV. 212.45
MH3
1200Ø P.C.
OPSD 701.010
TOP 214.77
S INV. 212.54
W INV. 212.95
N INV. 212.47
OGS2
STORMCEPTOR
EFO-4
TOP 214.04
IN INV. 212.48
OUT INV. 212.45
INV. 212.42
CB2
TOP 213.57
INV. 212.60
MH2
1200Ø P.C.
OPSD 701.010
TOP 213.64
N INV. 212.55
E INV. 212.55
W INV. 212.50
9.0m-250Ø PVC STM @ 0.50%
INV.
211.81
12.0m
CUL
C/W
OPS
CB1
TOP 213.36
INV. 212.59
3.5m-250Ø PVC
STM @ 2.00%
CB7
TOP 214.64
INV. 213.20
3.0m-450 PVC
STM @ 1.00%
INV. 212.42
INV. 212.42
5.0m-300Ø PVC
STM @ 1.00%
2.5m-375Ø PVC
STM @ 1.00%
14.5m-375Ø PVC
STM @ 0.50%
7.5m-250Ø
PVC STM
@ 0.50%
200Øx150Ø
TEE
PVC WM
200Ø PVC WATERMAIN
22.5°
BEND
X-12
X-13
150Ø
V&B
200Ø
V&B
S.C.
X-11
X-8
X-9
X-7
X-6
X-5
X-4
X-3
X-10
X-1
X-2
150Ø
13.00
26.5m-300Ø PVC
STM @ 1.00%
PLUG INV 213.22
9.0m-150Ø PVC
SAN @ 3.00%
PLUG INV 212.67
MH2A
1200Ø P.C.
OPSD 701.010
TOP 214.85
W INV. 212.40
E INV. 212.10
22.5°
BEND
200Øx150Ø
TEE
200Øx150Ø
TEE
200Ø PVC WATERMAIN
63.0m-200Ø PVC SAN @ 1.00%
16.5m-250Ø PVC
STM @ 2.00%
CB5
TOP 214.43
INV. 213.35
MH1A
1200Ø P.C.
OPSD 701.010
TOP 214.06
W INV. 211.47
S INV. 211.72
E INV. 211.42
24.5m-200Ø PVC SAN @ 2.00%
300Øx200Ø
REDUCER
200Ø
V&B
INV.
211.66
EX. 300ø V&B
AND PLUG
300ø PVC WATERMAIN
EX. MH 3A
EX. SAN MH 39A
H&V
150Ø V&B
ONFERENCE
RE
5.30
450Ø PVC STM @ 0.50%
CB6
TOP 214.55
INV. 212.95
20.5m-300Ø PVC
STM @ 2.00%
PLUG INV 212.95
TOP OF 150Ø
PLUG 213.00
15.5m-150Ø PVC
SAN @ 3.00%
PLUG INV 212.19
S.C.
60.0m-750Ø
CONC STM
@ 0.60%
37.4m - 375Ø PVC S
45°
BEND
PROPOSED 5 STOREY HOTEL
TOP OF DITCH
CENTRE LINE OF DITCH
EDGE OF ASPHALT
EDGE OF PAVEMENT
CENTER LINE
300Ø PVC WATERMAIN
EDGE OF
RELO
V&B
200Ø
EX 30
RELO
EXTE
TO SU
NEW
EX E
PROP
W DR
DROP
RE-BE
ADJU

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Isolator Row Testing Summary

Thank you for your interest in the StormTech Isolator Row testing done to date. Below is a summary of the testing that has been completed on the StormTech Isolator Row. The most current testing done by the University of New Hampshire is probably the best data to use for proof of 80% removal of TSS since this test was done in the field as opposed to a lab test. Any of the referenced reports are available upon request.

- February 23, 2005 - Tennessee Tech University summarized laboratory testing on the Isolator Row in accordance with Maine DEP testing protocol. Tests demonstrated the following:
  - 95% TSS overall removal at 8.1 gpm/sqft for US Silica OK-110 (110 micron).
  - 80% captured on fabric, 15% captured in stone

- October 20, 2006 - Tennessee Tech University summarized laboratory testing on the Isolator Row in accordance with New Jersey Center for Advanced Technologies (NJCAT) testing protocol. Tests demonstrated the following:
  - 60% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 106 with accumulated fines (D_{50} = 10 microns)
  - 66% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 106 (D_{50} = 22 microns)
  - 71% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 250 (D_{50} = 45 microns)
  - 88% TSS Removal at 1.7 gpm/sqft for Sil-Co-Sil 250 (D_{50} = 45 microns)

- August, 2007 – NJCAT summarized its third party evaluation of the Tennessee Tech test results and produced the "NJCAT Technology Verification Report StormTech Isolator Row". Their verification is summarized as follows:

  - **Claim 1:** A StormTech® SC-740 Isolator™ Row, sized at a treatment rate of no more than 2.5 gpm/ft^2 of bottom area, using two layers of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 270 mg/L (range of 139 – 361 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of at least 60% for SIL-CO-SIL 106, a manufactured silica product with an average particle size of 22 microns, in laboratory studies using simulated stormwater.

  - **Claim 2:** A StormTech® SC-740 Isolator™ Row, sized at a treatment rate of no more than 2.5 gpm/ft^2 of bottom area, using two layers of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 318 mg/L (range of 129 – 441 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of 84% for SIL-CO-SIL

250, a manufactured silica product with an average particle size of 45 microns, in laboratory studies using simulated stormwater.

  - **Claim 3:** A StormTech® SC-740 Isolator™ Row, sized at a treatment rate of no more than 6.5 gpm/ft^2 of bottom area, using a single layer of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 371 mg/L (range of 116 – 614 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of greater than 95% for OK-110, a manufactured silica product with an average particle size of 110 microns, in laboratory studies using simulated stormwater.

- June 2008 – The University of New Hampshire Stormwater Center releases the Final Report on Field Verification Testing of the StormTech Isolator Row Treatment Unit. Testing consisted of determining the water quality performance for multiple stormwater pollutants. As of the June report, data was recorded for 17 storm events.

  - TSS median removal efficiency – 80%
  - Petroleum Hydrocarbons median removal efficiency – 90%
  - Zinc median removal efficiency – 53%
  - Phosphorus median removal efficiency – 49%

References:

1. February 23, 2005 Tenn Tech report
2. October 20, 2006 Tenn Tech report
3. August 2007 NJCAT Verification
4. June 2008 UNH report

APPENDIX

F

GEOTECHNICAL INVESTIGATION

Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION
PROPOSED HOTEL & CONFERENCE CENTRE
16928 HIGHWAY 12
MIDLAND, ONTARIO

for

COLAND DEVELOPMENTS CORPORATION

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Distribution:
3 cc: Coland Developments Corporation (+email)
1 cc: PML Barrie

PML Ref.: 18BF056
Report: 2
December 2018

Peto MacCallum Ltd.
CONSULTING ENGINEERS

December 5, 2018 PML Ref.: 18BF056
Report: 2

Mr. David Colagiacomo
Coland Development Corporation
5875 Highway 7, Unit 3
Woodbridge, Ontario
L4L 1T9

Dear Mr. Colagiacomo

Geotechnical Investigation
Proposed Hotel & Conference Centre
16928 Highway 12
Midland, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the work described in this report was provided by Mr. D. Colagiacomo in the signed Engineering Services Agreement dated September 25, 2018 and the signed Engineering Services Agreement Change Order No. 1, dated October 10, 2018.

A hotel and conference centre with a total of seven buildings, is proposed for the 6.0 ha parcel of land at 16928 Highway 12 in Midland. The buildings will range in size from 932 to 3015 m^2 in plan. Six of the buildings will be slab-on-grade with a single storey, one with four storeys. The seventh building will have three storeys and will incorporate as many as three levels of underground parking. Site servicing and paved parking and access are also planned. Infiltration facilities are also proposed throughout the site. The proposed site configuration is shown on Drawing 2-1, appended.

The purpose of this investigation was to assess the subsurface conditions at the site, and based on this information, provide comments and geotechnical engineering recommendations for building foundations, underground parking, site servicing, infiltration parameters and pavement design.

It is noted that Report 1, dated November 20, 2018, provided the results of a geotechnical investigation and corresponding geotechnical engineering recommendations for a different and unrelated site for the same Client. This Report 2 provides the geotechnical investigation details and corresponding geotechnical engineering recommendations for the above noted project.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

Geoenvironmental services (observations, recording, testing or assessment of the environmental conditions of the soil and ground water) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess soil requiring transportation off-site is generated, a program of soil sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate Receiving Site options, in accordance with the MOECC document; Management of Excess Soil – A Guide for Best Management Practices, January, 2014.

INVESTIGATION PROCEDURES

The field work for this investigation was conducted on November 6 to 9, 2018, and consisted of Boreholes 101 to 118 advanced to 4.8 to 14.2 m depth across the site at the locations shown on Drawing 2-1, appended.

The boreholes were advanced for the site features as summarized in the below table:

SITE FEATURES	ASSOCIATED BOREHOLES
Building E – Three Storeys with Basement(s)	101 to 104
Building A – Single Storey	105 and 106
Building D – Single Storey	107 and 108
Building C – Single Storey	109 and 110
Building B – Single Storey	111 and 112
Building G – Single Storey Conference Centre	113 to 116
Building F – Four Storey Hotel	116 to 118

Test Pits 101 to 107 were excavated to 1.7 to 2.1 m depth below existing grade on November 8, 2018 across the site at locations provided by the Clients Civil consultant, for the purpose of conducting in-situ Guelph Permeameter (GP) tests.

The borehole locations were established in the field by a subcontracted surveying company based on a drawing provided by the Client. The test pit locations were determined in the field by PML based on a plan provided by the Client. Co-ordination of clearances of underground utilities was provided by PML with the aid of a sub-contracting private utility locating company. Boreholes were drilled and test pits were excavated, cognizant of utility locates. Tree clearing, as required, was provided for the boreholes by PML with the excavator utilized for the test pits.

The boreholes and test pts were conducted during the same time. The boreholes were advanced using continuous flight hollow or solid stem augers, powered by a rubber tire mounted CME-75 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor. The test pits were excavated using a track mounted mini-excavator supplied by an excavating contractor. Boreholes and test pits were advanced under the full-time supervision of a member of PML's engineering staff.

At the surface of the boreholes and test pits, the topsoil thicknesses encountered were measured.

Representative samples of the overburden in the boreholes were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the substrata. In-situ vane testing was conducted on cohesive soils to augment the strength data. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of water in the open boreholes upon completion, if any.

In the test pits, the exposed soils were tested and documented along with ground water observations.

Monitoring wells comprised of 50 mm diameter PVC pipe (bottom 1.5 m screened), filter sand, bentonite seal and above grade protective casing were installed in six boreholes to permit monitoring of the ground water table. Boreholes without wells were backfilled in accordance with O.Reg. 903. As per O.Reg. 903, wells become the property of the Owner and will have to be decommissioned when no longer required. PML would be pleased to assist in this regard.

Ground surface elevations of the boreholes were established in the field by Better Measures Inc. PML interpolated the surface elevations of the test pits utilizing a survey plan provided by the Client.

All recovered samples were returned to our laboratory for moisture content determination and detailed examination to confirm field classification. Grain size analyses were carried out on nine samples of the major soil types. Atterberg Limits testing was carried out on four of the samples. All the laboratory results are presented in Figures 2-1 to 2-4, attached.

SITE DESCRIPTION AND SUMMARIZED SUBSURFACE CONDITIONS

The site is undeveloped and is bounded by Highway 12 along the north limit and Beamish Road along the east limit. A gravel pit is directly to the south. Light tree cover is present in some areas otherwise light ground vegetation covers the site. Based on the boreholes the site has about 16 m of relief ranging from elevation 228 in the northwest to elevation 212 in the southeast. The northwest portion of the site has the highest grades and relief (elevation 228 to 215). The central and eastern portions of the site have flatter grades ranging between elevation 212 and 215.

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including soil classifications, inferred stratigraphy, Standard Penetration Test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), monitoring well installation details, ground water observations and the results of laboratory moisture content determinations and Atterberg Limits tests.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones, and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

The Log of Test Pit Sheets provide details of the soil stratigraphy, assessment of density, ground water observations and show the depths of the GP tests.

In general, the boreholes and test pits showed topsoil was encountered over upper native granular soils comprising layers of silty sand/sand and silt/sandy silt/sand with thicker underlying deposits of till and silty sand/sand. A silty clay unit was also encountered in the central and eastern boreholes and test pits between the upper granular soil layers and the lower till silty sand/sand deposits. A description of the distribution of the subsurface conditions encountered is provided below.

Topsoil

Topsoil was present at the surface of all boreholes and test pits. The topsoil was 100 to 450 mm thick.

Upper Silty Sand/Silt and Sand/Sandy Silt/Sand

Underlying the topsoil in almost all boreholes and test pits (excluding Boreholes 105 and 106) upper thin layers of silty sand/sand and silt/sandy silt/sand were present extending to 0.7 to 2.9 m (elevation 210.3 to 227.4) in the boreholes, 1.5 to 1.7 m depth (elevation 211.5 to 212.3) in Test Pits 102 and 105, and to the 1.7 to 2.1 m depth of excavation in Test Pits 101, 103, 104, 106 and 107. Three samples of the material from were submitted for grain size analysis and the results are presented on Figures 2-1 and 2-2, appended. The upper granular soil layers are very loose to compact (N Values 2 to 20), locally dense (N Value of 36). Moisture contents were 9 to 30%.

Silty Clay

A silty clay unit was encountered in the central and eastern boreholes and test pits (Boreholes 105 to 118 and Test Pits 102 and 105) below the upper thin granular soil layers. The unit extended to 1.4 to 7.0 m depth (elevation 206.2 to 213.0), locally to the 1.9 to 5.0 m to depth of exploration in Boreholes 111, 117 and 118 and Test Pits 102 and 105. Where penetrated the unit ranged from 1.1 to 4.1 m thick. Local sand seams and sandy silt layers were noted. A total of six samples from the boreholes and test pits were submitted for grain size analysis and the results are provided on Figure 2-3. Atterberg Limits testing was carried out on four samples and the results are provided on Figure 2-4. The liquid limits were between 52 to 57 and the plastic limits were 19 to 21, with resulting plasticity index of 33 to 36. The N Values ranged from 2 to 14 (soft to stiff) and local vane testing showed the soil to have a shear strength of 70 to 100 kPa. The moisture contents ranged from 25 to 74%, typically 30 to 65%.

Till

Beneath the silty clay and/or the upper thin granular soil layers, a till deposit was revealed in Boreholes 101 to 105, 107 to 110, 112 to 114 and 116, and Test Pit 101. The till deposit reached a depth of 2.1 to 4.4 m (elevation 210.7 to 226.0) where penetrated (Boreholes 101 to 104 and 107) and extended to the 2.1 to 8.2 m depth of exploration in Boreholes 105, 108 to 110, 112 to 114 and 116 and Test Pit 101. The till comprises silty sand to sandy silt, with trace gravel. Cobbles and boulders were noted. The N Values range from 10 to greater than 50 and show the material is compact to very dense, typically with depth. Water contents were typical 10% or less and the material was typically moist. Local wet seams were noted.

Silty Sand/Sand

Units of silty sand, locally sand, were revealed underlying the silty clay in Boreholes 106, 107, 110, 114 and 115, reaching a depth of 7.0 and 2.9 m (elevation 205.6 and 211.3) in Boreholes 114 and 110, respectively, where penetrated, and extending to the 4.9 to 5.0 m depth of exploration in Boreholes 106, 107 and 115. Trace gravel was typically noted in the samples.

The soil was typically compact to very dense with N Values of 11 to greater than 50, locally loose with an N Value of 9. The material was moist to wet with water contents typically 10 to 20%.

A major sand deposit was present beneath the till in Boreholes 101 to 104, in the northwest part of the site, and extended to the 7.3 to 14.2 m depth of exploration. The sand was very dense (N Values greater than 50) and moist (moisture contents less than 5%).

Ground Water

The first ground water strike (during drilling), water in the boreholes upon completion and water levels measured in the wells on November 27, 2018, along with seepage or ground water measured in the test pits are summarized in the table below.

BOREHOLE/ TEST PIT	FIRST GROUND WATER STRIKE (DEPTH (m) / ELEVATION)	WATER LEVEL UPON COMPLETION (DEPTH (m) / ELEVATION)	WATER LEVEL IN WELLS NOVEMBER 27, 2018 (DEPTH (m) / ELEVATION)
Boreholes			
101	No Water	No Water	Dry
102	No Water	No Water	--
103	No Water	No Water	--
104	No Water	No Water	--
105	3.1/210.7	4.9/208.9	--
106	2.5/211.7	4.0/210.2	1.7/212.5
107	No Water	No Water	--
108	No Water	No Water	Dry
109	No Water	No Water	--
110	5.0/207.6	5.3/207.3	--
111	4.6/207.7	4.6/207.7	3.1/209.2
112	2.0/211.2	2.0/211.2	--
113	No Water	No Water	--
114	No Water	No Water	Dry
115	No Water	No Water	--

BOREHOLE/ TEST PIT	FIRST GROUND WATER STRIKE (DEPTH (m) / ELEVATION)	WATER LEVEL UPON COMPLETION (DEPTH (m) / ELEVATION)	WATER LEVEL IN WELLS NOVEMBER 27, 2018 (DEPTH (m) / ELEVATION)
116	No Water	No Water	--
117	No Water	No Water	--
118	1.4/210.7	4.0/208.1	0.4/211.7
Test Pits			
101	--	No Water or Seepage	--
102	--	No Water or Seepage	--
103	--	No Water or Seepage	--
104	--	No Water or Seepage	--
105	--	No Water or Seepage	--
106	--	No Water or Seepage	--
107	--	No Water or Seepage	--

None of the test pits encountered seepage or water and only 6 of the 18 boreholes encountered ground water. Due to the absence of water in three of the five wells and the base of the neighboring gravel pit, directly to the south, below elevation 208, the regional ground water table is considered to be below the depth of exploration. The occurrences of water in the boreholes is consider to reflect perched water in the upper more pervious thin granular layers overlying the less pervious silty clay and till units.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

GEOTECHNCIAL ENGINEERING CONSIDERATIONS

General

A hotel and conference centre with a total of seven buildings, is proposed for the 6.0 ha parcel of land at 16928 Highway 12 in Midland. The buildings will range in size from 932 to 3015 m^2 in plan. Six of the buildings will be slab-on-grade with a single storey and one with four storeys. The seventh building will have three storeys and will incorporate as many as three levels of underground parking. Site servicing and paved parking and access are also planned. Infiltration facilities are also proposed throughout the site. The proposed site configuration is shown on Drawing 2-1, appended.

The site is generally characterized by topsoil, overlying thin granular soil layers over a silty clay unit, overlying deposits of till and silty sand/sand. The upper granular soil layers were loose to compact and the silty clay was soft to stiff. The underlying till and silty sand/sand deposits are compact to very dense. Based on the stabilized water level observations in the wells and general absence of ground water in the boreholes and test pits, the regional ground water table is believed to be below the depth of exploration for this assignment, with only local perched water anticipated.

Based on the subsurface conditions revealed in the boreholes and test pits in the higher northwest portion of the site, construction of the Building E, with three storeys above grade and three levels of underground parking, should be straightforward.

In the central and eastern parts of the site, the loose to compact upper granular soils and underlying soft to stiff silty clay will only yield low bearing capacities near the existing ground surface. Higher bearing capacity is typically at depth in the compact to very dense till and silty sand/sand, however these competent soil units may be at an impractical depth and a deep foundation system may be required for some buildings.

The soft silty clay in some areas is prone to settlement if grades are raised and preloading or surcharging may be required. Grade raise is not recommended in this these areas, as discussed below.

When the grading has been finalized the drawings should be provided to PML for review. Further investigation, laboratory testing and laboratory analysis will likely be required to assess settlement concerns and any required deep foundations.

Site Grading and Engineered Fill

The site grading has not been determined and as such building slab or founding elevations have also not been set. However, some site grading is anticipated for the site due to the relief at the site.

It is cautioned that the silty clay in Boreholes 109 to 113 and 116 to 118 is weak and subject to settlement if a grade raise is introduced. As such, if time permits, the site can be preloaded or surcharged to induce the settlement prior to developing the site. When the grading has been finalized the drawings should be provided to PML for review. Alternatively, where practically possible, the silty clay can be removed and replaced with engineered fill. Further investigation, laboratory testing and laboratory analysis will be required to assess settlement concerns. Monitoring during preloading or surcharging will also be required. Lastly, the buildings can be shifted to more favourable areas of the site, leaving less favourable areas for parking.

Where grades are raised under structures (buildings service pipes and pavement) the fill will need to be constructed as engineer fill.

Reference is made to Appendix A for guidelines for engineered fill construction. The following general highlights are provided:

- Strip existing topsoil, and other deleterious materials (possibly soft silty clay) down to competent native soil. The excavated soil should be segregated and stockpiled for reuse or disposal;

- Proofroll exposed subgrade using a heavy roller to a targeted 100% Standard Proctor maximum dry density, under geotechnical review. Where soft silty clay is present proof rolling may not be able to be performed. Also, wet areas/subgrade can be expected where perched water is present. In these areas proofrolling is subject to geotechnical review;

- Following geotechnical review and approval of the subgrade, spread approved material in maximum 200 mm thick lifts and uniformly compacted to 100% Standard Proctor maximum dry density in building areas and 95% Standard Proctor maximum dry density in pavement areas. In wet areas the use of Granular B Type II may be required for the first lift or two;

- Subject to geotechnical review during construction, the excavated granular soils above perched water are generally suitable for reuse as engineered fill, subject to remove of organics, topsoil, oversized (over 150 mm) or otherwise deleterious material. Material from within perched water areas will have to be dried out in order to render the material suitable for reuse. The excavated silty clay is not considered suitable for reuse as engineered fill. If imported fill is required, it should comprise OPSS Granular B or OPSS Select Subgrade Material (SSM). Other sources of imported material should be reviewed by our office to ensure suitability;

- The engineered fill pad must extend at least 1 m beyond the structure to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;

- Engineered fill construction must be carried out under full time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

Foundations

As noted above site grading or building slab elevations have not been established. Some general recommendations are provided below. The founding elevations and bearing resistance values will have to be reviewed when site grades have been determined.

For Building E in the northwest portion of the site, Boreholes 101 to 104 encountered dense to very dense soil typically below 1.5 to 2.0 m depth, locally 4.0 m depth in Borehole 104. Considering the proposed three levels of underground parking are assumed to extend about 9 to 10 m below existing grade the foundations for Building E are assumed to be founded within the very dense sand deposit.

Footings founded within the very dense sand deposit can be designed for a geotechnical bearing resistance at Serviceability Limit State (SLS) of 300 kPa, and a factored bearing resistance at Ultimate Limit State (ULS) of 450 kPa.

For the central and eastern parts of the site, the following table provides the available bearing resistance and subgrade soil on a borehole by borehole basis, for each building. It is noted that some areas have poor/weak soil where bearing resistance is limited and a deep foundation may be required where building loads are high.

BOREHOLE	DEPTH (m) / ELEVATION	GEOTECHNICAL BEARING RESISTANCE AT SLS (KPa)	FACTORED BEARING RESISTANCE AT ULS (KPa)	SOIL
Building A - One Storey Slab-on-Grade				
105	0.7 / 213.05	50	75	Silty Clay
	1.5 / 212.25	100	150	Till
	3.0 / 210.75	150	225	Till
106	0.7 / 213.5	150	225	Silty Clay
	1.5 / 212.7	300	450	Silty Sand
Building B - One Storey Slab-on-Grade (possible deep foundation)				
111	0.7 / 211.55	25	37	Sandy Silt Silty Clay
112	0.7 / 212.5	50	75	Sandy Silt Silty Clay
Building C - One Storey Slab-on-Grade (possible deep foundation)				
109	0.7 / 212.5	75	110	Sandy Silt/ Silty Clay
110	0.7 / 211.85	25	37	Silty Sand/ Silty Clay
Building D - One Storey Slab-on-Grade				
107	0.7 / 214.4	75	110	Silty Sand/ Silty Clay
108	0.7 / 212.6	75	110	Silty Sand/ Silty Clay
Building F – Four Storey Slab-on-Grade (possible deep foundation)				
116	0.7 / 212.0	50	75	Silty Clay
117	0.7 / 212.05	50	75	Sandy Silt/ Silty Clay
118	0.7 / 211.35	50	75	Silty Clay

BOREHOLE	DEPTH (m) / ELEVATION	GEOTECHNICAL BEARING RESISTANCE AT SLS (KPa)	FACTORED BEARING RESISTANCE AT ULS (KPa)	SOIL
Building D - One Storey Slab-on-Grade				
113	0.7 / 212.60	50	75	Silty Clay
114	0.7 / 212.05 2.1 / 212.1 3.0 / 211.2	50 100 150	110 150 225	Silty Clay Silty Sand Till
115	0.7 / 211.35 3.0 / 211.2	75 300	110 450	Silty Clay Silty Sand

If the building loading is more than the above bearing resistance values then a deep foundation, such as helical piles, may be required for the buildings. Further investigation will be required to aid with design of a deep foundation system.

The geotechnical bearing resistance at SLS is based on 25 mm or settlement in the bearing stratum with differential settlement not exceeding 75% of the value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent.

Prior to placement of structural concrete, all founding surfaces should be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

Seismic Design

Based on the soil profile revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site there is a low potential for liquefaction of soils to occur.

Floor Slab-on-Grade

Floor slab-on-grade construction is feasible on native soils or engineered fill, constructed as discussed earlier.

A minimum 200 mm thick base layer of crushed stone (nominal 20 mm size) is recommended directly beneath the floor slabs. Where a vapour sensitive floor finish is to be used then the use of polyethylene sheeting or similar means should be incorporation as a vapour barrier.

Exterior grades should be established to promote surface drainage away from the building.

Basement Walls and Floor Slabs

As much as three levels of underground parking are proposed for Building E, assumed to be 9 to 10 m below the ground floor slab. Perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls. The lateral earth pressure, P, may be computed using the following equation and assuming a triangular pressure distribution:

$$P = K(\gamma h + q) + C_p$$

Where
- P = lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of compacted backfill = 0.5
- h = depth below grade (m) at which lateral pressure is calculated
- γ = unit weight of compacted granular backfill = 22.0 kN/m^3
- q = surcharge loads (kPa)
- C_p = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, backfill should comprise free draining granular material conforming to OPSS Granular B. The native sand is generally considered to be free draining and a proprietary drainage board product can be utilized with on-site soils as backfill to ensure a proper drainage. A weeping tile system should be installed to prevent the build-up of hydrostatic pressure behind the wall. The weeping tiles should be protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet.

Foundation/basement wall backfill should be placed in thin lifts compacted to a minimum 95% Standard Proctor maximum dry density. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.

Basement floor slab construction is feasible on native soils.

In general, a minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. A polyethylene sheet vapour barrier should be incorporated under the ground floor slab if a vapour sensitive floor finish is planned.

Exterior grades should be established to promote surface drainage away from the buildings.

Site Servicing

Design details were not finalized at the time of this report. For purposes of this report, inverts are assumed to be as much as 3.0 m below existing grade.

Trench Excavation and Ground Water Control

Trench excavation and ground water control are described later in the report under Excavation and Ground Water Control.

Pipe Bedding

Native soils are generally expected at invert levels which are considered satisfactory for pipe support.

Where soft silty clay or other deleterious material is encountered at the design invert level, such material should be sub-excavated and replaced with an increased thickness of bedding material, subject to geotechnical field review and approval.

Standard Granular A bedding, in accordance with OPSS, compacted to 95% Standard Proctor maximum dry density should be satisfactory. For flexible pipes, bedding and cover material should comprise OPSS Granular A. For rigid pipes, the bedding material should comprise OPSS Granular A and cover material may comprise select native soil free of oversized material.

Trench Backfill

Backfill in trenches should comprise select inorganic soil and be placed in maximum 200 mm thick loose lifts compacted to at least 95% Standard Proctor maximum dry density to minimize post construction settlement in the backfill. Topsoil, organic, excessively wet, frozen oversized (greater than 200 mm), or otherwise deleterious material should not be incorporated as trench backfill. The moisture content of the trench backfill should be within 2% of the optimum moisture content in order to achieve the specified compaction and be close to optimum moisture content in the upper 1 m to prevent subgrade instability issues. Ideally the backfill should comprise excavated site soil, in order to minimize differential frost heave.

The excavated native granular soil will comprise silty sand/sand and silt/sandy silt/sand and locally the till or underlying sand/silty sand, till and sand and should generally be acceptable for reuse subject to moisture content control and removal of deleterious material and geotechnical review during construction. The silty clay soil is expected to be wet and will only be suitable for reuse if allowed to dry out, which will require considerable time and effort. As such, it may be impractical for use as trench backfill.

Earthworks operations should be inspected by PML to verify subgrade preparation, backfill materials, placement and compaction efforts and ensure the specified degree of compaction is achieved throughout.

Excavation and Ground Water Control

It is anticipated that excavation for the three levels of underground parking for Building E will extend about 9 to 10 m below grade in the higher northwestern part of the site. Excavation for buildings in the lower central and eastern portions of the site is expect to extend about 1.5 to 2.0 m below existing grade. Excavation for site servicing is assumed to extend 3.0 m below existing grade, across the site. Excavation will encounter the upper granular soil layers, the silty clay unit, and locally the underlying till or silty sand/sand. Harder digging and the presence of cobbles and boulders should be expected in the till and lower silty sand/sand deposits.

In general, the soils encountered at the site should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act (OHSA).

The silty clay encountered in Boreholes 109 to 113 and 116 to 118 was weak and should be considered as Type 4 soil and will require excavation sidewalls to be constructed at no steeper than 3H:1V from the base of the excavation in accordance with OHSA.

Excavation to 9 to 10 m depth in the higher northwest portion of the site is expected to be above the ground water table. Local perched water can be anticipated and can be handled by be managed using conventional sump pumping techniques.

In the lower lying central and eastern part of the site, no seepage or ground water was noted in the test pits (representing the upper 2 m of the site) and only perched water was encountered in some of the boreholes at about 2.0 to 5.0 m depth. Accordingly, it is expected that nuisance ground water seepage in the lower central and eastern parts of the site, for excavation to 2.0 to 3.0 m depth should also be managed using conventional sump pumping techniques.

Excavation during the dry time of the year when the ground water is generally at its lowest point would also aid in reducing ground water control requirements.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the Ministry of the Environment, Conservation and Parks (MECP). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed than more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-To-Take-Water (PTTW) is required.

Based on the conditions revealed in the boreholes and test pits, and anticipated excavation depths noted above, a PTTW or registry on the EASR is not anticipated as the excavation will generally be above the ground water table.

Pavement Design and Construction

The grading has not been determined and it is anticipated that the pavement subgrade will comprise near surface soils which are typically moderately to highly frost susceptible. The pavement structure thicknesses provided below are for preliminary planning purposes. When the pavement subgrade has been confirmed the pavement structure thickness should be reviewed and modified as required.

	LIGHT DUTY (CAR PARKING)	**HEAVY DUTY (FIRE ROUTE)**
Asphalt (mm)	80	110
Granular A Base Course (mm)	150	150
Granular B Subbase Course (mm)	400	550
Total Thickness (mm)	630	810

Following rough grading to the subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy compactor to a minimum 95% Standard Proctor maximum dry density under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replace with compacted select site material, subject to geotechnical field review.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B, and should be compacted to 100% Standard Proctor maximum dry density. Asphalt should be compacted in accordance with OPSS 310.

The pavement design considers that construction will be carried out during the drier time of the year and that the subgrade is stable, as determined by proofrolling operations. Where wet and/or unstable subgrade is identified, remediation may include increasing the depth of subbase, the use of Granular B Type II and/or use of geogrid reinforcement, subject to geotechnical review during construction.

For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. The incorporation of subdrains is recommended in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed at least 300 mm below the subgrade level. Refer to OPSD 216 Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance hole/catchbasins should be backfilled with free draining material with frost tapers and stub drains extending out from structures. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement.

Infiltration Parameters

Guelph Permeameter Testing

Guelph Permeameter (GP) tests were completed in Test Pits 101 to 107 at the locations shown on Drawing 2-1, appended. Tests were completed at depths of about 1.0 m and 1.5 to 2.0 m in each test pit to determine the field saturated hydraulic conductivity. For each GP test, the water level drop in the GP chamber was visually monitored and recorded until a steady infiltration rate was reached.

The field saturated hydraulic conductivity, K_{fs}, was determined utilizing the Zhang et al. (1998) Single Head Method:

$$K_{fs} = \frac{C_1 x Q_1}{2\pi {H_1}^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{a^*}\right)}$$

Where:

C = shape factor
Q = the steady-state rate of fall of water in reservoir (cm/s)
H = hydraulic head (cm)
α = borehole radius (cm)

Utilizing the method in the Toronto Region Conservation Authority (TRCA) LID Storm Water Management Planning and Design Guide, the K_{fs} value was utilized to established/determine infiltration rates based on the following equation. Factored infiltration rates were also determined.

$$Infiltrate\ Rate = \sqrt[3.7363]{\frac{K_{fs}}{6\ x\ 10^{-11}}}$$

The results of the GP testing are summarized below:

TEST PIT	TEST DEPTH (m)	MATERIAL TYPE	K_{fs} (cm/sec)	INFILTRATION RATE (mm/hr)	FACTORED INFILTRATION RATE (mm/hr)
101	GP1 Test 1 - 0.9 GP1 Test 2 - 2.1	Silty Sand Silty Sand Till	5.6×10^{-4} 9.1×10^{-4}	75 83	24
102	GP2 Test 1 - 1.4 GP2 Test 2 - 1.9	Silty Sand Silty Clay	6.1×10^{-5} 1.0×10^{-5}	40 25	10
103	GP3 Test 1 - 0.4 GP3 Test 2 - 1.7	Sandy Silt Sandy Silt	2.7×10^{-4} 6.0×10^{-4}	62 75	21
104	GP4 Test 1 - 0.6 GP4 Test 2 - 2.1	Sand and Silt Sand and Silt	1.4×10^{-3} 6.9×10^{-4}	96 78	31
105	GP5 Test 1 - 1.1 GP5 Test 2 - 1.9	Silty Sand Silty Clay	4.3×10^{-4} 1.0×10^{-5}	69 25	10
106	GP6 Test 1 - 1.0 GP6 Test 2 - 1.8	Sandy Silt Sandy Silt	5.4×10^{-4} 7.2×10^{-5}	73 43	17
107	GP7 Test 1 - 1.2 GP7 Test 2 - 1.9	Sandy Silt Sandy Silt	1.2×10^{-4} 1.7×10^{-3}	52 103	29

<u>Particle Size Distribution</u>

Four soil samples from the test pits were submitted for grain size analysis and Hydraulic Conductivity (K) was estimated based on the particle size distribution. The results of the laboratory testing are included in Figures 1-1 to 1-4 and an estimation of Hydraulic Conductivity is summarized in the table below.

SAMPLE	DEPTH (m)	SOIL TYPE	ESTIMATED K (cm/sec)
TP102 GP2 Test 2	2.1	Silty Clay; Trace to Some Sand	Less than 10^{-6}
TP103 GP3 Test 2	1.7	Sandy Silt, Some Clay	10^{-5} to 10^{-6}
TP104 GP4 Test 2	2.1	Silty Sand, Trace Gravel	10^{-3} to 10^{-4}
TP105 GP5 Test 2	1.9	Silty Clay; Trace to Some Sand	Less than 10^{-6}
TP106 GP6 Test 2	1.8	Sandy Silt, Some Clay	10^{-5} to 10^{-6}

The Vukovic & Soro method was used to assess K.

The K value derived from the particle size distribution curve does not take into consideration site specific details such as compaction, soil structure, organic content and/or the degree of saturation.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the final design drawings be submitted to PML for geotechnical review for compatibility with site conditions and recommendations of this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures and check the specified degree of compaction is achieved throughout.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on information revealed in the boreholes and test pits. Conditions away from and between boreholes/test pits may vary, particularly where foundation and/or service trenches exist. Geotechnical review during construction should be ongoing to confirm the subsurface conditions are substantially similar to those encountered in the boreholes/test pits, which may otherwise require modification to the original recommendations.

CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

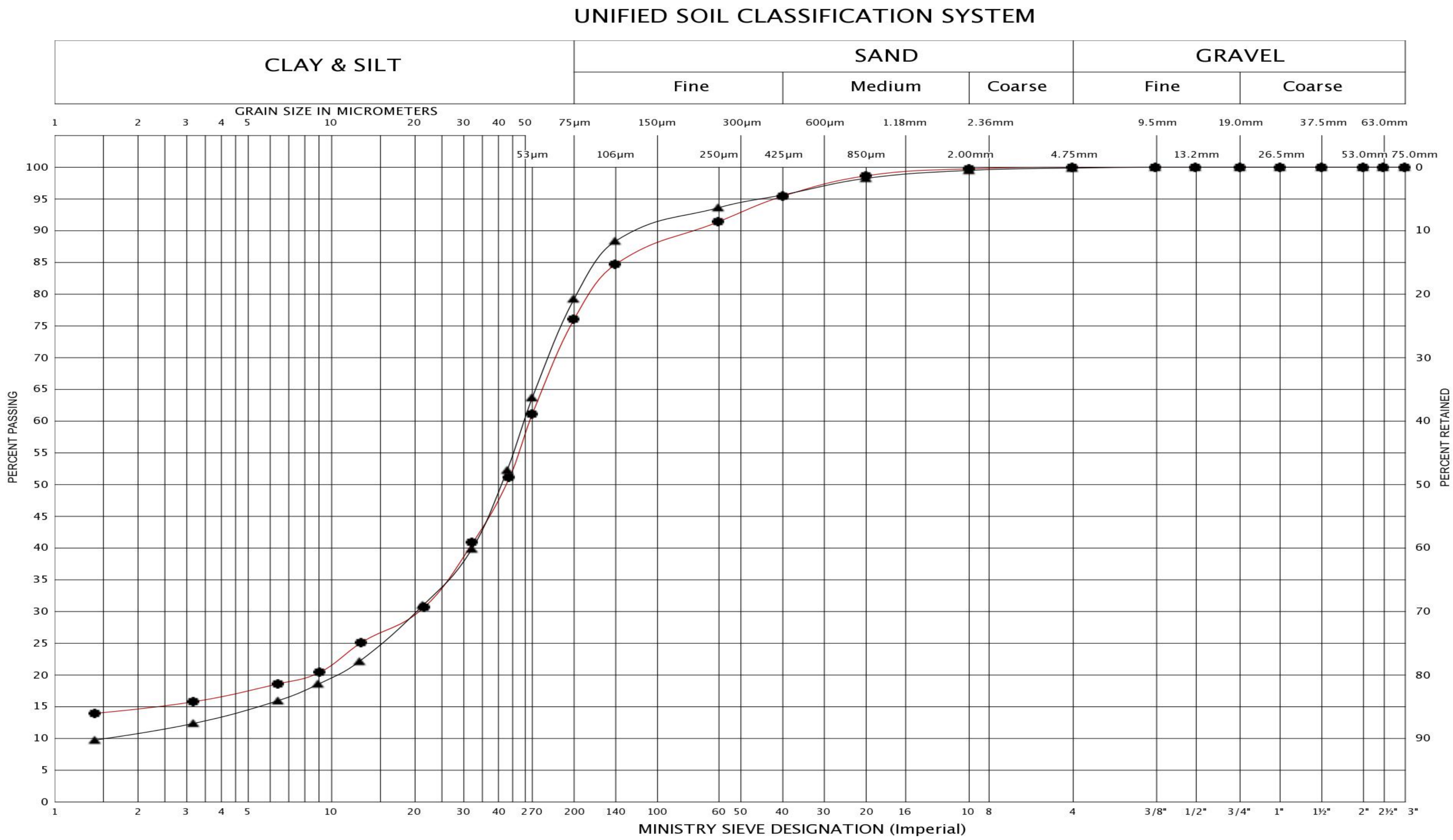
Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
G. R. WHITE
Dec 5/2018
PROVINCE OF ONTARIO

Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical and Geoenvironmental Services

GRW:jlb

Enclosures:
Figures 2-1 to 2-4 – Grain Size Distribution and Atterberg Limits Testing
List of Abbreviations
Log of Borehole Nos. 101 to 118
Log of Test Pits Nos. 101 to 107
Drawing 2-1 - Borehole and Test Pit Location Plan
Appendix A – Engineered Fill



LEGEND	TP	TP 103	TP 106
	SAMPLE	GP 2	GP 2
	SYMBOL	●	▲

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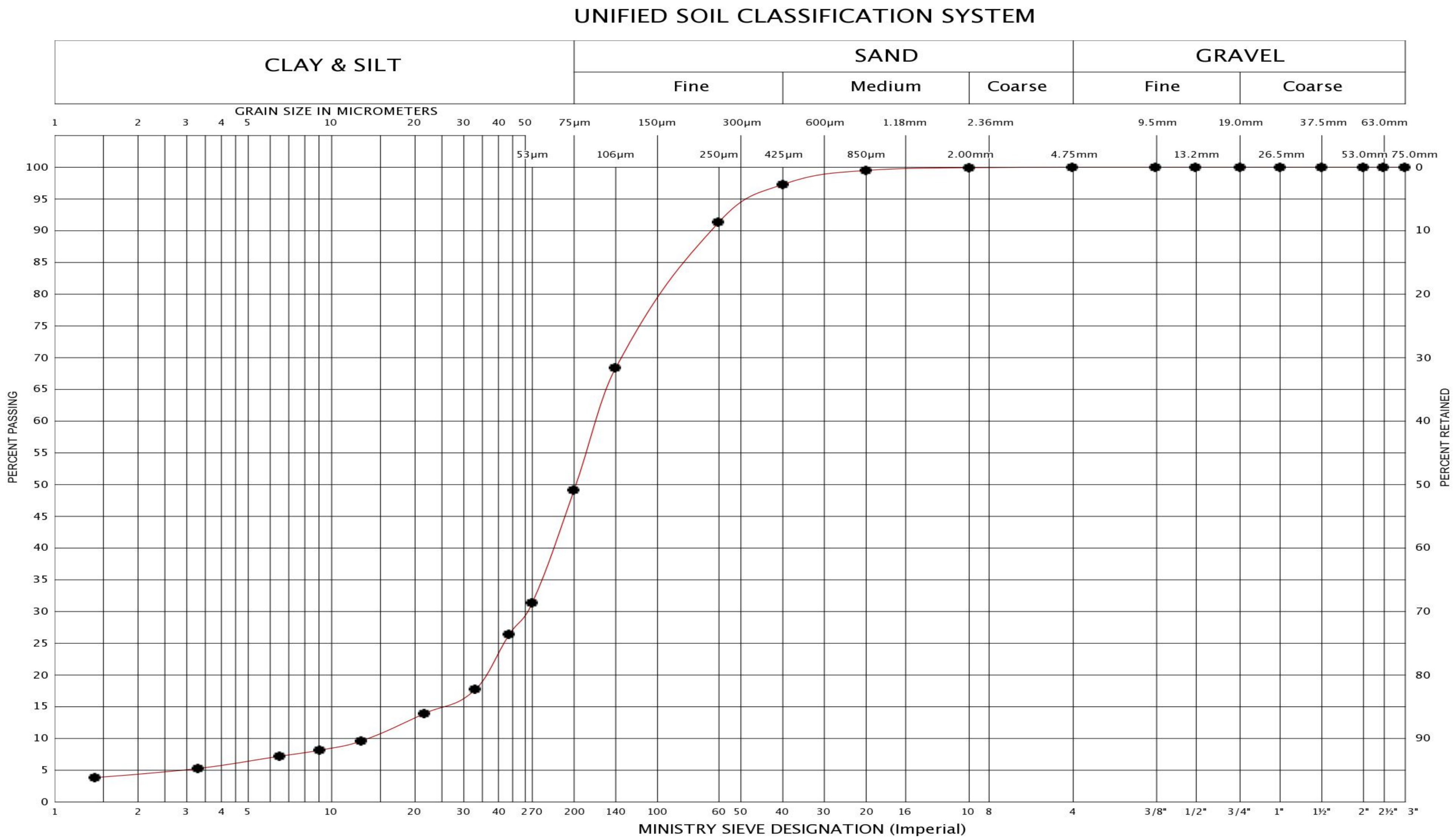
GRAIN SIZE DISTRIBUTION

SANDY SILT, Some Clay

FIG No.: 2-1

Project No.: 18BF056



LEGEND	TP	TP 104
	SAMPLE	GP 2
	SYMBOL	●

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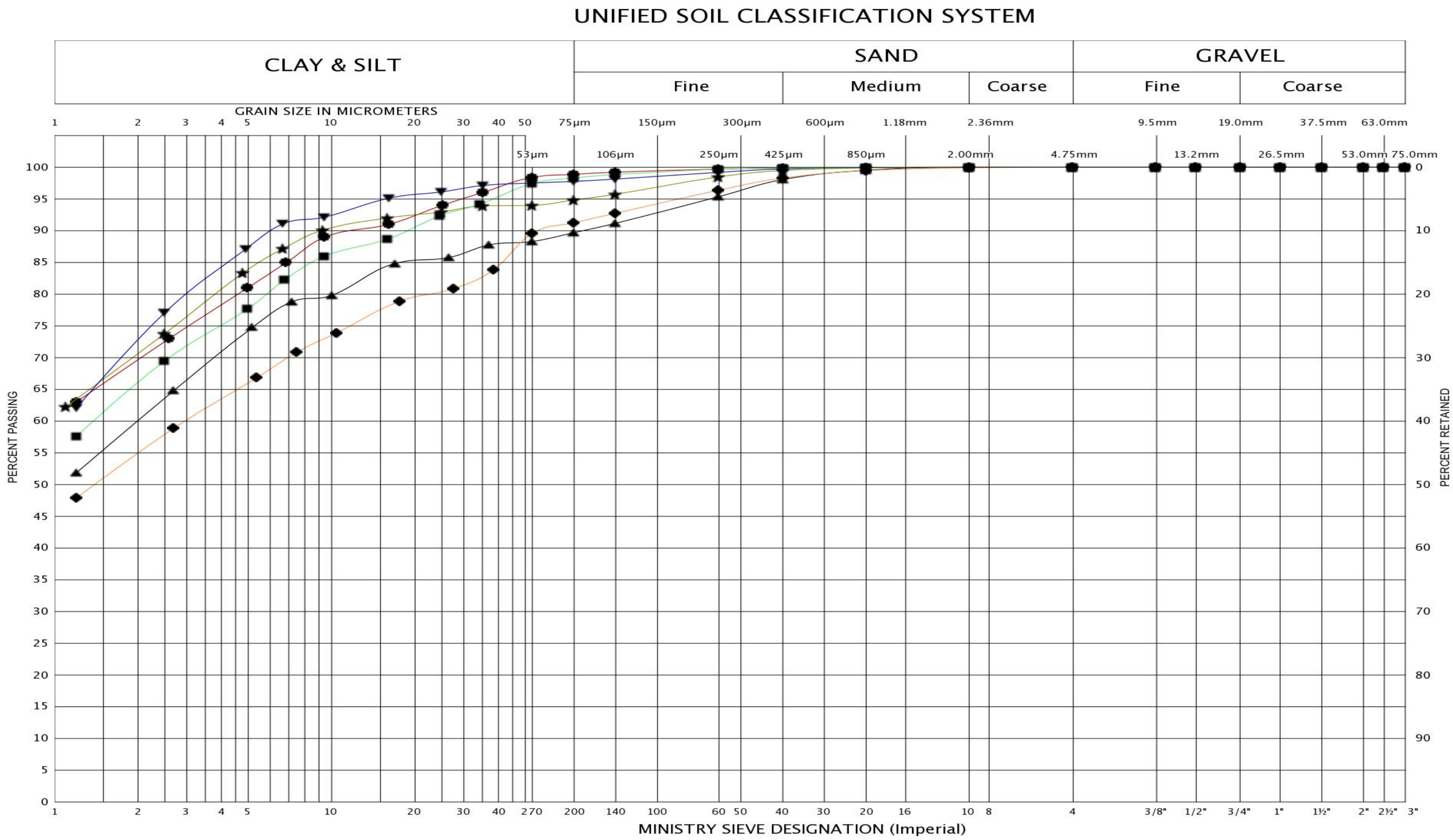
GRAIN SIZE DISTRIBUTION

SILTY SAND, Trace Clay

FIG No.: 2-2

Project No.: 18BF056



LEGEND	BH/TP	TP 102	TP 105	BH 110	BH 111	BH 113	BH 116
	SAMPLE	GP 2	GP 2	SS 4	SS 5	SS 4	SS 3
	SYMBOL	■	◆	▲	★	▼	⬢

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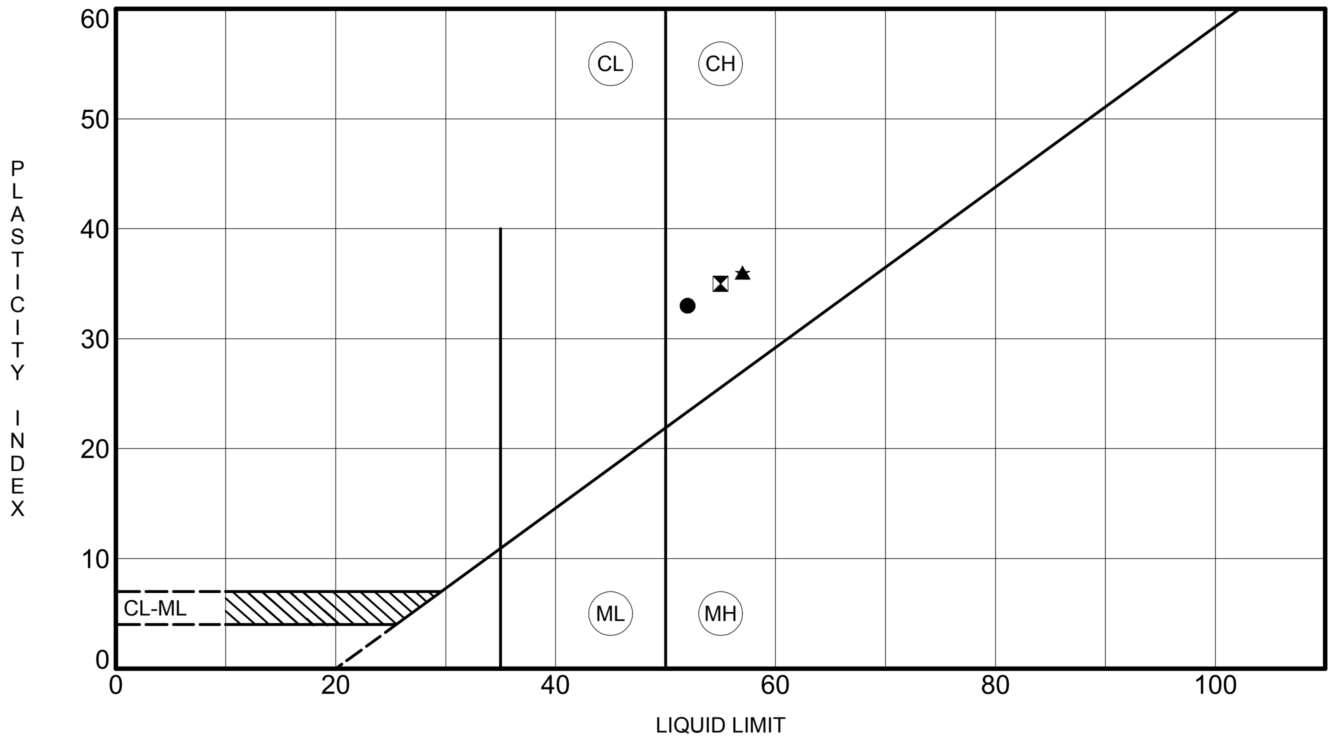
GRAIN SIZE DISTRIBUTION

SILTY CLAY, Trace to Some Sand; (CH)

FIG No.: 2-3

Project No.: 18BF056



Symbol	Borehole	Depth (m)	LL	PL	PI	Fines (%)	Classification
●	**110**	**2.52**	**52**	**19**	**33**	**89**	SILTY CLAY, Trace to Some Sand; (CH)
⧗	**111**	**3.28**	**55**	**20**	**35**	**94**	SILTY CLAY, Trace Sand; (CH)
▲	**113**	**2.52**	**57**	**21**	**36**	**98**	SILTY CLAY, Trace Sand; (CH)
★	**116**	**2.52**	**57**	**21**	**36**	**92**	SILTY CLAY, Trace Sand; (CH)

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ATTERBERG LIMITS' RESULTS

PROJECT Proposed Hotel & Conference Centre

LOCATION 16928 Highway 12, Midland, Ontario

OUR PROJECT NO. 18BF056 Figure 2-4

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTLL	Wetter Than Liquid Limit
WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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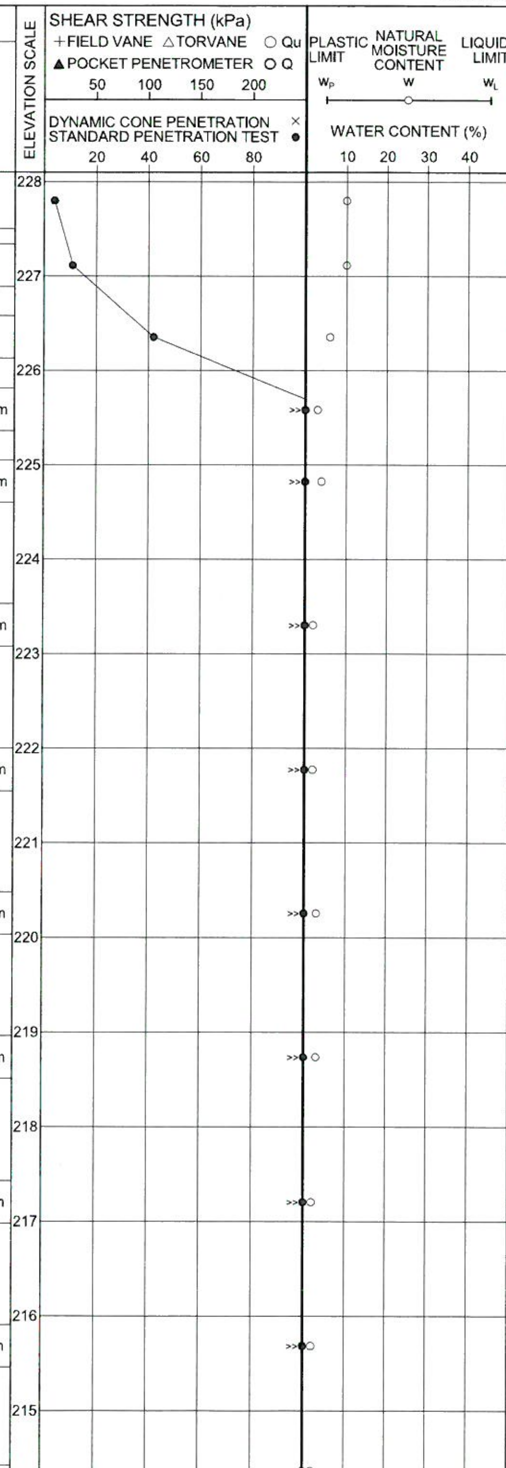
LOG OF BOREHOLE/MONITORING WELL NO. 101

17T 588442E 4952970N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE November 6, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 228.10

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT	GROUND WATER OBSERVATIONS AND REMARKS
0.30 / 227.80	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	4		Stick-up casing in concrete
0.70 / 227.40	SILTY SAND: Loose, brown, silty sand, trace gravel, moist					
	TILL: Compact to dense, brown to grey, silty sand, trace gravel, cobbles and boulders, moist	2	SS	11		
		3	SS	42		
2.1 / 226.0	SAND: Very dense, brown, sand, some gravel, trace silt, cobbles and boulders, moist	4	SS	50/275 mm		
		5	SS	50/275 mm		
		6	SS	50/275 mm		
		7	SS	50/275 mm		Bentonite seal
		8	SS	50/275 mm		
		9	SS	50/275 mm		
		10	SS	50/275 mm		
		11	SS	50/120 mm		50 mm slotted pipe Filter sand
13.8		12	SS	50/120 mm		
214.3	BOREHOLE TERMINATED AT 13.8 m					Upon completion of augering No water No cave Water Level Readings: Date / Depth / Elev. 2018-11-27 / Dry / -



NOTES

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LOG OF BOREHOLE NO. 102

17T 588486E 4952998N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE November 6, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 223.50

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	NATURAL MOISTURE CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
0.27 / 223.23	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	3		
1.00 / 222.50	SILTY SAND: Very loose to compact, brown, silty sand, trace gravel, moist	2	SS	20		
4.0 / 219.5	TILL: Compact to very dense, brown to grey, silty sand, trace gravel, cobbles and boulders, moist	3	SS	51		
		4	SS	59		
		5	SS	63/240 mm		
7.3 / 216.2	SAND: Very dense, brown, sand, some gravel, trace silt, cobbles and boulders, moist	6	SS	74/225 mm		
		7	SS	50/100 mm		
	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 7.3 m					Upon completion of augering: No water. Cave at 4.3 m

Column headings printed on the form: SOIL PROFILE (DEPTH / ELEV (metres), DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); ELEVATION SCALE; SHEAR STRENGTH (kPa) (+FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER O Q; 50 100 150 200); DYNAMIC CONE PENETRATION ×, STANDARD PENETRATION TEST ● (20 40 60 80); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10 20 30 40); UNIT WEIGHT kN/m³; GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

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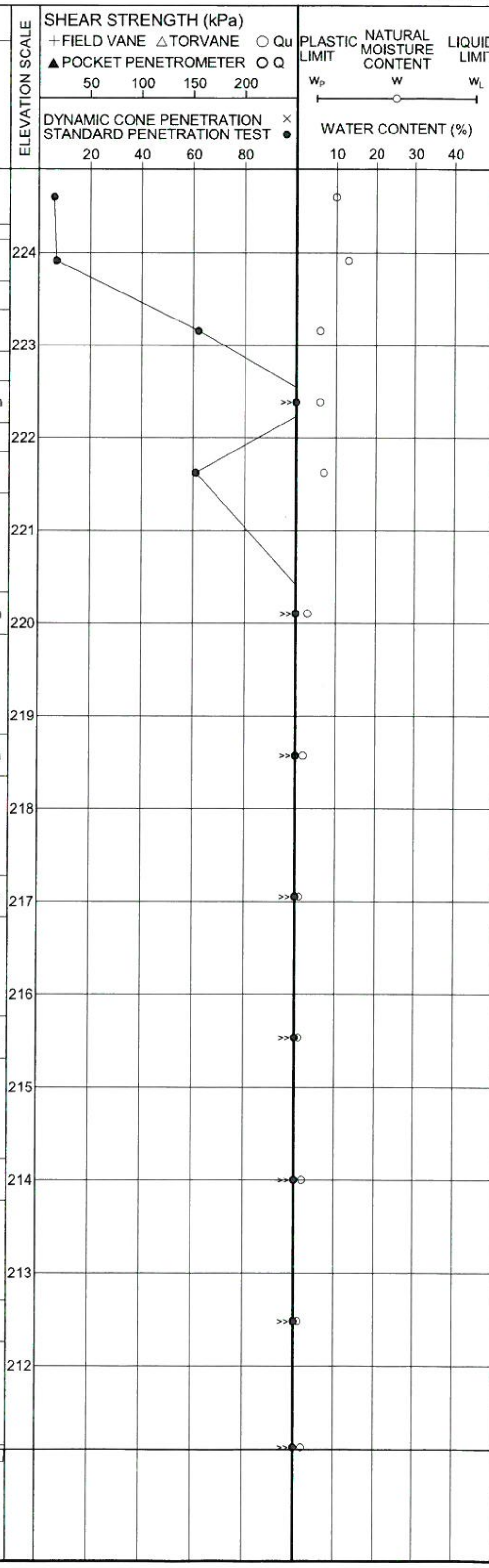
LOG OF BOREHOLE NO. 103

17T 588476E 4952917N

PROJECT Proposed Hotel & Conference Centre
PML REF. 18BF056
LOCATION 16928 Highway 12, Midland, Ontario
BORING DATE November 7, 2018
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN JR

SURFACE ELEVATION 224.90

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES
0.24 / 224.66	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	6
1.4 / 223.5	SILTY SAND: Loose, brown, silty sand, trace gravel, moist	2	SS	7
4.0 / 220.9	TILL: Very dense, brown to grey, silty sand, trace gravel, cobbles and boulders, moist	3	SS	62
		4	SS	67/275 mm
		5	SS	61
13.8 / 211.1	SAND: Very dense, brown, sand, some gravel, trace silt, cobbles and boulders, moist	6	SS	50/100 mm
		7	SS	72/290 mm
		8	SS	50/140 mm
		9	SS	92/215 mm
		10	SS	50/65
		11	SS	50/65
		12	SS	50/50 mm
	BOREHOLE TERMINATED AT 13.8 m			



GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering:
No water
Cave at 4.3 m

NOTES

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LOG OF BOREHOLE NO. 104

17T 588518E 4952946N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE November 7, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 219.40

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES
0.21 / 219.19	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	3
1.4 / 218.0	SILTY SAND: Very loose to loose, brown, silty sand, very moist to moist	2	SS	4
2.1 / 217.3	SAND: Dense, brown, sand, some silt, trace gravel, moist	3	SS	36
4.0 / 215.4	TILL: Compact, brown to grey, silty sand, trace gravel, cobbles and boulders, moist	4	SS	24
		5	SS	26
14.2 / 205.2	SAND: Very dense, brown, sand, some gravel, trace silt, cobbles and boulders, moist	6	SS	94/225 mm
		7	SS	92
		8	SS	50/125 mm
		9	SS	89/250 mm
		10	SS	97/275 mm
		11	SS	50/100 mm
		12	SS	90/290 mm
	BOREHOLE TERMINATED AT 14.2 m			

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q — 50 100 150 200
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● — 20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 10 20 30 40
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

GROUND WATER OBSERVATIONS AND REMARKS

Upon completion of augering:
No water
Cave at 4.5 m

NOTES

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LOG OF BOREHOLE NO. 105

17T 588681E 4953095N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 6, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 213.75

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
0.27 / 213.48	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	5		
1.4 / 212.4	SILTY CLAY: Firm, brown, silty clay, sand seams, APL to WTPL	2	SS	8		
5.0 / 208.8	TILL: Compact to dense, grey, silty sand to sandy silt, trace gravel, cobbles and boulders, moist (wet seams)	3	SS	10		
		4	SS	11		
		5	SS	17		First water strike at 3.1 m
		6	SS	29		
		7	SS	35		
	BOREHOLE TERMINATED AT 5.0 m					Upon completion of augering: Water at 4.9 m No cave

Column headings: SHEAR STRENGTH (kPa) — +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q (50 100 150 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20 40 60 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; STRAT PLOT; ELEVATION SCALE (213, 212, 211, 210, 209); DEPTH scale 0.0–15.0

NOTES

![PML logo] Peto MacCallum Ltd.
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LOG OF BOREHOLE/MONITORING WELL NO. 106

17T 588693E 4953134N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 7, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 214.20

SOIL PROFILE

DEPTH / ELEV (metres)	DESCRIPTION
0.24 / 213.96	TOPSOIL: Dark brown, sandy silt, trace clay, trace organics, moist
1.4 / 212.8	SILTY CLAY: Firm to stiff, brown, silty clay, trace sand, WTPL
5.0 / 209.2	SILTY SAND: Compact to very dense, brown, silty sand, trace gravel, sand seams, till-like layers, moist to wet. Wet seam (approx. 3.3 m)
	BOREHOLE TERMINATED AT 5.0 m

SAMPLES

NUMBER	TYPE	"N" VALUES	Approx. Depth (m)	Water Content (%)
1	SS	5	0.3	~33
2	SS	14	1.0	~33
3	SS	51	1.8	~9
4	SS	27	2.5	~11
5	SS	3*	3.3	~12
6	SS	36	4.0	~8
7	SS	39	4.8	~9

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50 100 150 200)
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20 40 60 80)
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30 40)
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

GROUND WATER OBSERVATIONS AND REMARKS

Stick-up casing in concrete
Bentonite seal
First water strike at 2.5 m
* - Suspected sample disturbed
50 mm slotted pipe
Filter sand

Upon completion of augering
Water at 4.0 m
No cave
Water Level Readings:

Date	Depth	Elev.
2018-11-27	1.7	212.5

NOTES

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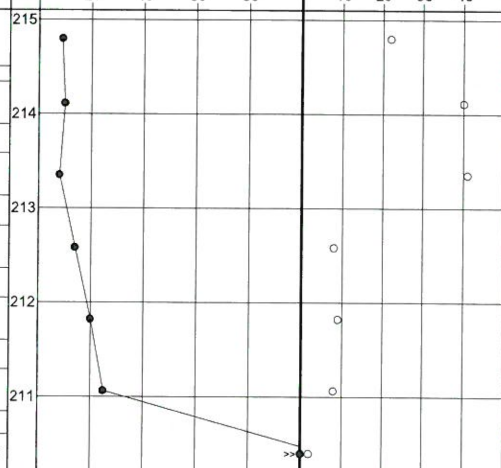
LOG OF BOREHOLE NO. 107

17T 588571E 4952940N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 215.10			
0.30 / 214.80	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	9
1.00 / 214.10	SILTY SAND: Loose, brown, silty sand, very moist			
2.1 / 213.0	SILTY CLAY: Stiff, brown, silty clay, sand seams, WTPL	2	SS	10
		3	SS	8
3.7 / 211.4	SILTY SAND: Compact, brown, silty sand, trace gravel, moist	4	SS	14
		5	SS	20
4.4 / 210.7	TILL: Compact, grey, silty sand, trace gravel, cobbles and boulders, moist	6	SS	25
4.9 / 210.2	SAND: Very dense, grey, sand, some silt, moist	7	SS	76/225 mm
	BOREHOLE TERMINATED AT 4.9 m			



UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering:
No water
No cave

NOTES

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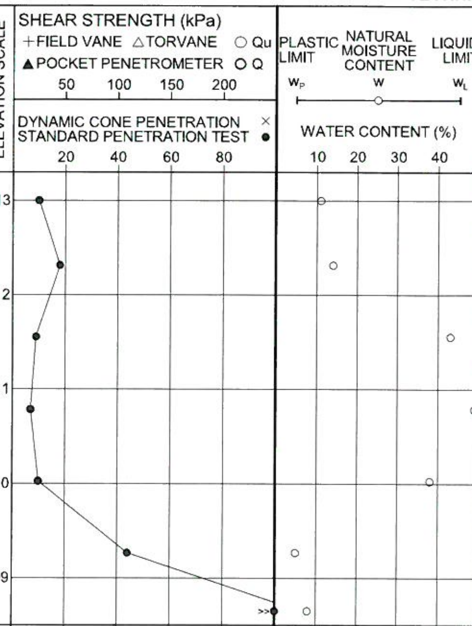
LOG OF BOREHOLE/MONITORING WELL NO. 108

17T 588606E 4952997N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 213.30				
0.27 / 213.03	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	10	Stick-up casing in concrete
	SANDY SILT: Compact, brown, sandy silt, moist	2	SS	18	
1.4 / 211.9	SILTY CLAY: Firm to stiff, brown, silty clay, sand seams, WTPL	3	SS	9	Bentonite seal
		4	SS	7	
		5	SS	10	
3.7 / 209.6	TILL: Dense to very dense, grey, silty sand, trace gravel, cobbles and boulders, moist	6	SS	44	50 mm slotted pipe Filter sand
		7	SS	64/250 mm	
4.8 / 208.5	BOREHOLE TERMINATED AT 4.8 m				Upon completion of augering No water No cave Water Level Readings: Date / Depth / Elev. 2018-11-27 / Dry / -



Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; ELEVATION SCALE; UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Depth scale (m): 0.0 – 15.0

NOTES

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LOG OF BOREHOLE NO. 109

17T 588634E 4952979N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 213.20

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
0.30 / 212.90	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	6		
1.4 / 211.8	SILTY SAND: Loose to compact, brown, silty sand, moist to very moist	2	SS	14		
4.0 / 209.2	SILTY CLAY: Stiff to firm, brown, silty clay, WTPL	3	SS	11		
		4	SS	7	55	
		5	SS	7		
5.0 / 208.2	TILL: Compact, grey, silty sand, trace gravel, cobbles and boulders, moist	6	SS	25		
	BOREHOLE TERMINATED AT 5.0 m					Upon completion of augering No water No cave

Chart columns: SHEAR STRENGTH (kPa) — + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL. ELEVATION SCALE 213–209. Depth scale 0.0–15.0.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 110

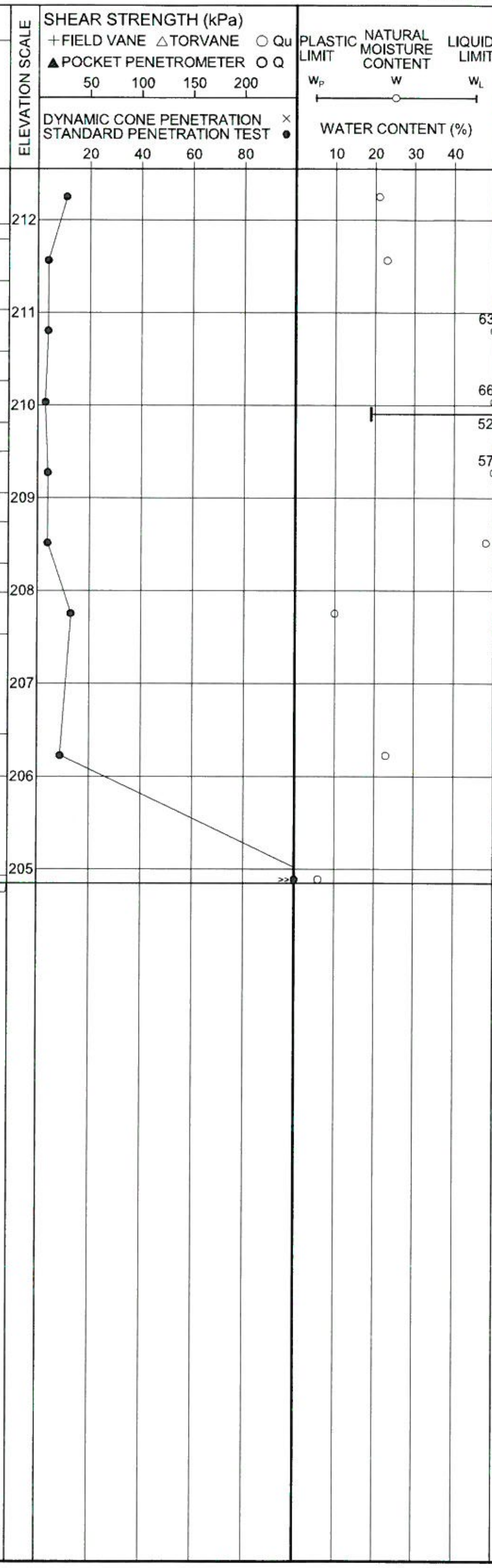
17T 588667E 4953036N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 212.55

DEPTH / ELEV (metres)	DESCRIPTION
0.20 / 212.35	TOPSOIL: Dark brown, silty sand, trace organics, moist
1.4 / 211.2	SILTY SAND: Compact to loose, brown to grey, silty sand, moist to very moist
4.5 / 208.1	SILTY CLAY: Soft, brown, silty clay, some sand, WTLL Sand seams
7.0 / 205.6	SILTY SAND: Compact to loose, brown, silty sand, till-like layers, very moist to wet
7.7 / 204.9	TILL: Very dense, grey, silty sand, trace gravel, cobbles and boulders, moist
	BOREHOLE TERMINATED AT 7.7 m

SAMPLE NUMBER	TYPE	"N" VALUES
1	SS	11
2	SS	4
3	SS	4
4	SS	3
5	SS	4
6	SS	4
7	SS	13
8	SS	9
9	SS	50/90 mm



GROUND WATER OBSERVATIONS AND REMARKS (GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL)

First water strike at 5.0 m

Upon completion of augering:
Water at 5.3 m
Cave at 5.5 m

NOTES

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LOG OF BOREHOLE/MONITORING WELL NO. 111

17T 588695E 4953019N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 212.25

DEPTH (m) / ELEV	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	NATURAL MOISTURE / LIQUID LIMIT	GROUND WATER OBSERVATIONS AND REMARKS
0.25 / 212.00	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	9		Stick-up casing in concrete
	SANDY SILT: Loose, brown to grey, sandy silt, very moist	2	SS	8		
1.4 / 210.9	SILTY CLAY: Soft to firm, brown, silty clay, trace sand, WTLL	3	SS	4	57	Bentonite seal
		4	SS	4	64	
		5	SS	5	64, 55	
		6	SS	3	69	50 mm slotted pipe Filter sand
		7	SS	7	62	First water strike at 4.6 m
5.0 / 207.3	BOREHOLE TERMINATED AT 5.0 m					

Upon completion of augering:
Water at 4.6
No cave

Water Level Readings:

Date	Depth	Elev.
2018-11-27	3.1	209.2

Legend: SHEAR STRENGTH (kPa): + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 112

17T 588729E 4953077N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 213.20

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.40	FILL: Dark brown to brown, silty sand, trace organics, moist	1	SS	14	
212.80	SANDY SILT: Compact to loose, brown to grey, sandy silt, sand layers, moist to wet	2	SS	10	
		3	SS	14	First water strike at 2.0 m
2.9		4	SS	6	
210.3	SILTY CLAY: Firm, brown, silty clay, trace sand, WTLL to WTPL	5	SS	5	Water content 57
		6	SS	8	
		7	SS	6	Water content 58
7.0		8	SS	8	
206.2	TILL: Dense, grey, silty sand, trace gravel, cobbles and boulders, moist (wet seams)	9	SS	47	
8.2 / 205.0	BOREHOLE TERMINATED AT 8.2 m				Upon completion of augering: Water at 2.0 m Cave at 3.5 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ● Q; 50 100 150 200
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30 40
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 113

17T 588669E 4952953N

PROJECT Proposed Hotel & Conference Centre
PML REF. 18BF056
LOCATION 16928 Highway 12, Midland, Ontario
BORING DATE November 8, 2018
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN JR

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 213.30						
0.29 / 213.01	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	2	213		
0.70 / 212.60	SANDY SILT: Very loose, brown, sandy silt, moist						
	SILTY CLAY: Stiff to soft, brown to grey, silty clay, trace sand, WTPL	2	SS	11	212		
		3	SS	8		52	
		4	SS	8	211	54, 57	
		5	SS	2	210	53	
4.0 / 209.3	TILL: Compact, grey, silty sand, trace gravel, cobbles and boulders, moist (wet seams)				209		
		6	SS	11			
5.0 / 208.3	BOREHOLE TERMINATED AT 5.0 m						Upon completion of augering No water No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

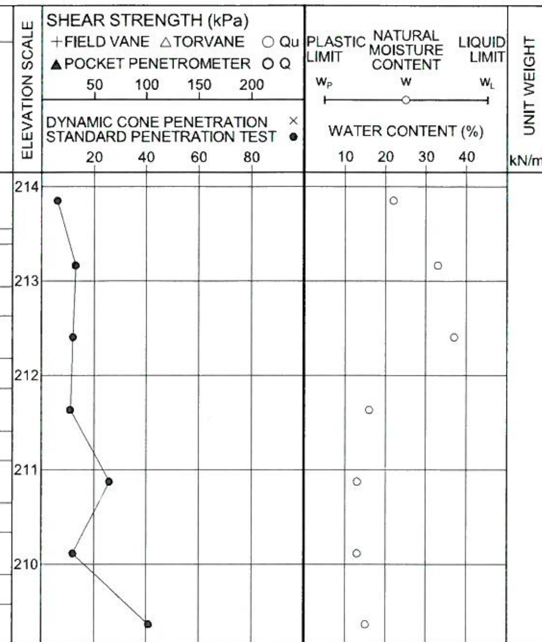
LOG OF BOREHOLE/MONITORING WELL NO. 114

17T 588660E 4952919N

PROJECT Proposed Hotel & Conference Centre
PML REF. 18BF056
LOCATION 16928 Highway 12, Midland, Ontario
BORING DATE November 9, 2018
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN JR

SURFACE ELEVATION 214.15

DEPTH / ELEV (metres)	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.30 / 213.85	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	6	Stick-up casing in concrete
0.70 / 213.45	SANDY SILT: Loose, brown, sandy silt, very moist				
	SILTY CLAY: Stiff, brown, silty clay, trace sand, WTPL	2	SS	13	Bentonite seal
		3	SS	12	
2.1 / 212.1	SILTY SAND: Compact, brown, silty sand, trace gravel, moist	4	SS	11	
2.9 / 211.3	TILL: Compact to dense, brown to grey, silty sand, trace gravel, cobbles and boulders, moist	5	SS	26	
		6	SS	12	50 mm slotted pipe Filter sand
		7	SS	41	
5.0 / 209.2	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering: No water No cave



GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Water Level Readings:

Date	Depth	Elev.
2018-11-27	Dry	-

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 115

17T 588697E 4952911N

PROJECT Proposed Hotel & Conference Centre
PML REF. 18BF056
LOCATION 16928 Highway 12, Midland, Ontario
BORING DATE November 8, 2018
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN JR

SURFACE ELEVATION 214.20

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
0.22 / 213.98	TOPSOIL: Dark brown, silty sand, trace organics, moist					
	SANDY SILT: Loose to compact, dark brown to brown, sandy silt, moist	1	SS	6		
		2	SS	15		
1.4 / 212.8	SILTY CLAY: Stiff, brown to grey, silty clay, trace sand, APL to WTPL	3	SS	11	54	
	Sandy silt layers	4	SS	12		
2.9 / 211.3	SILTY SAND: Very dense to dense, brown, silty sand, trace gravel, moist	5	SS	50/125 mm		
		6	SS	3*		* - Suspected sample disturbed
		7	SS	46		
5.0 / 209.2	BOREHOLE TERMINATED AT 5.0 m					Upon completion of augering: No water No cave

Chart headings: SHEAR STRENGTH (kPa) — + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, O Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION ×, STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; STRAT PLOT; ELEVATION SCALE (214, 213, 212, 211, 210).

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 116

17T 588717E 4952952N

PROJECT Proposed Hotel & Conference Centre

LOCATION 16928 Highway 12, Midland, Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE November 9, 2018

PML REF. 18BF056

ENGINEER GW

TECHNICIAN JR

DEPTH / ELEV (metres)	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%) / UNIT WEIGHT (kN/m³)	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 212.70					
0.30 / 212.40	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	4		
0.70 / 212.00	SANDY SILT: Loose, brown, sandy silt, wet					
	SILTY CLAY: Firm to stiff, brown to grey, silty clay, trace sand, WTLL to WTPL	2	SS	9	52	
		3	SS	7	68	
		4	SS	10	61, 57	
		5	SS	7	65	
	Sand seams	6	SS	9		
4.5 / 208.2	TILL: Very dense, grey, silty sand, trace gravel, cobbles and boulders, moist	7	SS	64/225 mm		
5.0 / 207.7	BOREHOLE TERMINATED AT 5.0 m					Upon completion of augering: No water No cave

Column headings: SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; STRAT PLOT; ELEVATION SCALE (212, 211, 210, 209, 208).

NOTES

Peto MacCallum Ltd. CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 117

17T 588759E 4952956N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 9, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

DEPTH (m)	ELEV (m)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%) / LIQUID LIMIT	SHEAR STRENGTH / SENSITIVITY	GROUND WATER OBSERVATIONS AND REMARKS
0.0	212.75	SURFACE ELEVATION 212.75						
0.35	212.40	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	8			
		SANDY SILT: Loose to compact, brown, sandy silt, some clay, moist to very moist	2	SS	18			
			3	SS	15			
2.1	210.7	SILTY CLAY: Firm to stiff, brown to grey, silty clay, trace sand, WTLL	4	SS	6	62		
			5	SS	4	74		
			6	FV	-		+6	
			7	SS	7	51		
5.0	207.8	BOREHOLE TERMINATED AT 5.0 m						Upon completion of augering: No water No cave

Legend: + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

+3 SENSITIVITY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 118

17T 588771E 4952986N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE November 9, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN JR

SURFACE ELEVATION 212.05

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.32 / 211.73	TOPSOIL: Dark brown, silty sand, trace organics, moist	1	SS	4	Stick-up casing in concrete
0.70 / 211.35	SANDY SILT: Loose, brown to grey, sandy silt, moist				
	SILTY CLAY: Firm to stiff, brown to grey, silty clay, trace sand, WTPL	2	SS	7	
		3	SS	4	Bentonite seal. First water strike at 1.4 m
		4	SS	7	
		5	SS	8	
		6	FV	-	50 mm slotted pipe. Filter sand
		7	SS	7	
5.0 / 207.1	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering: Water at 4.0 m. No cave

Liquid limit values plotted: 59 (sample 3), 70 (sample 4), 65 (sample 7).

Water Level Readings:

Date	Depth	Elev.
2018-11-27	0.4	211.7

Legend: SHEAR STRENGTH (kPa): + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

+3 SENSITIVITY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 101

17T 588521E 4953001N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 219.35				
0.30 / 219.05	TOPSOIL: Dark brown, silty sand, moist				
1.1 / 218.3	SILTY SAND: Loose, brown, silty sand, trace gravel, moist	1	GS	-	GP1 Test One
2.1 / 217.3	TILL: Compact to dense, brown, silty sand, trace gravel, cobbles and boulders, moist	2	GS	-	GP1 Test Two
	TEST PIT TERMINATED AT 2.1 m				Upon completion of excavating No water No cave

Chart headings: SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200. DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80. PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30 40. UNIT WEIGHT kN/m³. GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL. ELEVATION SCALE: 219, 218. Depth scale: 0.0 – 10.0.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 102

17T 588598E 4953019N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

SURFACE ELEVATION 213.80

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.0	TOPSOIL: Dark brown, silty sand, trace gravel, moist				
0.45 / 213.35	SILTY SAND: Loose to compact, brown, silty sand, moist	1	GS	-	GP2 Test One
1.5 / 212.3	SILTY CLAY: Firm, brown, silty clay, trace sand, WTPL	2	GS	-	GP2 Test Two
1.9 / 211.9	TEST PIT TERMINATED AT 1.9 m				Upon completion of excavating No water No cave

Chart column headings: SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; ELEVATION SCALE 213, 212.

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 103

17T 588701E 4953077N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

DEPTH / ELEV (metres)	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (WATER CONTENT %)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 213.30									
0.10 / 213.20	TOPSOIL: Dark brown, silty sand, trace gravel, moist									
	SANDY SILT: Compact, brown, sandy silt, some clay, moist		1	GS	-	213				GP3 Test One
						212				
1.7			2	GS	-					GP3 Test Two
211.6	TEST PIT TERMINATED AT 1.7 m									Upon completion of excavating No water No cave

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

Shear strength scale: 50, 100, 150, 200; Penetration scale: 20, 40, 60, 80; Water content scale: 10, 20, 30, 40

Legend: + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; W_P, W, W_L

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 104

17T 588524E 4952936N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu; ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80
PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30 40
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 219.55						
0.30	TOPSOIL: Dark brown, silty sand, trace gravel, moist						
219.25	SAND AND SILT: Loose to compact, brown, sand and silt, trace clay, moist		1	GS	-	219	GP4 Test One
						218	
2.1			2	GS	-		GP4 Test Two
217.5	TEST PIT TERMINATED AT 2.1 m						Upon completion of excavating No water No cave

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 105

17T 588643E 4952973N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (WATER CONTENT %)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 213.20									
0.0	TOPSOIL: Dark brown, silty sand, moist					213				
0.30 / 212.90	SILTY SAND: Loose, brown, silty sand, moist		1	GS	-	212				GP5 Test One
1.7	SILTY CLAY: Firm, brown, silty clay, trace sand, WTPL		2	GS	-					GP5 Test Two
1.9 / 211.3	TEST PIT TERMINATED AT 1.9 m									Upon completion of excavating No water No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 106

17T 588735E 4952993N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 212.00									
0.25	TOPSOIL: Dark brown, silty sand, trace gravel, moist									
211.75	SANDY SILT: Loose to compact, brown, sandy silt, some clay, moist		1	GS	-	211				GP6 Test One
			2	GS	-					GP6 Test Two
1.8 / 210.2	TEST PIT TERMINATED AT 1.8 m									Upon completion of excavating No water No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 107

17T 588665E 4952907N

PROJECT Proposed Hotel & Conference Centre
LOCATION 16928 Highway 12, Midland, Ontario
EXCAVATION METHOD Excavator
BORING DATE November 8, 2018
PML REF. 18BF056
ENGINEER GW
TECHNICIAN AK/AT

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 214.50					
0.30	TOPSOIL: Dark brown, silty sand, trace gravel, moist					
214.20	SANDY SILT: Loose to compact, brown, sandy silt, some clay, moist to very moist				214	
		1	GS	-		GP7 Test One
					213	
1.9		2	GS	-		GP7 Test Two
212.6	TEST PIT TERMINATED AT 1.9 m					Upon completion of excavating No water No cave

Chart columns (no data plotted): SHEAR STRENGTH (kPa) +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q, 50 100 150 200; DYNAMIC CONE PENETRATION ×, STANDARD PENETRATION TEST ●, 20 40 60 80; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L, WATER CONTENT (%) 10 20 30 40; UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

NOTES

KEY PLAN
MIDLAND, ONTARIO

LEGEND:

BH 101 EL. 228.10 — BOREHOLE 101 (WITH MONITORING WELL) SURFACE ELEVATION

BH 102 EL. 223.50 — BOREHOLE 102 SURFACE ELEVATION

TP 101 EL. 219.35 — TEST PIT 101 SURFACE ELEVATION

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.

0m 10 20 30 40 50 75

SCALE

BOREHOLE AND TEST PIT LOCATION PLAN

PROPOSED HOTEL & CONFERENCE CENTRE
16928 HIGHWAY 12
MIDLAND, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	RB	DEC. 2018	AS SHOWN	18BF056	2-1
APPROVED	GW				

APPENDIX A

Engineered Fill

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and

- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

APPENDIX

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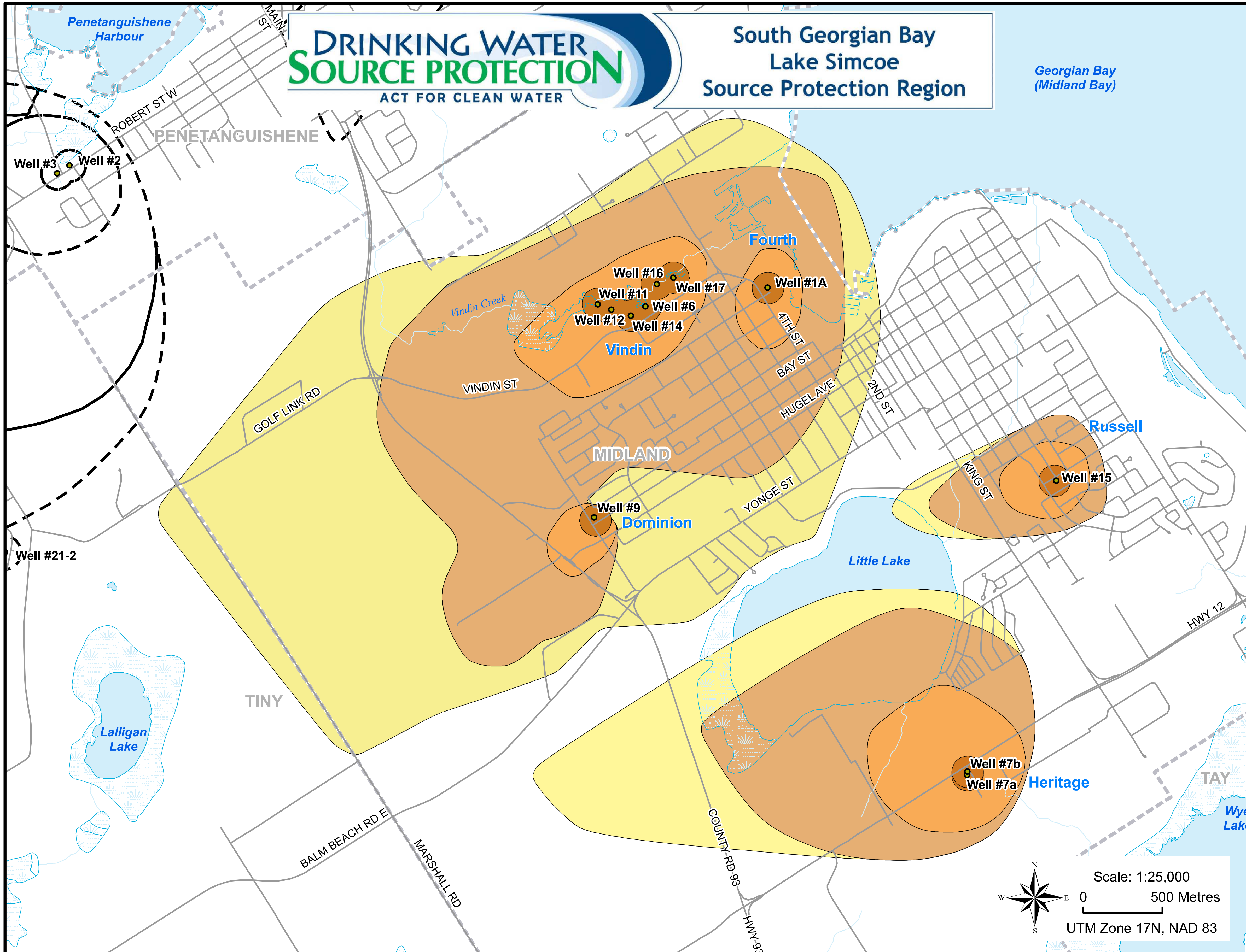
FIGURE 7A-1 OF SEVERN SOUND SOURCE PROTEDTION AREA APPROVED ASSESSMENT REPORT



Town of Midland Wellhead Protection Areas

LEGEND

- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C1 (10 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

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Ontario

7a-1

This map was produced for the Town of Midland for the purpose of updating the South Georgian Bay Lake Simcoe Assessment Report Supplement. Base data have been compiled from various sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.