Sheridan Park Drive Extension Municipal Class Environmental Assessment

Stormwater Management Report

City of Mississauga

R.J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga ON L5N 8R9 CANADA

January 18, 2018
300039474.0000

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
0	Yes	Yes	City of Mississauga

Record of Revisions

Revision	Date	Description
0	December 19, 2017	Draft Submission to City
1	January 12, 2018	Second Draft Submission to City and Credit Valley Conservation
2	January 18, 2018	Final Submission to City of Mississauga

R.J. Burnside & Associates Limited

Report Prepared By:

Harold Faulkner, P.Eng.
Project Engineer
HF:mb/bs

Report Reviewed By:

Tony Elias, P.Eng.
Sr. Water Resources Engineer
TE:mb/bs

Table of Contents

Tables

Figures

Appendices

Plans

Plan C: Drainage Management Plans

Disclaimer

Other than by the addressee, copying or distribution of this document, in whole or in part, is not permitted without the express written consent of R.J. Burnside & Associates Limited.

R.J. Burnside & Associates Limited makes no warranties, either express or implied, of merchantability and fitness of the documents and other instruments of service for any purpose other than that specified by the contract.

1.0 Introduction

The City of Mississauga (City) has undertaken a Municipal Class Environmental Assessment (EA) to investigate the proposed extension of Sheridan Park Drive between Homelands Drive and Speakman Drive in the southwestern area of Mississauga. R.J. Burnside & Associates Limited (Burnside) has facilitated the EA on behalf of the City.

The Study has followed a comprehensive planning and design process in order to explore the opportunity to connect the east and west sections of Sheridan Park Drive, improve the road network connectivity in the residential neighbourhood and business area, create options for alternative routes and improve multi-modal network connectivity. The Study has been completed in accordance with the requirements of a Schedule B Undertaking as outlined in the Municipal Engineers Association Municipal Class Environmental Assessment Document (October 2000, as amended 2007, 2011 & 2015), which is an approved process under the *Ontario Environmental Assessment Act.*

As part of the EA Study, Burnside has completed a Stormwater Management Report to provide a stormwater management and conveyance assessment and initial design.

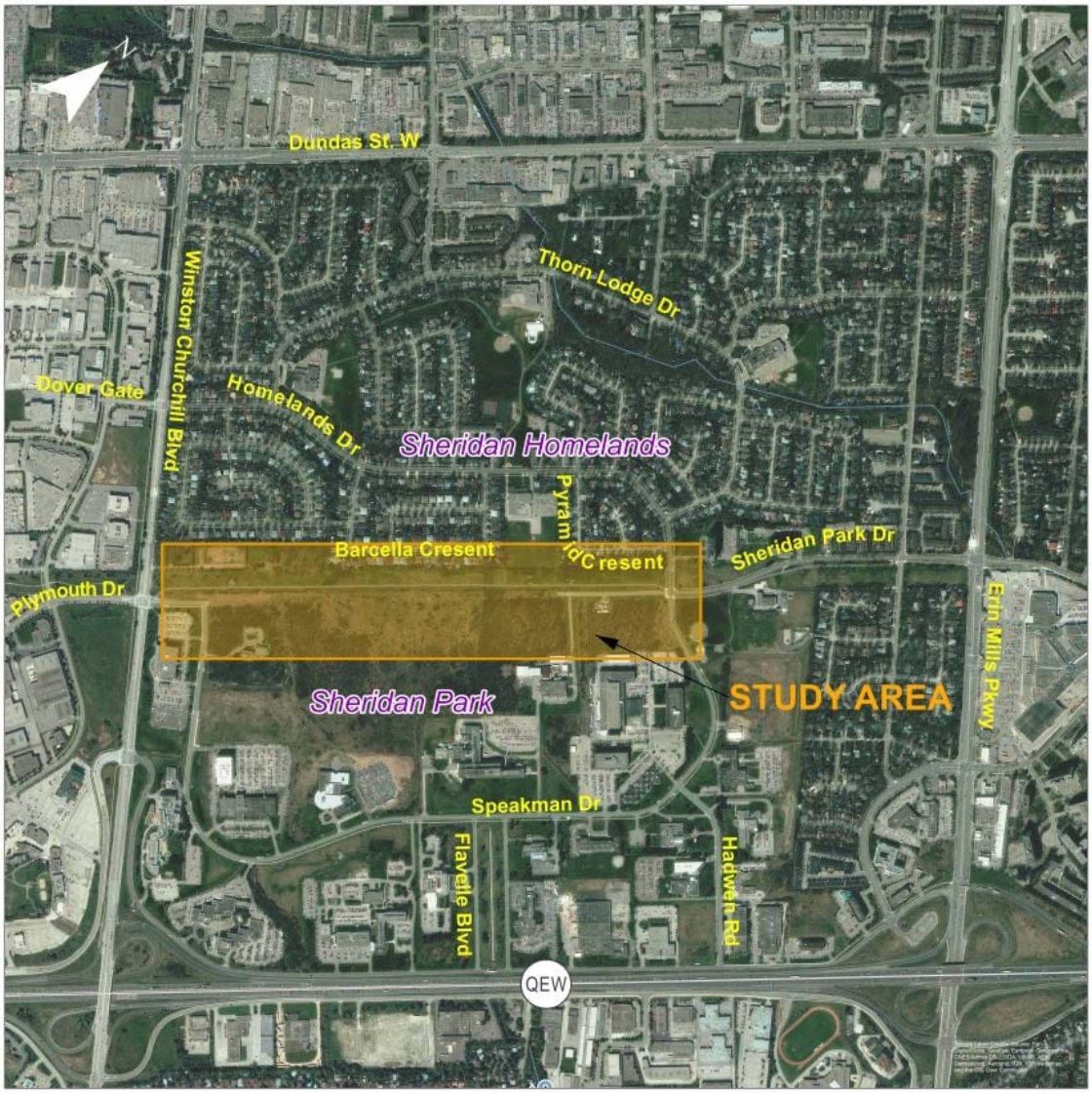
1.1 Description of Study Area

The Study Area is generally bordered by a utility corridor to the north, Winston Churchill Boulevard to the west, Speakman Drive/Homelands Drive to the east and naturalized private lands to the south. The Study Area is illustrated on Figure 1-1. The proposed extension of Sheridan Park Drive falls within the existing City of Mississauga owned right-of-way (ROW), which runs through the centre part of the Study Area.

The Study Area includes a unique combination of uses including the Sheridan Park Corporate Centre (Sheridan Park), a utility corridor that includes a multi-use trail (MUT) and the Sheridan Homelands residential neighbourhood.

Sheridan Park is a 340 acre corporate centre, which is primarily designated Business Employment in the City of Mississauga's Official Plan (MOP). The majority of Sheridan Park is occupied by private industries and businesses, which include in their landholdings significant natural areas particularly on the north side of corporate centre, within the Study Area. These naturalized areas include two wooded areas that are identified as Significant Natural Areas in the City's Natural Areas Survey (2016 Update).

Figure 1-1: Study Area



2.0 Design Criteria

The hydrologic and hydraulic design criteria were based on the City design guidelines for a major collector road, and Ministry of the Environment and Climate Change (MOECC) water quality guidelines. The Study Area is also located within the Credit Valley Conservation (CVC) watershed and the Sheridan Creek sub-watershed.

Typically, stormwater quantity control measures are required to ensure post-development peak flow rates do not exceed pre-development levels. For the purposes of this report, the criteria of '1:100-year Post to 1:100-year Pre-development Control' was applied. In this case, the road extension will result in a very minor increase in impervious area, compared to the total drainage area of 185 ha. The hydrologic model results provided in this report show the post-development flows are essentially unchanged from the pre-development condition, without quantity controls (see Section 4.7).

According to Section 3.0, Table 3-1 of the Credit Valley Conservation Stormwater Management Criteria (August 2012), the Flood Control criteria for new development in the Sheridan Creek Watershed is '1:100-year Post to 1:2-year Pre-development Control'. Additional analysis was undertaken applying this criteria. When the stricter controls are applied, there is a storage volume requirement of 590 m^3. The detailed calculations of this additional analysis are provided in Appendix F. Storage containment options within a road right-of-way are somewhat limited. Storage volume may be provided in the form of over-sized storm sewer (i.e., superpipe) or possibly underground storage chambers. These stormwater calculations are preliminary and will be finalized, together with the approach to storing/managing stormwater attributed to the road extension during the detailed design phase of the project. If development has occurred within the tributary catchment between the EA Phase and detailed design phase of the project, the relevant hydrologic parameters will need to be updated. If there are opportunities to combine the flood storage requirement for the Sheridan Park Drive Extension with an adjacent (hydrologically-connected) development where space is less restricted, and the timing is favourable, this is strongly encouraged.

The stormwater management design will also incorporate a Low Impact Development (LID) best practices approach to quality control. The LID feature will also provide some quantity control; however, this has not been quantified in the analysis.

The proposed watercourse crossing has been designed to convey the 1:50-year storm without overtopping the roadway as per City standards.

3.0 Existing Drainage Conditions

Sheridan Park Drive is located within the headwaters area of Sheridan Creek, which empties into Lake Ontario through the Rattray Marsh Conservation Area, approximately 6 km downstream. The channel meanders through a heavily urbanized area of Mississauga.

There are remnants of natural drainage systems within the Study Area, but the area is drained predominantly by engineered drainage systems. Lands to the north have been developed as a residential subdivision, known as Sheridan Homelands. The development of these lands resulted in the conversion of open channels to a combination of storm sewers, to convey minor storms, and overland flow routes in the form of roads, with curbs, and to convey major storm events to a suitable outlet. Based on information provided by the City, minor storm sewer system appears to be based on the 1:10-year storm.

There are two main storm sewer systems which drain the Sheridan Homelands Subdivision through the Study Area. One system drains the westerly portion of the Sheridan Homelands development and the section of Sheridan Park Drive abutting Winston Churchill Boulevard, which currently terminates at Speakman Drive. The system outlets into an open channel via a 1,500 mm dia. storm sewer, roughly 330 m east of Winston Churchill Boulevard, on the south of the Sheridan Park Drive right-of-way.

The second system drains the easterly portion of the Sheridan Homelands development through the Study Area. This system eventually drains into a concrete-lined channel on the south side of the right-of-way, via a 1,650 mm dia. storm sewer. The existing storm sewer systems are illustrated on the Drainage Management Plans.

At the time that these systems were installed, they did not appear to incorporate any type of quantity control or water quality treatment. Today, these systems would include measures such as stormwater management facilities, to prevent flow increases associated with development and also to enhance water quality, prior to discharging to the natural environment.

4.0 Hydrology

4.1 General

In order to ensure that upstream lands are adequately conveyed through the Sheridan Park Drive ROW with the extension in place, a hydrologic analysis was completed. This assessment considers the lands which are presently contributing flows to the undeveloped right-of-way. Once the extent of these areas is delineated, Return Period flows can be generated based on land use, topography and soil type.

The drainage limits of each catchment have been determined based on topographic survey contours. In general, existing topographic features indicate that overland sheet flow occurs from the northwest to southeast, perpendicular to the road ROW. Several minor drainage features begin within the Study Area, which ultimately convey flows to the Sheridan Creek.

It is assumed a portion of the existing rear yards within the Study Area will drain overland towards the Sheridan Park Drive ROW. In addition to the overland flow, two storm sewer outlets for the subdivision cross through the ROW. These sewers are assumed to convey the minor 1:10-year storm from the subdivision. This assumption is to be confirmed in conjunction with the completion of the EA. The remaining major runoff not captured by the subdivision storm sewer system will drain across the Sheridan Park Drive ROW.

A Drainage Area Plan is included in Appendix A of this report.

4.2 Soil Conditions

According to the Peel County soil map, prepared for the Department of Agriculture in 1953, the predominant soil is Trafalgar Clay. A hydrologic soil group of D was chosen as the most representative for all catchment areas. The Runoff Curve Numbers for the individual drainage areas were computed by calculating weighted curve numbers based on the corresponding land use and soil type. A summary of these calculations for each drainage area is included in Appendix B. The hydrologic soil groups were determined in accordance with the Ontario Ministry of Transportation (MTO) soil classification system, and is in agreement with the Draft Geotechnical Investigation (November 17, 2017), prepared by Peto MacCallum Ltd. Consulting Engineers in support of the proposed extension.

4.3 Land Use Patterns

Each catchment area was subdivided into meadow/field and wooded land uses based on the aerial photography illustrated in the Drainage Management Plans included in the back pocket of this report.

4.4 Hydrologic Model

The hydrologic model Visual OTTHYMO 3.0 was used to assess peak flows for each drainage area. OTTHYMO is recognized throughout the industry and by various ministries as being an effective method by which runoff can be determined based on topography, soil conditions and land use. Due to the nature of this drainage area and the relatively low imperious level of each catchment, the NASHYD command was used to assess peak flows. NASHYD is used for rural catchments.

DUHYD commands are used in the model to represent the split in the minor (piped 1:10-year) and major flow within the Sheridan Homelands development.

4.5 Time of Concentration

The City's standard minimum initial time of concentration is 15 minutes, however, calculated values are used in this analysis to account for the site-specific conditions. The areas containing the road extension are relatively pervious, and would not be expected to have a standard urban concentration time. The external areas are very large and therefore have much longer concentration times. The time of concentration is a function of "time to peak" which represents the time from the beginning of rainfall to the peak of the runoff hydrograph. It is indicative of the basin response to storm events. It depends on the physical characteristics of the watershed such as length, slope, area and surface cover. Estimates of time to peak were determined using the catchment area time of concentration by computing the travel time across the catchment. The required flow lengths and slopes were determined from the topographic mapping. The Airport Method was used where the runoff coefficient is less than 0.40, and the Bransby-Williams Formula for higher runoff coefficients. A detailed summary of all hydrologic calculations is included in Appendix B.

4.6 Rainfall Data

City of Mississauga intensity-duration frequency curves (Standard 2111.010) for the 4-hour Chicago and 24-hour SCS Type II rainfall distributions were used for the 2 to 100-year storm event calculations.

When comparing flows generated by the 4 and 24-hour storm distributions, the 24-hour storm was determined to generate the highest peak flows. As such the 24-hour SCS storm distribution was used for design purposes.

4.7 Hydrologic Results

Using the site drainage areas as illustrated in the Drainage Plan Figure and the program OTTHYMO, the total flows were determined for the 2 to 100-year storms. These flows are summarized in Table 4-1 below. The OTTHYMO runs for the 24-hour SCS storm distribution can be found in Appendix C.

Table 4-1: Existing Peak Flows at Outlet Locations

Outlet Location & Catchment Areas		Area (ha)	Existing Peak Flows (24-hour SCS Storm Distribution)					
			2-yr (m^3/s)	5-yr (m^3/s)	10-yr (m^3/s)	25-yr (m^3/s)	50-yr (m^3/s)	100-yr (m^3/s)
A	101 & 301	64.84	1.66	2.76	3.85	4.74	5.58	6.51
B	102 to 105 & 302 Major	4.86 + 112.64(major)	0.19	0.32	0.45	0.90	1.88	2.85
C	106 & 302 Minor	3.23 + 112.64(minor)	1.74	2.88	4.01	4.15	4.24	4.35
TOTAL 101 to 106 & 301 to 302		**185.57***	**3.16**	**5.27**	**7.35**	**9.05**	**10.68**	**12.47**

*Total Area calculation counts Catchment 302 once, i.e. 64.84+4.86+3.23+112.64 = 185.57 ha.

Table 4-2: Proposed Peak Flows at Outlet Locations

Outlet Location & Catchment Areas		Area (ha)	Proposed Peak Flows (24-hour SCS Storm Distribution)					
			2-yr (m^3/s)	5-yr (m^3/s)	10-yr (m^3/s)	25-yr (m^3/s)	50-yr (m^3/s)	100-yr (m^3/s)
A	201 & 301	64.84	1.67	2.78	3.87	4.76	5.61	6.54
B	202 to 204 & 302 Major	4.31 + 112.64(major)	0.23	0.38	0.52	0.97	1.85	2.82
C	205 to 206 & 302 Minor	3.78 + 112.64(minor)	1.74	2.89	4.01	4.15	4.28	4.39
TOTAL 101 to 106 & 301 to 302		**185.57***	**3.15**	**5.24**	**7.30**	**9.00**	**10.61**	**12.38**

*Total Area calculation counts Catchment 302 once, i.e. 64.84+4.31+3.78+112.64 = 185.57 ha.

As presented in Tables 4-1 and 4-2, the anticipated increases in peak flows are essentially unchanged from the existing condition. Therefore, it is proposed that quantity control facilities will not be provided. The clay soils beneath the study area are also not suitable for infiltrating large areas of surface runoff.

5.0 Hydraulics

5.1 General

Station 0+840 has been identified as a location where the proposed road extension will interrupt an existing drainage feature. A culvert will be required to maintain this existing flow condition. As noted in Section 2.0, the culvert will be sized to convey the 1:50-year storm in accordance with City of Mississauga design standards.

Within the road, catchbasins are proposed at low points and at regular intervals to maintain the City's standard minimum spacing of 90 m. Where feasible, proposed catchbasins will discharge to the existing storm sewers from the adjacent subdivisions. A review of the capacity of these existing sewers will be required at the detailed design stage to ensure adequate capacity. Where it is not feasible to connect into an existing storm sewer, new storm sewers are provided.

5.2 Hydraulic Modeling

The software program HY-8, has been used to analyze culvert hydraulics at the proposed crossing location. HY-8 is derived by the United States Federal Highway Administration and is recognized throughout the industry and by various ministries as being an effective method by which culvert hydraulics can be analyzed. The tailwater data was estimated based on available survey information and contour data for the downstream watercourse.

5.3 Proposed Culvert Hydraulics

The maximum conveyance capacity for the culvert was calculated based on the culvert diameter, the headwater elevation and the tailwater conditions. The headwater elevation was determined based on the elevation at which road overtopping will occur (the nearest sag).

Peak flow rates estimated in the hydrologic study (Section 4.0) were used to determine an approximate Return Period capacity.

A summary of the proposed culvert dimensions and capacities is provided in Table 5-1 below. Detailed HY-8 hydraulic modelling for proposed conditions is included in Appendix D.

Table 5-1: Sheridan Park Drive Proposed Culvert Capacity Summary

Crossing	Culvert Description	Roadway Elevation (m)	Peak Flow without Overtopping (m^3/s)	1:50-year Flow (m^3/s)
0+840	1.8 m span x 0.9 m rise concrete box culvert	148.25	2.32	1.79

As illustrated in Table 5-1, the proposed culvert has sufficient capacity to convey the 1:50-year flow without overtopping the proposed road centerline.

6.0 Water Quality

6.1 Enhanced Quality Control

The proposed roadway extension will have a very minor impact on the water quality; however, MOE criteria for “enhanced” water quality is required, where possible, prior to discharge into any watercourse or the natural environment. Given the site restrictions noted in Section 4.7, there are minimal opportunities to provide water quality control. As a best efforts approach, the eastern horizontal deflection (median) will be constructed as a bioretention filter and infiltration facility. This bioretention area is illustrated on the Drainage Management Plans provided in the back pocket of this report. This facility is proposed to treat a catchment area of approximately 3.13 ha, with 17% imperviousness (catchment areas 202 and 203). Minor runoff from the road ROW and tributary external area will enter the bioretention area through the proposed storm sewer system. Excess runoff which cannot be infiltrated will drain through a piped outlet to the existing channel crossing near Station 0+740. Major runoff will overflow to the east, following the slope of the road to a low point near Station 0+840.

Using the CVC/TRCA Low Impact Development Planning and Design Guide – Bioretention Fact Sheet (see Appendix E) as a basis for design, the following criteria have been considered:

- Surface area of roughly 550 m^2 provides a surface area to impervious drainage area ratio of 10.6, which is within the recommended 5:1 to 15:1 ratio.
- Based on Table 3.2 of the 2003 MOE SWMP&D Manual, the required infiltration volume to satisfy an ‘enhanced’ level of treatment is 20 m^3/ha, or 62 m^3 (for catchment area of 3.13 ha). The current design calls for 300 mm thick layer of clear stone, with a void ratio of 40% which will provide an infiltration storage volume of 65 m^3. Due to the underlying clay soils, a subdrain will be provided.
- A small parking area is included in the design to accommodate a light-duty maintenance vehicle.

6.2 Water Balance

A water balance analysis ensures efforts are made to maintain existing ground infiltration amounts which may be reduced as a result of the proposed hardened surface. Site conditions are not ideal for infiltration, however, the bioretention area described in Section 6.1 will provide the best available opportunity to achieve water balance volumes.

The minimum City and CVC criteria for erosion protection is to detain the first 5mm of runoff on-site. The minimum CVC water balance criteria is to infiltrate the first 3mm of runoff. These targets are not cumulative, therefore, the 5mm runoff governs in this case. A more comprehensive water balance design may be necessary at detailed design.

The total proposed impervious area is approximately 8,000 m^2. Therefore, the 5mm runoff volume is equal to 40 m^3. As detailed in Section 6.1, the proposed bioretention area is designed to have an infiltration storage volume of 65 m^3. This provided volume relates to a runoff depth of 8mm. Additional volume will also be provided in the 250mm vegetated ponding area above the infiltration gallery, which provides an opportunity for evapotranspiration.

7.0 Sediment and Erosion Controls

As part of the 50% Detailed Design Completion of the project, detailed, phased Erosion and Sediment Control Plans will be provided. The Erosion and Sediment Control Plans will include all necessary siltation control fence and designed in accordance with the current city of Mississauga guideline and the TRCA's / CVC Erosion and Sediment Control Guidelines for Urban Construction (2006).

Below is a list of recommended erosion and sediment control measure that may be installed and maintained during construction of the subject site:

- Temporary sediment control fence, and a tree protection fence if required will be installed prior to grading or any earth work;
- Flow check dams, where necessary, to reduce velocity;
- Controlled access during construction to reduce mud trafficking;
- Use of Mud Mats and nightly clean-up of roads to prevent migration of sediment into City streets;
- Employ on-site Sediment and Erosion Control inspectors to ensure that erosion control practices are adhered to and any breaches are repaired immediately;
- Complete monthly Inspection reports.

8.0 Recommendations and Conclusions

This Stormwater Management Report has been prepared in support of Sheridan Park Drive Schedule B Class EA Study for the proposed extension of Sheridan Park Drive between Homelands Drive and Speakman Drive, in the City of Mississauga. A preliminary hydrologic and hydraulic analysis was completed to ensure that upstream lands are adequately conveyed through the right-of-way following the construction of the extension.

The proposed roadway extension does not alter the runoff potential for the catchment studied and, as a result, no mitigative quantity control measures are proposed for peak flows.

A ‘best efforts’ approach is proposed to address impacts to water quality which are, again, anticipated to be minimal. Nonetheless, a relatively large portion of the new road will be directed to a bioretention area, located within one of horizontal deflection medians. Runoff, which cannot be treated and infiltrated at this location, will be intercepted by an overflow system and directed to an existing drainage feature.

The bioretention area is designed to accommodate parking for a light-duty maintenance vehicle.

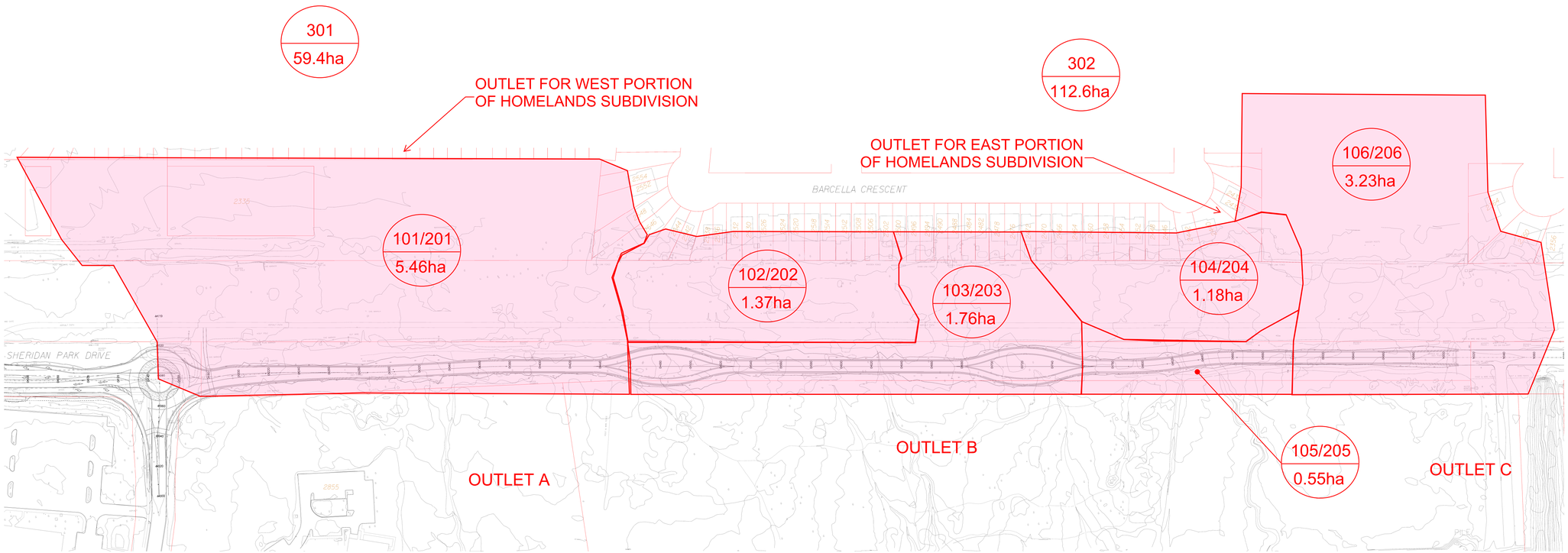
Detailed, phased Erosion and Sediment Control Plans will accompany the 50% Design Complete submission.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Drainage Area Plan



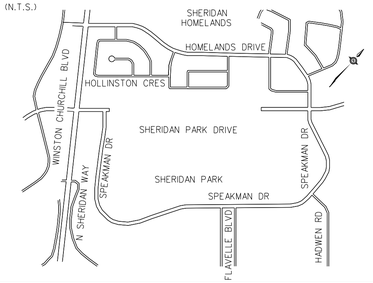
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STM. SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
M.O.E.			ROGERS U/G CABLE		

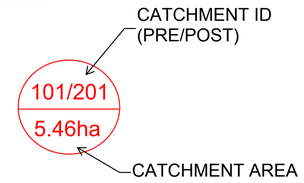
REVISIONS

DATE	DETAILS	INIT.

KEY PLAN:
(N.T.S.)



LEGEND:



BURNSIDE

R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2, Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 **fax** (905) 821-1809
web www.rjburnside.com

RJB Project No. 300039474

MISSISSAUGA

PRODUCED FOR - T&W, ENGINEERING AND WORKS

SHERIDAN PARK DRIVE EXTENSION

DRAINAGE AREA PLAN

SCALE 1:3000	AREA	PROJECT No.
DRAWN BY H.F.	CHECKED BY H.F.	PLAN No.
DATE DECEMBER 2017	SHEET 1 OF 1	

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Hydrologic Model Data

BURNSIDE

OTTHYMO MODEL DATA - PRE-DEVELOPMENT NASHYD COMMANDS

Project: Sheridan Park Drive Extension
Project No: 300039474

By: H. Faulkner
Date: 18-Dec-17

Catchment	Area (ha)	L (m)	S (%)	CN	IA (mm)	t_p (hr)	DT (min)
101	*5.46*	*300*	*1.2*	80	5.9	0.47	6
102	*1.37*	*165*	*1.5*	82	5.5	0.29	4
103	*1.76*	*160*	*1.6*	81	5.8	0.30	4
104	*1.18*	*130*	*2.7*	82	5.5	0.22	3
105	*0.55*	*80*	*1.9*	80	6.0	0.21	3
106	*3.23*	*220*	*1.7*	81	5.8	0.35	4
301	*59.38*	*1200*	*0.6*	83	5.4	0.56	7
302	*112.64*	*2500*	*0.5*	83	5.4	1.13	14
Total Area	185.57						

Catchment	Landscaped Area (ha)	Impervious Area (ha)	Impervious Percentag (%)	Weighted		
				CN	IA (mm)	C
101	*5.31*	*0.15*	*3*	80.5	5.9	0.32
102	*1.20*	*0.17*	*12*	82.2	5.5	0.38
103	*1.66*	*0.10*	*6*	81.0	5.8	0.34
104	*1.04*	*0.14*	*12*	82.1	5.5	0.38
105	*0.55*	*0.00*	*0*	80.0	6.0	0.30
106	*3.07*	*0.16*	*5*	80.9	5.8	0.33
301	*50.23*	*9.15*	*15*	82.8	5.4	0.40
302	*95.24*	*17.40*	*15*	82.8	5.4	0.40

Summarize Site Conditions Below (soil, land use, etc)
Trafalgar Clay Group D

Land Use or Surface	CN	IA (mm)	C
Landscaped	*80*	*6*	*0.30*
Impervious	*98*	*2*	*0.95*

Airport Equation (When C < 0.40)

$$Tc = 3.26 \times (1.1 - C) \times L^{0.50} \times Sw^{-0.33}$$

Bransby-Williams Formula (When C > 0.40)

$$Tc = 0.057 \times L \times Sw^{-0.20} \times A^{-0.10}$$

Catchment	Equation	Tc (minutes)	Tp (2/3 Tc) (minutes)	Tp (hours)
101	Airport	41.97	27.98	0.47
102	Airport	26.30	17.53	0.29
103	Airport	27.18	18.12	0.30
104	Airport	19.38	12.92	0.22
105	Airport	18.96	12.64	0.21
106	Airport	31.15	20.77	0.35
301	Bransby-Williams	50.36	33.57	0.56
302	Bransby-Williams	102.06	68.04	1.13

BURNSIDE

OTTHYMO MODEL DATA - POST-DEVELOPMENT NASHYD COMMANDS

Project: Sheridan Park Drive Extension
Project No: 300039474

By: H. Faulkner
Date: 18-Dec-17

Catchment	Area (ha)	L (m)	S (%)	CN	IA (mm)	t_p (hr)	DT (min)
201	*5.46*	*300*	*1.2*	81	5.7	0.45	5
202	*1.37*	*165*	*1.5*	82	5.5	0.29	4
203	*1.76*	*160*	*1.6*	84	5.2	0.09	2
204	*1.18*	*130*	*2.7*	82	5.5	0.22	3
205	*0.55*	*80*	*1.9*	84	5.1	0.05	2
206	*3.23*	*220*	*1.7*	82	5.6	0.33	4
301	*59.38*	*1200*	*0.6*	83	5.4	0.25	3
302	*112.64*	*2500*	*0.5*	83	5.4	0.26	3
Total Area	185.57						

Catchment	Landscaped Area (ha)	Impervious Area (ha)	Impervious Percentag (%)	Weighted		
				CN	IA (mm)	C
201	*5.03*	*0.43*	*8*	81.4	5.7	0.35
202	*1.20*	*0.17*	*12*	82.2	5.5	0.38
203	*1.39*	*0.37*	*21*	83.8	5.2	0.44
204	*1.04*	*0.14*	*12*	82.1	5.5	0.38
205	*0.42*	*0.13*	*23*	84.1	5.1	0.45
206	*2.92*	*0.31*	*10*	81.7	5.6	0.36
301	*50.23*	*9.15*	*15*	82.8	5.4	0.40
302	*95.24*	*17.40*	*15*	82.8	5.4	0.40

Summarize Site Conditions Below (soil, land use, etc)
Trafalgar Clay Group D

Land Use or Surface	CN	IA (mm)	C
Landscaped	*80*	*6*	*0.30*
Impervious	*98*	*2*	*0.95*

Airport Equation (When C < 0.40)

$$Tc = 3.26 \times (1.1 - C) \times L^{0.50} \times Sw^{-0.33}$$

Bransby-Williams Formula (When C > 0.40)

$$Tc = 0.057 \times L \times Sw^{-0.20} \times A^{-0.10}$$

Catchment	Equation	Tc (minutes)	Tp (2/3 Tc) (minutes)	Tp (hours)
201	Airport	40.19	26.79	0.45
202	Airport	26.30	17.53	0.29
203	Bransby-Williams	7.88	5.26	0.09
204	Airport	19.38	12.92	0.22
205	Bransby-Williams	4.27	2.85	0.05
206	Airport	29.90	19.94	0.33
301	Bransby-Williams	50.36	33.57	0.56
302	Bransby-Williams	102.06	68.04	1.13

BURNSIDE

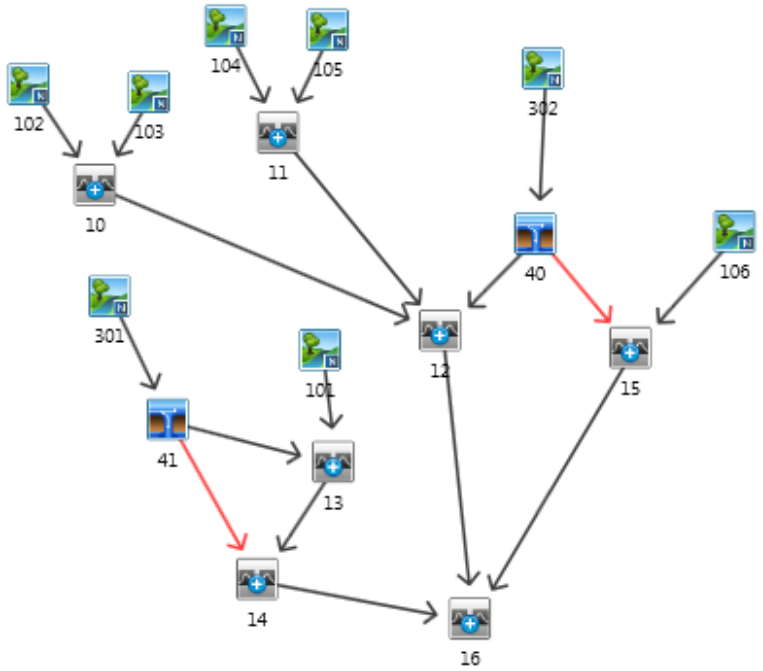
[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

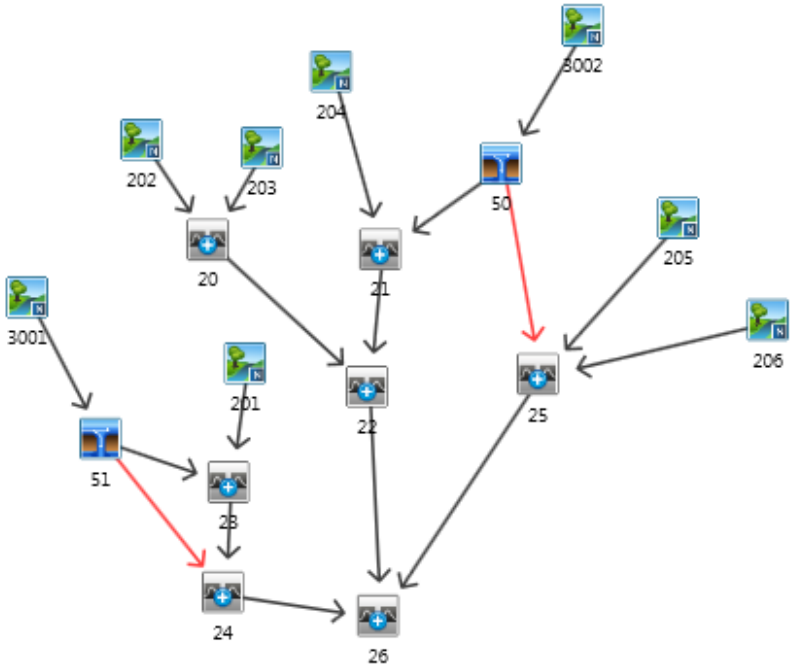
OTTHYMO Model Output

OTTHYMO SCHEMATIC

PRE-DEVELOPMENT



POST-DEVELOPMENT



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

       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 M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
Copyright 2007 - 2013 Civica Infrastructure
All rights reserved.

                    *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VO Suite 3.0\VO2\voin.dat
  Output  filename: C:\Users\hfaulkner\AppData\Local\Temp\5d386156-70e4-411f-bad3-
2103062fc1ea\Scenario.out
  Summary filename: C:\Users\hfaulkner\AppData\Local\Temp\5d386156-70e4-411f-bad3-
2103062fc1ea\Scenario.sum


DATE: 12/18/2017                          TIME: 12:05:33

USER:


COMMENTS: _____________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      ---------------------
      MASS STORM                 12.0
      [ Ptot= 50.20 mm ]
*
  **  CALIB NASHYD       0101  1  6.0    5.46    0.14 12.40  18.20 0.36   0.000
      [CN=80.0        ]
      [ N = 3.0:Tp 0.47]
*
  **  CALIB NASHYD       0301  1  5.0   59.38    1.53 12.50  20.73 0.41   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0041  1  5.0   59.38    1.53 12.50  20.73  n/a   0.000
         MAJOR SYSTEM:   0041  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0041  3  5.0   59.38    1.53 12.50  20.73  n/a   0.000
*
      ADD [0101 + 0041]  0013  3  6.0    5.46    0.14 12.40  18.20  n/a   0.000
*
      ADD [0013 + 0041]  0014  3  5.0   64.84    1.66 12.42  20.52  n/a   0.000
*
  **  CALIB NASHYD       0102  1  4.0    1.37    0.05 12.20  19.89 0.40   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
  **  CALIB NASHYD       0103  1  4.0    1.76    0.06 12.20  18.96 0.38   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.30]
*
      ADD [0102 + 0103]  0010  3  4.0    3.13    0.12 12.20  19.36  n/a   0.000
*
  **  CALIB NASHYD       0104  1  3.0    1.18    0.06 12.10  19.89 0.40   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
  **  CALIB NASHYD       0105  1  3.0    0.55    0.02 12.10  18.13 0.36   0.000
      [CN=80.0        ]
      [ N = 3.0:Tp 0.21]
*
      ADD [0104 + 0105]  0011  3  3.0    1.73    0.08 12.10  19.33  n/a   0.000
*
  **  CALIB NASHYD       0302  1  5.0  112.64    1.71 13.08  20.73 0.41   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0040  1  5.0  112.64    1.71 13.08  20.73  n/a   0.000
         MAJOR SYSTEM:   0040  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0040  3  5.0  112.64    1.71 13.08  20.73  n/a   0.000
*
      ADD [0010 + 0011]  0012  3  3.0    4.86    0.19 12.15  19.35  n/a   0.000
*
      ADD [0012 + 0040]  0012  1  3.0    4.86    0.19 12.15  19.35  n/a   0.000
*
  **  CALIB NASHYD       0106  1  4.0    3.23    0.11 12.27  18.96 0.38   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.35]
*
      ADD [0106 + 0040]  0015  3  4.0  115.87    1.74 13.07  20.68  n/a   0.000
*
      ADD [0012 + 0014]  0016  3  3.0   69.70    1.79 12.40  20.43  n/a   0.000
*
      ADD [0016 + 0015]  0016  1  3.0  185.57    3.16 12.60  20.59  n/a   0.000
*
  **  CALIB NASHYD       0205  1  2.0    0.55    0.05 12.00  21.51 0.43   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.05]
*
  **  CALIB NASHYD       0206  1  4.0    3.23    0.12 12.20  19.82 0.39   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.33]
*
  **  CALIB NASHYD       3002  1  5.0  112.64    1.71 13.08  20.73 0.41   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0050  1  5.0  112.64    1.71 13.08  20.73  n/a   0.000
         MAJOR SYSTEM:   0050  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0050  3  5.0  112.64    1.71 13.08  20.73  n/a   0.000
*
      ADD [0205 + 0206]  0025  3  2.0    3.78    0.13 12.00  20.06  n/a   0.000
*
      ADD [0025 + 0050]  0025  1  2.0  116.42    1.74 13.10  20.71  n/a   0.000
*
  **  CALIB NASHYD       0201  1  5.0    5.46    0.15 12.33  19.02 0.38   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.45]
*
  **  CALIB NASHYD       3001  1  5.0   59.38    1.53 12.50  20.73 0.41   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0051  1  5.0   59.38    1.53 12.50  20.73  n/a   0.000
         MAJOR SYSTEM:   0051  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0051  3  5.0   59.38    1.53 12.50  20.73  n/a   0.000
*
      ADD [0201 + 0051]  0023  3  5.0    5.46    0.15 12.33  19.02  n/a   0.000
*
      ADD [0023 + 0051]  0024  3  5.0   64.84    1.67 12.42  20.58  n/a   0.000
*
  **  CALIB NASHYD       0203  1  2.0    1.76    0.14 12.00  21.66 0.43   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.09]
*
  **  CALIB NASHYD       0202  1  4.0    1.37    0.05 12.20  19.89 0.40   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
      ADD [0202 + 0203]  0020  3  2.0    3.13    0.18 12.03  20.88  n/a   0.000
*
  **  CALIB NASHYD       0204  1  3.0    1.18    0.06 12.10  19.89 0.40   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
      ADD [0204 + 0050]  0021  3  3.0    1.18    0.06 12.10  19.89  n/a   0.000
*
      ADD [0020 + 0021]  0022  3  2.0    4.31    0.23 12.03  20.61  n/a   0.000
*
      ADD [0022 + 0024]  0026  3  2.0   69.15    1.76 12.43  20.59  n/a   0.000
*
      ADD [0026 + 0025]  0026  1  2.0  185.57    3.15 12.60  20.66  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      ---------------------
      MASS STORM                 12.0
      [ Ptot= 67.50 mm ]
*
  **  CALIB NASHYD       0101  1  6.0    5.46    0.23 12.30  30.33 0.45   0.000
      [CN=80.0        ]
      [ N = 3.0:Tp 0.47]
*
  **  CALIB NASHYD       0301  1  5.0   59.38    2.53 12.42  33.79 0.50   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0041  1  5.0   59.38    2.53 12.42  33.79  n/a   0.000
         MAJOR SYSTEM:   0041  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0041  3  5.0   59.38    2.53 12.42  33.79  n/a   0.000
*
      ADD [0101 + 0041]  0013  3  6.0    5.46    0.23 12.30  30.33  n/a   0.000
*
      ADD [0013 + 0041]  0014  3  5.0   64.84    2.76 12.42  33.50  n/a   0.000
*
  **  CALIB NASHYD       0102  1  4.0    1.37    0.09 12.13  32.64 0.48   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
  **  CALIB NASHYD       0103  1  4.0    1.76    0.11 12.20  31.38 0.46   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.30]
*
      ADD [0102 + 0103]  0010  3  4.0    3.13    0.20 12.20  31.93  n/a   0.000
*
  **  CALIB NASHYD       0104  1  3.0    1.18    0.09 12.10  32.64 0.48   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
  **  CALIB NASHYD       0105  1  3.0    0.55    0.04 12.10  30.25 0.45   0.000
      [CN=80.0        ]
      [ N = 3.0:Tp 0.21]
*
      ADD [0104 + 0105]  0011  3  3.0    1.73    0.13 12.10  31.88  n/a   0.000
*
  **  CALIB NASHYD       0302  1  5.0  112.64    2.84 13.08  33.79 0.50   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0040  1  5.0  112.64    2.84 13.08  33.79  n/a   0.000
         MAJOR SYSTEM:   0040  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0040  3  5.0  112.64    2.84 13.08  33.79  n/a   0.000
*
      ADD [0010 + 0011]  0012  3  3.0    4.86    0.32 12.15  31.91  n/a   0.000
*
      ADD [0012 + 0040]  0012  1  3.0    4.86    0.32 12.15  31.91  n/a   0.000
*
  **  CALIB NASHYD       0106  1  4.0    3.23    0.18 12.20  31.39 0.46   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.35]
*
      ADD [0106 + 0040]  0015  3  4.0  115.87    2.88 13.07  33.72  n/a   0.000
*
      ADD [0012 + 0014]  0016  3  3.0   69.70    2.97 12.40  33.39  n/a   0.000
*
      ADD [0016 + 0015]  0016  1  3.0  185.57    5.27 12.60  33.60  n/a   0.000
*
  **  CALIB NASHYD       0205  1  2.0    0.55    0.08 12.00  34.74 0.51   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.05]
*
  **  CALIB NASHYD       0206  1  4.0    3.23    0.19 12.20  32.56 0.48   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.33]
*
  **  CALIB NASHYD       3002  1  5.0  112.64    2.84 13.08  33.79 0.50   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0050  1  5.0  112.64    2.84 13.08  33.79  n/a   0.000
         MAJOR SYSTEM:   0050  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0050  3  5.0  112.64    2.84 13.08  33.79  n/a   0.000
*
      ADD [0205 + 0206]  0025  3  2.0    3.78    0.21 12.00  32.88  n/a   0.000
*
      ADD [0025 + 0050]  0025  1  2.0  116.42    2.89 13.07  33.76  n/a   0.000
*
  **  CALIB NASHYD       0201  1  5.0    5.46    0.25 12.33  31.46 0.47   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.45]
*
  **  CALIB NASHYD       3001  1  5.0   59.38    2.53 12.42  33.79 0.50   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0051  1  5.0   59.38    2.53 12.42  33.79  n/a   0.000
         MAJOR SYSTEM:   0051  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0051  3  5.0   59.38    2.53 12.42  33.79  n/a   0.000
*
      ADD [0201 + 0051]  0023  3  5.0    5.46    0.25 12.33  31.46  n/a   0.000
*
      ADD [0023 + 0051]  0024  3  5.0   64.84    2.78 12.42  33.59  n/a   0.000
*
  **  CALIB NASHYD       0203  1  2.0    1.76    0.22 12.00  35.02 0.52   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.09]
*
  **  CALIB NASHYD       0202  1  4.0    1.37    0.09 12.13  32.64 0.48   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
      ADD [0202 + 0203]  0020  3  2.0    3.13    0.29 12.00  33.98  n/a   0.000
*
  **  CALIB NASHYD       0204  1  3.0    1.18    0.09 12.10  32.64 0.48   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
      ADD [0204 + 0050]  0021  3  3.0    1.18    0.09 12.10  32.64  n/a   0.000
```

```
*
     ADD [0020 + 0021]  0022  3  2.0    4.31    0.38 12.03  33.61  n/a   0.000
*
     ADD [0022 + 0024]  0026  3  2.0   69.15    2.92 12.40  33.60  n/a   0.000
*
     ADD [0026 + 0025]  0026  1  2.0  185.57    5.24 12.60  33.70  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

     START @  0.00 hrs
     --------------------
     MASS STORM               12.0
     [ Ptot= 83.20 mm ]
*
  **  CALIB NASHYD       0101  1  6.0    5.46    0.33 12.30  42.43 0.51   0.000
      [CN=80.0         ]
      [ N = 3.0:Tp 0.47]
*
  **  CALIB NASHYD       0301  1  5.0   59.38    3.52 12.42  46.62 0.56   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0041  1  5.0   59.38    3.52 12.42  46.62  n/a   0.000
         MAJOR SYSTEM:   0041  2  5.0    0.00    0.00 12.42  46.62  n/a   0.000
         MINOR SYSTEM:   0041  3  5.0   59.38    3.52 12.42  46.62  n/a   0.000
*
      ADD [0101 + 0041]  0013  3  5.0    5.46    0.33 12.33  42.43  n/a   0.000
*
      ADD [0013 + 0041]  0014  3  5.0   64.84    3.85 12.42  46.27  n/a   0.000
*
  **  CALIB NASHYD       0102  1  4.0    1.37    0.12 12.13  45.23 0.54   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.29]
*
  **  CALIB NASHYD       0103  1  4.0    1.76    0.15 12.20  43.73 0.53   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.30]
*
      ADD [0102 + 0103]  0010  3  4.0    3.13    0.27 12.13  44.38  n/a   0.000
*
  **  CALIB NASHYD       0104  1  3.0    1.18    0.13 12.10  45.23 0.54   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.22]
*
  **  CALIB NASHYD       0105  1  3.0    0.55    0.06 12.10  42.35 0.51   0.000
      [CN=80.0         ]
      [ N = 3.0:Tp 0.21]
*
      ADD [0104 + 0105]  0011  3  3.0    1.73    0.19 12.10  44.31  n/a   0.000
*
  **  CALIB NASHYD       0302  1  5.0  112.64    3.95 13.08  46.62 0.56   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0040  1  5.0  112.64    3.95 13.08  46.62  n/a   0.000
         MAJOR SYSTEM:   0040  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0040  3  5.0  112.64    3.95 13.08  46.62  n/a   0.000
*
      ADD [0010 + 0011]  0012  3  3.0    4.86    0.45 12.15  44.36  n/a   0.000
*
      ADD [0012 + 0040]  0012  1  3.0    4.86    0.45 12.15  44.36  n/a   0.000
*
  **  CALIB NASHYD       0106  1  4.0    3.23    0.25 12.20  43.73 0.53   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.35]
*
      ADD [0106 + 0040]  0015  3  4.0  115.87    4.01 13.07  46.54  n/a   0.000
*
      ADD [0012 + 0014]  0016  3  3.0   69.70    4.14 12.40  46.14  n/a   0.000
*
      ADD [0016 + 0015]  0016  1  3.0  185.57    7.35 12.60  46.39  n/a   0.000
*
  **  CALIB NASHYD       0205  1  2.0    0.55    0.11 12.00  47.67 0.57   0.000
      [CN=84.0         ]
      [ N = 3.0:Tp 0.05]
*
  **  CALIB NASHYD       0206  1  4.0    3.23    0.27 12.20  45.15 0.54   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.33]
*
  **  CALIB NASHYD       3002  1  5.0  112.64    3.95 13.08  46.62 0.56   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0050  1  5.0  112.64    3.95 13.08  46.62  n/a   0.000
         MAJOR SYSTEM:   0050  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0050  3  5.0  112.64    3.95 13.08  46.62  n/a   0.000
*
      ADD [0205 + 0206]  0025  3  2.0    3.78    0.30 12.00  45.52  n/a   0.000
*
      ADD [0025 + 0050]  0025  1  2.0  116.42    4.01 13.07  46.59  n/a   0.000
*
  **  CALIB NASHYD       0201  1  5.0    5.46    0.35 12.33  43.81 0.53   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.45]
*
  **  CALIB NASHYD       3001  1  5.0   59.38    3.52 12.42  46.62 0.56   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0051  1  5.0   59.38    3.52 12.42  46.62  n/a   0.000
         MAJOR SYSTEM:   0051  2  5.0    0.00    0.00 12.42  46.62  n/a   0.000
         MINOR SYSTEM:   0051  3  5.0   59.38    3.52 12.42  46.62  n/a   0.000
*
      ADD [0201 + 0051]  0023  3  5.0    5.46    0.35 12.33  43.81  n/a   0.000
*
      ADD [0023 + 0051]  0024  3  5.0   64.84    3.87 12.42  46.39  n/a   0.000
*
  **  CALIB NASHYD       0203  1  2.0    1.76    0.31 12.00  48.08 0.58   0.000
      [CN=84.0         ]
      [ N = 3.0:Tp 0.09]
*
  **  CALIB NASHYD       0202  1  4.0    1.37    0.12 12.13  45.23 0.54   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.29]
*
      ADD [0202 + 0203]  0020  3  2.0    3.13    0.40 12.00  46.83  n/a   0.000
*
  **  CALIB NASHYD       0204  1  3.0    1.18    0.13 12.10  45.23 0.54   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.22]
*
      ADD [0204 + 0050]  0021  3  3.0    1.18    0.13 12.10  45.23  n/a   0.000
*
      ADD [0020 + 0021]  0022  3  2.0    4.31    0.52 12.03  46.39  n/a   0.000
*
      ADD [0022 + 0024]  0026  3  2.0   69.15    4.06 12.40  46.39  n/a   0.000
*
      ADD [0026 + 0025]  0026  1  2.0  185.57    7.30 12.60  46.51  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

     START @  0.00 hrs
     --------------------
     MASS STORM               12.0
     [ Ptot= 95.50 mm ]
*
  **  CALIB NASHYD       0101  1  6.0    5.46    0.41 12.30  52.43 0.55   0.000
      [CN=80.0         ]
      [ N = 3.0:Tp 0.47]
*
  **  CALIB NASHYD       0301  1  5.0   59.38    4.33 12.42  57.12 0.60   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0041  1  5.0   59.38    4.33 12.42  57.12  n/a   0.000
         MAJOR SYSTEM:   0041  2  5.0    2.10    0.81 12.42  57.12  n/a   0.000
         MINOR SYSTEM:   0041  3  5.0   57.28    3.52 12.17  57.12  n/a   0.000
*
      ADD [0101 + 0041]  0013  3  5.0    7.56    1.22 12.42  53.73  n/a   0.000
*
      ADD [0013 + 0041]  0014  3  5.0   64.84    4.74 12.42  56.72  n/a   0.000
*
  **  CALIB NASHYD       0102  1  4.0    1.37    0.15 12.13  55.56 0.58   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.29]
*
  **  CALIB NASHYD       0103  1  4.0    1.76    0.19 12.20  53.89 0.56   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.30]
*
      ADD [0102 + 0103]  0010  3  4.0    3.13    0.34 12.13  54.62  n/a   0.000
*
  **  CALIB NASHYD       0104  1  3.0    1.18    0.16 12.10  55.56 0.58   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.22]
*
  **  CALIB NASHYD       0105  1  3.0    0.55    0.07 12.10  52.34 0.55   0.000
      [CN=80.0         ]
      [ N = 3.0:Tp 0.21]
*
      ADD [0104 + 0105]  0011  3  3.0    1.73    0.23 12.10  54.54  n/a   0.000
*
  **  CALIB NASHYD       0302  1  5.0  112.64    4.85 13.08  57.12 0.60   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0040  1  5.0  112.64    4.85 13.08  57.12  n/a   0.000
         MAJOR SYSTEM:   0040  2  5.0    4.70    0.90 13.08  57.12  n/a   0.000
         MINOR SYSTEM:   0040  3  5.0  107.94    3.95 12.58  57.12  n/a   0.000
*
      ADD [0010 + 0011]  0012  3  3.0    4.86    0.56 12.15  54.59  n/a   0.000
*
      ADD [0012 + 0040]  0012  1  3.0    9.56    0.99 13.05  55.83  n/a   0.000
*
  **  CALIB NASHYD       0106  1  4.0    3.23    0.31 12.20  53.89 0.56   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.35]
*
      ADD [0106 + 0040]  0015  3  4.0  111.17    4.15 12.60  57.02  n/a   0.000
*
      ADD [0012 + 0014]  0016  3  3.0   74.40    5.09 12.40  56.61  n/a   0.000
*
      ADD [0016 + 0015]  0016  1  3.0  185.57    9.05 12.60  56.86  n/a   0.000
*
  **  CALIB NASHYD       0205  1  2.0    0.55    0.13 12.00  58.21 0.61   0.000
      [CN=84.0         ]
      [ N = 3.0:Tp 0.05]
*
  **  CALIB NASHYD       0206  1  4.0    3.23    0.33 12.20  55.48 0.58   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.33]
*
  **  CALIB NASHYD       3002  1  5.0  112.64    4.85 13.08  57.12 0.60   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0050  1  5.0  112.64    4.85 13.08  57.12  n/a   0.000
         MAJOR SYSTEM:   0050  2  5.0    4.70    0.90 13.08  57.12  n/a   0.000
         MINOR SYSTEM:   0050  3  5.0  107.94    3.95 12.58  57.12  n/a   0.000
*
      ADD [0205 + 0206]  0025  3  2.0    3.78    0.37 12.00  55.88  n/a   0.000
*
      ADD [0025 + 0050]  0025  1  2.0  111.72    4.15 12.60  57.08  n/a   0.000
*
  **  CALIB NASHYD       0201  1  5.0    5.46    0.44 12.33  53.98 0.57   0.000
      [CN=81.0         ]
      [ N = 3.0:Tp 0.45]
*
  **  CALIB NASHYD       3001  1  5.0   59.38    4.33 12.42  57.12 0.60   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0051  1  5.0   59.38    4.33 12.42  57.12  n/a   0.000
         MAJOR SYSTEM:   0051  2  5.0    2.10    0.81 12.42  57.12  n/a   0.000
         MINOR SYSTEM:   0051  3  5.0   57.28    3.52 12.17  57.12  n/a   0.000
*
      ADD [0201 + 0051]  0023  3  5.0    7.56    1.24 12.42  54.85  n/a   0.000
*
      ADD [0023 + 0051]  0024  3  5.0   64.84    4.76 12.42  56.85  n/a   0.000
*
  **  CALIB NASHYD       0203  1  2.0    1.76    0.37 12.00  58.73 0.61   0.000
      [CN=84.0         ]
      [ N = 3.0:Tp 0.09]
*
  **  CALIB NASHYD       0202  1  4.0    1.37    0.15 12.13  55.56 0.58   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.29]
*
      ADD [0202 + 0203]  0020  3  2.0    3.13    0.49 12.00  57.34  n/a   0.000
*
  **  CALIB NASHYD       0204  1  3.0    1.18    0.16 12.10  55.56 0.58   0.000
      [CN=82.0         ]
      [ N = 3.0:Tp 0.22]
*
      ADD [0204 + 0050]  0021  3  3.0    5.88    0.92 13.05  56.79  n/a   0.000
*
      ADD [0020 + 0021]  0022  3  2.0    9.01    0.97 13.03  56.98  n/a   0.000
*
      ADD [0022 + 0024]  0026  3  2.0   73.85    4.99 12.40  56.87  n/a   0.000
*
      ADD [0026 + 0025]  0026  1  2.0  185.57    9.00 12.57  56.99  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

     START @  0.00 hrs
     --------------------
     MASS STORM               12.0
     [ Ptot=107.00 mm ]
*
  **  CALIB NASHYD       0101  1  6.0    5.46    0.49 12.30  62.09 0.58   0.000
      [CN=80.0         ]
      [ N = 3.0:Tp 0.47]
*
  **  CALIB NASHYD       0301  1  5.0   59.38    5.10 12.42  67.19 0.63   0.000
      [CN=83.0         ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0041  1  5.0   59.38    5.10 12.42  67.19  n/a   0.000
         MAJOR SYSTEM:   0041  2  5.0    4.63    1.58 12.42  67.19  n/a   0.000
         MINOR SYSTEM:   0041  3  5.0   54.75    3.52 12.17  67.19  n/a   0.000
```

```
*
      ADD [0101 + 0041]  0013  3  5.0   10.09    2.06 12.42  64.43  n/a   0.000
*
      ADD [0013 + 0041]  0014  3  5.0   64.84    5.58 12.42  66.76  n/a   0.000
*
  **  CALIB NASHYD       0102  1  4.0    1.37    0.18 12.13  65.50 0.61   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
  **  CALIB NASHYD       0103  1  4.0    1.76    0.22 12.13  63.69 0.60   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.30]
*
      ADD [0102 + 0103]  0010  3  4.0    3.13    0.40 12.13  64.48  n/a   0.000
*
  **  CALIB NASHYD       0104  1  3.0    1.18    0.19 12.10  65.50 0.61   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
  **  CALIB NASHYD       0105  1  3.0    0.55    0.08 12.10  62.00 0.58   0.000
      [CN=80.0        ]
      [ N = 3.0:Tp 0.21]
*
      ADD [0104 + 0105]  0011  3  3.0    1.73    0.27 12.10  64.39  n/a   0.000
*
  **  CALIB NASHYD       0302  1  5.0  112.64    5.72 13.08  67.19 0.63   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0040  1  5.0  112.64    5.72 13.08  67.19  n/a   0.000
         MAJOR SYSTEM:   0040  2  5.0   10.38    1.77 13.08  67.19  n/a   0.000
         MINOR SYSTEM:   0040  3  5.0  102.26    3.95 12.42  67.19  n/a   0.000
*
      ADD [0010 + 0011]  0012  3  3.0    4.86    0.66 12.15  64.45  n/a   0.000
*
      ADD [0012 + 0040]  0012  1  3.0   15.24    1.88 13.00  66.33  n/a   0.000
*
  **  CALIB NASHYD       0106  1  4.0    3.23    0.37 12.20  63.69 0.60   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.35]
*
      ADD [0106 + 0040]  0015  3  4.0  105.49    4.24 12.47  67.09  n/a   0.000
*
      ADD [0012 + 0014]  0016  3  3.0   80.08    6.50 12.60  66.68  n/a   0.000
*
      ADD [0016 + 0015]  0016  1  3.0  185.57   10.68 12.60  66.91  n/a   0.000
*
  **  CALIB NASHYD       0205  1  2.0    0.55    0.15 12.00  68.30 0.64   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.05]
*
  **  CALIB NASHYD       0206  1  4.0    3.23    0.39 12.20  65.42 0.61   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.33]
*
  **  CALIB NASHYD       3002  1  5.0  112.64    5.72 13.08  67.19 0.63   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 1.13]
*
      DUHYD              0050  1  5.0  112.64    5.72 13.08  67.19  n/a   0.000
         MAJOR SYSTEM:   0050  2  5.0   10.38    1.77 13.08  67.19  n/a   0.000
         MINOR SYSTEM:   0050  3  5.0  102.26    3.95 12.42  67.19  n/a   0.000
*
      ADD [0205 + 0206]  0025  3  2.0    3.78    0.43 12.00  65.84  n/a   0.000
*
      ADD [0025 + 0050]  0025  1  2.0  106.04    4.28 12.43  67.14  n/a   0.000
*
  **  CALIB NASHYD       0201  1  5.0    5.46    0.52 12.33  63.78 0.60   0.000
      [CN=81.0        ]
      [ N = 3.0:Tp 0.45]
*
  **  CALIB NASHYD       3001  1  5.0   59.38    5.10 12.42  67.19 0.63   0.000
      [CN=83.0        ]
      [ N = 3.0:Tp 0.56]
*
      DUHYD              0051  1  5.0   59.38    5.10 12.42  67.19  n/a   0.000
         MAJOR SYSTEM:   0051  2  5.0    4.63    1.58 12.42  67.19  n/a   0.000
         MINOR SYSTEM:   0051  3  5.0   54.75    3.52 12.17  67.19  n/a   0.000
*
      ADD [0201 + 0051]  0023  3  5.0   10.09    2.09 12.42  65.34  n/a   0.000
*
      ADD [0023 + 0051]  0024  3  5.0   64.84    5.61 12.42  66.90  n/a   0.000
*
  **  CALIB NASHYD       0203  1  2.0    1.76    0.43 12.00  68.92 0.64   0.000
      [CN=84.0        ]
      [ N = 3.0:Tp 0.09]
*
  **  CALIB NASHYD       0202  1  4.0    1.37    0.18 12.13  65.50 0.61   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.29]
*
      ADD [0202 + 0203]  0020  3  2.0    3.13    0.58 12.00  67.42  n/a   0.000
*
  **  CALIB NASHYD       0204  1  3.0    1.18    0.19 12.10  65.50 0.61   0.000
      [CN=82.0        ]
      [ N = 3.0:Tp 0.22]
*
      ADD [0204 + 0050]  0021  3  3.0   11.56    1.79 13.05  67.04  n/a   0.000
*
      ADD [0020 + 0021]  0022  3  2.0   14.69    1.85 13.03  67.12  n/a   0.000
*
      ADD [0022 + 0024]  0026  3  2.0   79.53    6.42 12.60  66.94  n/a   0.000
*
      ADD [0026 + 0025]  0026  1  2.0  185.57   10.61 12.60  67.06  n/a   0.000
*
 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
Developed and Distributed by Civica Infrastructure
Copyright 2007 - 2013 Civica Infrastructure
All rights reserved.

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


  Input   filename: C:\Program Files (x86)\VO Suite 3.0\VO2\voin.dat
  Output  filename: C:\Users\hfaulkner\AppData\Local\Temp\c8936e73-3aee-421a-9fb0-
4bfc97ff0070\Scenario.out
  Summary filename: C:\Users\hfaulkner\AppData\Local\Temp\c8936e73-3aee-421a-9fb0-
4bfc97ff0070\Scenario.sum

DATE: 12/18/2017                          TIME: 12:02:31

USER:


COMMENTS: _____________________________________________

--------------------------------------------------------------------------------
--------------
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

--------------------
| MASS STORM       |    Filename: C:\Users\hfaulkner\AppD
|                  |              ata\Local\Temp\
|                  |              c8936e73-3aee-421a-9fb0-4bfc97ff0070\6d3a9bd3
| Ptotal=119.40 mm |    Comments: 24-HR SCS Type II
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 12.00 min

     TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
      hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.20    1.19 |  6.20    2.15 | 12.20   21.25 | 18.20    2.09
     0.40    1.25 |  6.40    2.27 | 12.40   15.88 | 18.40    2.09
     0.60    1.25 |  6.60    2.27 | 12.60   10.87 | 18.60    1.97
     0.80    1.25 |  6.80    2.27 | 12.80    9.19 | 18.80    1.97
     1.00    1.31 |  7.00    2.39 | 13.00    7.88 | 19.00    1.85
     1.20    1.31 |  7.20    2.39 | 13.20    6.93 | 19.20    1.85
     1.40    1.37 |  7.40    2.51 | 13.40    6.33 | 19.40    1.79
     1.60    1.37 |  7.60    2.51 | 13.60    5.61 | 19.60    1.67
     1.80    1.37 |  7.80    2.51 | 13.80    5.13 | 19.80    1.61
     2.00    1.43 |  8.00    2.63 | 14.00    4.66 | 20.00    1.61
     2.20    1.43 |  8.20    2.75 | 14.20    4.36 | 20.20    1.55
     2.40    1.49 |  8.40    2.99 | 14.40    4.12 | 20.40    1.55
     2.60    1.49 |  8.60    3.22 | 14.60    4.00 | 20.60    1.49
     2.80    1.49 |  8.80    3.46 | 14.80    3.88 | 20.80    1.49
     3.00    1.55 |  9.00    3.70 | 15.00    3.64 | 21.00    1.49
     3.20    1.55 |  9.20    3.82 | 15.20    3.52 | 21.20    1.49
     3.40    1.61 |  9.40    3.82 | 15.40    3.28 | 21.40    1.49
     3.60    1.61 |  9.60    3.88 | 15.60    3.16 | 21.60    1.49
     3.80    1.61 |  9.80    4.18 | 15.80    3.04 | 21.80    1.43
     4.00    1.67 | 10.00    4.60 | 16.00    2.81 | 22.00    1.43
     4.20    1.67 | 10.20    5.07 | 16.20    2.69 | 22.20    1.43
     4.40    1.79 | 10.40    5.61 | 16.40    2.69 | 22.40    1.43
     4.60    1.79 | 10.60    6.27 | 16.60    2.63 | 22.60    1.37
     4.80    1.79 | 10.80    7.16 | 16.80    2.51 | 22.80    1.37
     5.00    1.91 | 11.00    8.12 | 17.00    2.51 | 23.00    1.37
     5.20    1.91 | 11.20    9.73 | 17.20    2.39 | 23.20    1.37
     5.40    2.03 | 11.40   12.06 | 17.40    2.33 | 23.40    1.37
     5.60    2.03 | 11.60   21.07 | 17.60    2.33 | 23.60    1.37
     5.80    2.03 | 11.80   74.03 | 17.80    2.21 | 23.80    1.31
     6.00    2.15 | 12.00  138.62 | 18.00    2.21 | 24.00    1.31

--------------------------------------------------------------------------------
------------------
| CALIB            |
| NASHYD    (0101) |   Area     (ha)=   5.46   Curve Number    (CN)= 80.0
|ID= 1 DT= 6.0 min |   Ia       (mm)=   5.90   # of Linear Res.(N)= 3.00
-------------------  U.H. Tp(hrs)=   0.47

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


                    ---- TRANSFORMED HYETOGRAPH ----
     TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
      hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
    0.100    1.19 | 6.100    2.15 |12.100   21.25 | 18.10    2.09
    0.200    1.19 | 6.200    2.15 |12.200   21.25 | 18.20    2.09
    0.300    1.25 | 6.300    2.27 |12.300   15.88 | 18.30    2.09
    0.400    1.25 | 6.400    2.27 |12.400   15.88 | 18.40    2.09
    0.500    1.25 | 6.500    2.27 |12.500   10.87 | 18.50    1.97
    0.600    1.25 | 6.600    2.27 |12.600   10.87 | 18.60    1.97
    0.700    1.25 | 6.700    2.27 |12.700    9.19 | 18.70    1.97
    0.800    1.25 | 6.800    2.27 |12.800    9.19 | 18.80    1.97
    0.900    1.31 | 6.900    2.39 |12.900    7.88 | 18.90    1.85
    1.000    1.31 | 7.000    2.39 |13.000    7.88 | 19.00    1.85
    1.100    1.31 | 7.100    2.39 |13.100    6.93 | 19.10    1.85
    1.200    1.31 | 7.200    2.39 |13.200    6.93 | 19.20    1.85
    1.300    1.37 | 7.300    2.51 |13.300    6.33 | 19.30    1.79
    1.400    1.37 | 7.400    2.51 |13.400    6.33 | 19.40    1.79
    1.500    1.37 | 7.500    2.51 |13.500    5.61 | 19.50    1.67
    1.600    1.37 | 7.600    2.51 |13.600    5.61 | 19.60    1.67
    1.700    1.37 | 7.700    2.51 |13.700    5.13 | 19.70    1.61
    1.800    1.37 | 7.800    2.51 |13.800    5.13 | 19.80    1.61
    1.900    1.43 | 7.900    2.63 |13.900    4.66 | 19.90    1.61
    2.000    1.43 | 8.000    2.63 |14.000    4.66 | 20.00    1.61
    2.100    1.43 | 8.100    2.75 |14.100    4.36 | 20.10    1.55
    2.200    1.43 | 8.200    2.75 |14.200    4.36 | 20.20    1.55
    2.300    1.49 | 8.300    2.98 |14.300    4.12 | 20.30    1.55
    2.400    1.49 | 8.400    2.99 |14.400    4.12 | 20.40    1.55
    2.500    1.49 | 8.500    3.22 |14.500    4.00 | 20.50    1.49
    2.600    1.49 | 8.600    3.22 |14.600    4.00 | 20.60    1.49
    2.700    1.49 | 8.700    3.46 |14.700    3.88 | 20.70    1.49
    2.800    1.49 | 8.800    3.46 |14.800    3.88 | 20.80    1.49
    2.900    1.55 | 8.900    3.70 |14.900    3.64 | 20.90    1.49
    3.000    1.55 | 9.000    3.70 |15.000    3.64 | 21.00    1.49
    3.100    1.55 | 9.100    3.82 |15.100    3.52 | 21.10    1.49
    3.200    1.55 | 9.200    3.82 |15.200    3.52 | 21.20    1.49
    3.300    1.61 | 9.300    3.82 |15.300    3.28 | 21.30    1.49
    3.400    1.61 | 9.400    3.82 |15.400    3.28 | 21.40    1.49
    3.500    1.61 | 9.500    3.88 |15.500    3.16 | 21.50    1.49
    3.600    1.61 | 9.600    3.88 |15.600    3.16 | 21.60    1.49
    3.700    1.61 | 9.700    4.18 |15.700    3.04 | 21.70    1.43
    3.800    1.61 | 9.800    4.18 |15.800    3.04 | 21.80    1.43
    3.900    1.67 | 9.900    4.60 |15.900    2.81 | 21.90    1.43
    4.000    1.67 |10.000    4.60 |16.000    2.81 | 22.00    1.43
    4.100    1.67 |10.100    5.07 |16.100    2.69 | 22.10    1.43
    4.200    1.67 |10.200    5.07 |16.200    2.69 | 22.20    1.43
    4.300    1.79 |10.300    5.61 |16.300    2.69 | 22.30    1.43
    4.400    1.79 |10.400    5.61 |16.400    2.69 | 22.40    1.43
    4.500    1.79 |10.500    6.27 |16.500    2.63 | 22.50    1.37
    4.600    1.79 |10.600    6.27 |16.600    2.63 | 22.60    1.37
    4.700    1.79 |10.700    7.16 |16.700    2.51 | 22.70    1.37
    4.800    1.79 |10.800    7.16 |16.800    2.51 | 22.80    1.37
    4.900    1.91 |10.900    8.12 |16.900    2.51 | 22.90    1.37
    5.000    1.91 |11.000    8.12 |17.000    2.51 | 23.00    1.37
    5.100    1.91 |11.100    9.73 |17.100    2.39 | 23.10    1.37
    5.200    1.91 |11.200    9.73 |17.200    2.39 | 23.20    1.37
    5.300    2.03 |11.300   12.06 |17.300    2.33 | 23.30    1.37
    5.400    2.03 |11.400   12.06 |17.400    2.33 | 23.40    1.37
    5.500    2.03 |11.500   21.07 |17.500    2.33 | 23.50    1.37
    5.600    2.03 |11.600   21.08 |17.600    2.33 | 23.60    1.37
    5.700    2.03 |11.700   74.03 |17.700    2.21 | 23.70    1.31
    5.800    2.03 |11.800   74.03 |17.800    2.21 | 23.80    1.31
    5.900    2.15 |11.900  138.62 |17.900    2.21 | 23.90    1.31
    6.000    2.15 |12.000  138.61 |18.000    2.21 | 24.00    1.31

     Unit Hyd Qpeak  (cms)=   0.444

     PEAK FLOW       (cms)=   0.575 (i)
     TIME TO PEAK    (hrs)=  12.300
     RUNOFF VOLUME    (mm)=  72.771
     TOTAL RAINFALL   (mm)= 119.400
     RUNOFF COEFFICIENT   =   0.609

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

--------------------------------------------------------------------------------
------------------
| CALIB            |
| NASHYD    (0301) |   Area     (ha)=  59.38   Curve Number    (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.40   # of Linear Res.(N)= 3.00
-------------------  U.H. Tp(hrs)=   0.56

        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    1.19 |  6.083    2.15 |12.083   21.27 | 18.08    2.09
     0.167    1.19 |  6.167    2.15 |12.167   21.25 | 18.17    2.09
     0.250    1.23 |  6.250    2.22 |12.250   18.03 | 18.25    2.09
     0.333    1.25 |  6.333    2.27 |12.333   15.88 | 18.33    2.09
     0.417    1.25 |  6.417    2.27 |12.417   14.88 | 18.42    2.07
     0.500    1.25 |  6.500    2.27 |12.500   10.87 | 18.50    1.97
     0.583    1.25 |  6.583    2.27 |12.583   10.87 | 18.58    1.97
     0.667    1.25 |  6.667    2.27 |12.667    9.53 | 18.67    1.97
     0.750    1.25 |  6.750    2.27 |12.750    9.19 | 18.75    1.97
     0.833    1.28 |  6.833    2.32 |12.833    8.67 | 18.83    1.92
     0.917    1.31 |  6.917    2.39 |12.917    7.88 | 18.92    1.85
     1.000    1.31 |  7.000    2.39 |13.000    7.88 | 19.00    1.85
     1.083    1.31 |  7.083    2.39 |13.083    6.93 | 19.08    1.85
     1.167    1.31 |  7.167    2.39 |13.167    6.93 | 19.17    1.85
     1.250    1.35 |  7.250    2.46 |13.250    6.57 | 19.25    1.81
     1.333    1.37 |  7.333    2.51 |13.333    6.33 | 19.33    1.79
     1.417    1.37 |  7.417    2.51 |13.417    6.19 | 19.42    1.77
     1.500    1.37 |  7.500    2.51 |13.500    5.61 | 19.50    1.67
     1.583    1.37 |  7.583    2.51 |13.583    5.61 | 19.58    1.67
     1.667    1.37 |  7.667    2.51 |13.667    5.23 | 19.67    1.62
     1.750    1.37 |  7.750    2.51 |13.750    5.13 | 19.75    1.61
     1.833    1.40 |  7.833    2.56 |13.833    4.94 | 19.83    1.61
     1.917    1.43 |  7.917    2.63 |13.917    4.66 | 19.92    1.61
     2.000    1.43 |  8.000    2.63 |14.000    4.66 | 20.00    1.61
     2.083    1.43 |  8.083    2.75 |14.083    4.36 | 20.08    1.55
     2.167    1.43 |  8.167    2.75 |14.167    4.36 | 20.17    1.55
     2.250    1.47 |  8.250    2.89 |14.250    4.21 | 20.25    1.55
     2.333    1.49 |  8.333    2.99 |14.333    4.12 | 20.33    1.55
     2.417    1.49 |  8.417    3.03 |14.417    4.10 | 20.42    1.54
     2.500    1.49 |  8.500    3.22 |14.500    4.00 | 20.50    1.49
     2.583    1.49 |  8.583    3.22 |14.583    4.00 | 20.58    1.49
     2.667    1.49 |  8.667    3.41 |14.667    3.90 | 20.67    1.49
     2.750    1.49 |  8.750    3.46 |14.750    3.88 | 20.75    1.49
     2.833    1.52 |  8.833    3.56 |14.833    3.79 | 20.83    1.49
     2.917    1.55 |  8.917    3.70 |14.917    3.64 | 20.92    1.49
     3.000    1.55 |  9.000    3.70 |15.000    3.64 | 21.00    1.49
     3.083    1.55 |  9.083    3.82 |15.083    3.52 | 21.08    1.49
     3.167    1.55 |  9.167    3.82 |15.167    3.52 | 21.17    1.49
     3.250    1.59 |  9.250    3.82 |15.250    3.38 | 21.25    1.49
     3.333    1.61 |  9.333    3.82 |15.333    3.28 | 21.33    1.49
     3.417    1.61 |  9.417    3.83 |15.417    3.26 | 21.42    1.49
     3.500    1.61 |  9.500    3.88 |15.500    3.16 | 21.50    1.49
     3.583    1.61 |  9.583    3.88 |15.583    3.16 | 21.58    1.49
     3.667    1.61 |  9.667    4.12 |15.667    3.07 | 21.67    1.44
     3.750    1.61 |  9.750    4.18 |15.750    3.04 | 21.75    1.43
     3.833    1.64 |  9.833    4.35 |15.833    2.95 | 21.83    1.43
     3.917    1.67 |  9.917    4.60 |15.917    2.81 | 21.92    1.43
     4.000    1.67 | 10.000    4.60 |16.000    2.81 | 22.00    1.43
     4.083    1.67 | 10.083    5.07 |16.083    2.69 | 22.08    1.43
     4.167    1.67 | 10.167    5.07 |16.167    2.69 | 22.17    1.43
     4.250    1.74 | 10.250    5.40 |16.250    2.69 | 22.25    1.43
     4.333    1.79 | 10.333    5.61 |16.333    2.69 | 22.33    1.43
     4.417    1.79 | 10.417    5.74 |16.417    2.67 | 22.42    1.42
     4.500    1.79 | 10.500    6.27 |16.500    2.63 | 22.50    1.37
     4.583    1.79 | 10.583    6.27 |16.583    2.63 | 22.58    1.37
     4.667    1.79 | 10.667    6.98 |16.667    2.53 | 22.67    1.37
     4.750    1.79 | 10.750    7.16 |16.750    2.51 | 22.75    1.37
     4.833    1.84 | 10.833    7.55 |16.833    2.51 | 22.83    1.37
     4.917    1.91 | 10.917    8.12 |16.917    2.51 | 22.92    1.37
     5.000    1.91 | 11.000    8.12 |17.000    2.51 | 23.00    1.37
     5.083    1.91 | 11.083    9.73 |17.083    2.39 | 23.08    1.37
     5.167    1.91 | 11.167    9.73 |17.167    2.39 | 23.17    1.37
     5.250    1.98 | 11.250   11.13 |17.250    2.35 | 23.25    1.37
     5.333    2.03 | 11.333   12.06 |17.333    2.33 | 23.33    1.37
     5.417    2.03 | 11.417   13.86 |17.417    2.33 | 23.42    1.37
     5.500    2.03 | 11.500   21.07 |17.500    2.33 | 23.50    1.37
     5.583    2.03 | 11.583   21.07 |17.583    2.33 | 23.58    1.37
     5.667    2.03 | 11.667   63.43 |17.667    2.23 | 23.67    1.33
     5.750    2.03 | 11.750   74.03 |17.750    2.21 | 23.75    1.31
     5.833    2.08 | 11.833   99.86 |17.833    2.21 | 23.83    1.31
     5.917    2.15 | 11.917  138.62 |17.917    2.21 | 23.92    1.31
     6.000    2.15 | 12.000  138.62 |18.000    2.21 | 24.00    1.31

     Unit Hyd Qpeak  (cms)=   4.050

     PEAK FLOW       (cms)=   5.950 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  78.276
     TOTAL RAINFALL   (mm)= 119.400
     RUNOFF COEFFICIENT   =   0.656

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0041) |
| Inlet Cap.=3.520 |
| #of Inlets=    1 |
| Total(cms)=  3.5 |       AREA     QPEAK     TPEAK     R.V.
--------------------       (ha)     (cms)     (hrs)     (mm)
     TOTAL HYD.(ID= 1):  59.38      5.95      12.42    78.28
     ================================================
     MAJOR SYS.(ID= 2):   7.20      2.43      12.42    78.28
     MINOR SYS.(ID= 3):  52.18      3.52      12.08    78.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK      R.V.
--------------------         (ha)     (cms)    (hrs)      (mm)
          ID1= 1 (0101):     5.46   0.575    12.30     72.77
```

+ ID2= 2 (0041):	7.20	2.430	12.42	78.28
ID = 3 (0013):	12.66	2.992	12.42	75.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0014)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0013):	12.66	2.992	12.42	75.90
+ ID2= 2 (0041):	52.18	3.520	12.08	78.28
ID = 3 (0014):	64.84	6.512	12.42	77.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD (0102)	Area (ha)=	1.37	Curve Number	(CN)= 82.0
ID= 1 DT= 4.0 min	Ia (mm)=	5.50	# of Linear Res.	(N)= 3.00
	U.H. Tp(hrs)=	0.29		

NOTE: RAINFALL WAS TRANSFORMED TO 4.0 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
0.067	1.19	6.067	2.15	12.067	21.27	18.07	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.600	1.25	6.600	2.27	12.600	10.87	18.60	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.200	1.31	7.200	2.39	13.200	6.93	19.20	1.85
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.267	1.49	8.267	2.98	14.267	4.12	20.27	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.600	2.03	11.600	21.07	17.600	2.33	23.60	1.37
5.667	2.03	11.667	74.02	17.667	2.21	23.67	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31
5.800	2.03	11.800	74.03	17.800	2.21	23.80	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.180

PEAK FLOW (cms)= 0.212 (i)
TIME TO PEAK (hrs)= 12.133
RUNOFF VOLUME (mm)= 76.453
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.640

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

CALIB				
NASHYD (0103)	Area (ha)=	1.76	Curve Number	(CN)= 81.0
ID= 1 DT= 4.0 min	Ia (mm)=	5.80	# of Linear Res.	(N)= 3.00
	U.H. Tp(hrs)=	0.30		

Unit Hyd Qpeak (cms)= 0.224

PEAK FLOW (cms)= 0.258 (i)
TIME TO PEAK (hrs)= 12.133
RUNOFF VOLUME (mm)= 74.505
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.624

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

ADD HYD (0010)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0102):	1.37	0.212	12.13	76.45
+ ID2= 2 (0103):	1.76	0.258	12.13	74.51
ID = 3 (0010):	3.13	0.470	12.13	75.36

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD (0104)	Area (ha)=	1.18	Curve Number	(CN)= 82.0
ID= 1 DT= 3.0 min	Ia (mm)=	5.50	# of Linear Res.	(N)= 3.00
	U.H. Tp(hrs)=	0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 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
0.050	1.19	6.050	2.15	12.050	21.25	18.05	2.09
0.100	1.19	6.100	2.15	12.100	21.25	18.10	2.09
0.150	1.19	6.150	2.15	12.150	21.25	18.15	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.250	1.25	6.250	2.27	12.250	15.88	18.25	2.09
0.300	1.25	6.300	2.27	12.300	15.88	18.30	2.09
0.350	1.25	6.350	2.27	12.350	15.88	18.35	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.450	1.25	6.450	2.27	12.450	10.87	18.45	1.97
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.550	1.25	6.550	2.27	12.550	10.87	18.55	1.97
0.600	1.25	6.600	2.27	12.600	10.86	18.60	1.97
0.650	1.25	6.650	2.27	12.650	9.19	18.65	1.97
0.700	1.25	6.700	2.27	12.700	9.19	18.70	1.97
0.750	1.25	6.750	2.27	12.750	9.19	18.75	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.850	1.31	6.850	2.39	12.850	7.88	18.85	1.85
0.900	1.31	6.900	2.39	12.900	7.88	18.90	1.85
0.950	1.31	6.950	2.39	12.950	7.88	18.95	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.050	1.31	7.050	2.39	13.050	6.93	19.05	1.85
1.100	1.31	7.100	2.39	13.100	6.93	19.10	1.85
1.150	1.31	7.150	2.39	13.150	6.93	19.15	1.85
1.200	1.31	7.200	2.39	13.200	6.92	19.20	1.85
1.250	1.37	7.250	2.51	13.250	6.33	19.25	1.79
1.300	1.37	7.300	2.51	13.300	6.33	19.30	1.79
1.350	1.37	7.350	2.51	13.350	6.33	19.35	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.450	1.37	7.450	2.51	13.450	5.61	19.45	1.67
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.550	1.37	7.550	2.51	13.550	5.61	19.55	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.650	1.37	7.650	2.51	13.650	5.13	19.65	1.61
1.700	1.37	7.700	2.51	13.700	5.13	19.70	1.61
1.750	1.37	7.750	2.51	13.750	5.13	19.75	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.850	1.43	7.850	2.63	13.850	4.66	19.85	1.61
1.900	1.43	7.900	2.63	13.900	4.66	19.90	1.61
1.950	1.43	7.950	2.63	13.950	4.66	19.95	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.050	1.43	8.050	2.75	14.050	4.36	20.05	1.55
2.100	1.43	8.100	2.75	14.100	4.36	20.10	1.55
2.150	1.43	8.150	2.75	14.150	4.36	20.15	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.250	1.49	8.250	2.99	14.250	4.12	20.25	1.55
2.300	1.49	8.300	2.99	14.300	4.12	20.30	1.55
2.350	1.49	8.350	2.99	14.350	4.12	20.35	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.450	1.49	8.450	3.22	14.450	4.00	20.45	1.49
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.550	1.49	8.550	3.22	14.550	4.00	20.55	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.650	1.49	8.650	3.46	14.650	3.88	20.65	1.49
2.700	1.49	8.700	3.46	14.700	3.88	20.70	1.49
2.750	1.49	8.750	3.46	14.750	3.88	20.75	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.850	1.55	8.850	3.70	14.850	3.64	20.85	1.49
2.900	1.55	8.900	3.70	14.900	3.64	20.90	1.49
2.950	1.55	8.950	3.70	14.950	3.64	20.95	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.050	1.55	9.050	3.82	15.050	3.52	21.05	1.49
3.100	1.55	9.100	3.82	15.100	3.52	21.10	1.49
3.150	1.55	9.150	3.82	15.150	3.52	21.15	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.250	1.61	9.250	3.82	15.250	3.28	21.25	1.49
3.300	1.61	9.300	3.82	15.300	3.28	21.30	1.49
3.350	1.61	9.350	3.82	15.350	3.28	21.35	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.450	1.61	9.450	3.88	15.450	3.16	21.45	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.550	1.61	9.550	3.88	15.550	3.16	21.55	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.650	1.61	9.650	4.18	15.650	3.04	21.65	1.43
3.700	1.61	9.700	4.18	15.700	3.04	21.70	1.43
3.750	1.61	9.750	4.18	15.750	3.04	21.75	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.850	1.67	9.850	4.60	15.850	2.81	21.85	1.43
3.900	1.67	9.900	4.60	15.900	2.81	21.90	1.43
3.950	1.67	9.950	4.60	15.950	2.81	21.95	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.050	1.67	10.050	5.07	16.050	2.69	22.05	1.43
4.100	1.67	10.100	5.07	16.100	2.69	22.10	1.43
4.150	1.67	10.150	5.07	16.150	2.69	22.15	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.250	1.79	10.250	5.61	16.250	2.69	22.25	1.43
4.300	1.79	10.300	5.61	16.300	2.69	22.30	1.43
4.350	1.79	10.350	5.61	16.350	2.69	22.35	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.450	1.79	10.450	6.27	16.450	2.63	22.45	1.37
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.550	1.79	10.550	6.27	16.550	2.63	22.55	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.650	1.79	10.650	7.16	16.650	2.51	22.65	1.37
4.700	1.79	10.700	7.16	16.700	2.51	22.70	1.37
4.750	1.79	10.750	7.16	16.750	2.51	22.75	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.850	1.91	10.850	8.12	16.850	2.51	22.85	1.37
4.900	1.91	10.900	8.12	16.900	2.51	22.90	1.37
4.950	1.91	10.950	8.12	16.950	2.51	22.95	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.050	1.91	11.050	9.73	17.050	2.39	23.05	1.37
5.100	1.91	11.100	9.73	17.100	2.39	23.10	1.37
5.150	1.91	11.150	9.73	17.150	2.39	23.15	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.250	2.03	11.250	12.06	17.250	2.33	23.25	1.37
5.300	2.03	11.300	12.06	17.300	2.33	23.30	1.37
5.350	2.03	11.350	12.06	17.350	2.33	23.35	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.450	2.03	11.450	21.07	17.450	2.33	23.45	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37

5.550	2.03	11.550	21.07	17.550	2.33	23.55	1.37
5.600	2.03	11.600	21.10	17.600	2.33	23.60	1.37
5.650	2.03	11.650	74.03	17.650	2.21	23.65	1.31
5.700	2.03	11.700	74.03	17.700	2.21	23.70	1.31
5.750	2.03	11.750	74.03	17.750	2.21	23.75	1.31
5.800	2.03	11.800	74.06	17.800	2.21	23.80	1.31
5.850	2.15	11.850	138.62	17.850	2.21	23.85	1.31
5.900	2.15	11.900	138.62	17.900	2.21	23.90	1.31
5.950	2.15	11.950	138.62	17.950	2.21	23.95	1.31
6.000	2.15	12.000	138.56	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.205

PEAK FLOW (cms)= 0.217 (i)
TIME TO PEAK (hrs)= 12.100
RUNOFF VOLUME (mm)= 76.453
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.640

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

CALIB					
NASHYD (0105)	Area (ha)=	0.55	Curve Number (CN)=	80.0	
ID= 1 DT= 3.0 min	Ia (mm)=	6.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.21			

Unit Hyd Qpeak (cms)= 0.100

PEAK FLOW (cms)= 0.099 (i)
TIME TO PEAK (hrs)= 12.100
RUNOFF VOLUME (mm)= 72.677
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.609

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

ADD HYD (0011)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0104):	1.18	0.217	12.10	76.45
+ ID2= 2 (0105):	0.55	0.099	12.10	72.68
ID = 3 (0011):	1.73	0.315	12.10	75.25

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0302)	Area (ha)=	112.64	Curve Number (CN)=	83.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.40	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	1.13			

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	1.19	6.083	2.15	12.083	21.27	18.08	2.09
0.167	1.19	6.167	2.15	12.167	21.25	18.17	2.09
0.250	1.23	6.250	2.22	12.250	18.03	18.25	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.417	1.25	6.417	2.27	12.417	14.88	18.42	2.07
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.583	1.25	6.583	2.27	12.583	10.87	18.58	1.97
0.667	1.25	6.667	2.27	12.667	9.53	18.67	1.97
0.750	1.25	6.750	2.27	12.750	9.19	18.75	1.97
0.833	1.28	6.833	2.32	12.833	8.67	18.83	1.92
0.917	1.31	6.917	2.39	12.917	7.88	18.92	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.083	1.31	7.083	2.39	13.083	6.93	19.08	1.85
1.167	1.31	7.167	2.39	13.167	6.93	19.17	1.85
1.250	1.35	7.250	2.46	13.250	6.57	19.25	1.81
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.417	1.37	7.417	2.51	13.417	6.19	19.42	1.77
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.583	1.37	7.583	2.51	13.583	5.61	19.58	1.67
1.667	1.37	7.667	2.51	13.667	5.23	19.67	1.62
1.750	1.37	7.750	2.51	13.750	5.13	19.75	1.61
1.833	1.40	7.833	2.56	13.833	4.94	19.83	1.61
1.917	1.43	7.917	2.63	13.917	4.66	19.92	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.083	1.43	8.083	2.75	14.083	4.36	20.08	1.55
2.167	1.43	8.167	2.75	14.167	4.36	20.17	1.55
2.250	1.47	8.250	2.89	14.250	4.21	20.25	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.417	1.49	8.417	3.03	14.417	4.10	20.42	1.54
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.583	1.49	8.583	3.22	14.583	4.00	20.58	1.49
2.667	1.49	8.667	3.41	14.667	3.90	20.67	1.49
2.750	1.49	8.750	3.46	14.750	3.88	20.75	1.49
2.833	1.52	8.833	3.56	14.833	3.79	20.83	1.49
2.917	1.55	8.917	3.70	14.917	3.64	20.92	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.083	1.55	9.083	3.82	15.083	3.52	21.08	1.49
3.167	1.55	9.167	3.82	15.167	3.52	21.17	1.49
3.250	1.59	9.250	3.82	15.250	3.38	21.25	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.417	1.61	9.417	3.83	15.417	3.26	21.42	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.583	1.61	9.583	3.88	15.583	3.16	21.58	1.49
3.667	1.61	9.667	4.12	15.667	3.07	21.67	1.44
3.750	1.61	9.750	4.18	15.750	3.04	21.75	1.43
3.833	1.64	9.833	4.35	15.833	2.95	21.83	1.43
3.917	1.67	9.917	4.60	15.917	2.81	21.92	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.083	1.67	10.083	5.07	16.083	2.69	22.08	1.43
4.167	1.67	10.167	5.07	16.167	2.69	22.17	1.43
4.250	1.74	10.250	5.40	16.250	2.69	22.25	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.417	1.79	10.417	5.74	16.417	2.67	22.42	1.42
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.583	1.79	10.583	6.27	16.583	2.63	22.58	1.37
4.667	1.79	10.667	6.98	16.667	2.53	22.67	1.37
4.750	1.79	10.750	7.16	16.750	2.51	22.75	1.37
4.833	1.84	10.833	7.55	16.833	2.51	22.83	1.37
4.917	1.91	10.917	8.12	16.917	2.51	22.92	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.083	1.91	11.083	9.73	17.083	2.39	23.08	1.37
5.167	1.91	11.167	9.73	17.167	2.39	23.17	1.37
5.250	1.98	11.250	11.13	17.250	2.35	23.25	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.417	2.03	11.417	13.86	17.417	2.33	23.42	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37
5.583	2.03	11.583	21.07	17.583	2.33	23.58	1.37
5.667	2.03	11.667	63.43	17.667	2.23	23.67	1.33
5.750	2.03	11.750	74.03	17.750	2.21	23.75	1.31
5.833	2.08	11.833	99.86	17.833	2.21	23.83	1.31
5.917	2.15	11.917	138.62	17.917	2.21	23.92	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 3.807

PEAK FLOW (cms)= 6.672 (i)
TIME TO PEAK (hrs)= 13.083
RUNOFF VOLUME (mm)= 78.278
TOTAL RAINFALL (mm)= 119.400

RUNOFF COEFFICIENT = 0.656

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

DUHYD (0040)				
Inlet Cap.=3.950				
#of Inlets= 1				
Total(cms)= 4.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	112.64	6.67	13.08	78.28
MAJOR SYS.(ID= 2):	16.13	2.72	13.08	78.28
MINOR SYS.(ID= 3):	96.51	3.95	12.33	78.28

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	3.13	0.470	12.13	75.36
+ ID2= 2 (0011):	1.73	0.315	12.10	75.25
ID = 3 (0012):	4.86	0.771	12.15	75.32

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0012):	4.86	0.771	12.15	75.32
+ ID2= 2 (0040):	16.13	2.722	13.08	78.28
ID = 1 (0012):	20.99	2.850	13.00	77.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0106)	Area (ha)=	3.23	Curve Number (CN)=	81.0	
ID= 1 DT= 4.0 min	Ia (mm)=	5.80	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.35			

NOTE: RAINFALL WAS TRANSFORMED TO 4.0 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
0.067	1.19	6.067	2.15	12.067	21.27	18.07	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.600	1.25	6.600	2.27	12.600	10.87	18.60	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.200	1.31	7.200	2.39	13.200	6.93	19.20	1.85
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.267	1.49	8.267	2.98	14.267	4.12	20.27	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.600	2.03	11.600	21.07	17.600	2.33	23.60	1.37
5.667	2.03	11.667	74.02	17.667	2.21	23.67	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31

5.800	2.03	11.800	74.03	17.800	2.21	23.80	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.352

PEAK FLOW (cms)= 0.429 (i)
TIME TO PEAK (hrs)= 12.200
RUNOFF VOLUME (mm)= 74.511
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.624

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

ADD HYD (0015)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0106):	3.23	0.429	12.20	74.51
+ ID2= 2 (0040):	96.51	3.950	12.33	78.28
ID = 3 (0015):	99.74	4.353	12.33	78.16

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0016)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0012):	20.99	2.850	13.00	77.59
+ ID2= 2 (0014):	64.84	6.512	12.42	77.81
ID = 3 (0016):	85.83	8.245	12.60	77.76

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0016)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0016):	85.83	8.245	12.60	77.76
+ ID2= 2 (0015):	99.74	4.353	12.33	78.16
ID = 1 (0016):	185.57	12.467	12.55	77.97

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0205)	Area (ha)=	0.55	Curve Number (CN)=	84.0	
ID= 1 DT= 2.0 min	Ia (mm)=	5.10	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.05			

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	1.19	6.033	2.15	12.033	21.25	18.03	2.09
0.067	1.19	6.067	2.15	12.067	21.25	18.07	2.09
0.100	1.19	6.100	2.15	12.100	21.25	18.10	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.167	1.19	6.167	2.15	12.167	21.25	18.17	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.233	1.25	6.233	2.27	12.233	15.88	18.23	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.300	1.25	6.300	2.27	12.300	15.88	18.30	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.367	1.25	6.367	2.27	12.367	15.88	18.37	2.09
0.400	1.25	6.400	2.27	12.400	15.87	18.40	2.09
0.433	1.25	6.433	2.27	12.433	10.87	18.43	1.97
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.567	1.25	6.567	2.27	12.567	10.87	18.57	1.97
0.600	1.25	6.600	2.27	12.600	10.86	18.60	1.97
0.633	1.25	6.633	2.27	12.633	9.19	18.63	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.700	1.25	6.700	2.27	12.700	9.19	18.70	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.767	1.25	6.767	2.27	12.767	9.19	18.77	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.833	1.31	6.833	2.39	12.833	7.88	18.83	1.85
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.900	1.31	6.900	2.39	12.900	7.88	18.90	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
0.967	1.31	6.967	2.39	12.967	7.88	18.97	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.033	1.31	7.033	2.39	13.033	6.93	19.03	1.85
1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.100	1.31	7.100	2.39	13.100	6.93	19.10	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.167	1.31	7.167	2.39	13.167	6.93	19.17	1.85
1.200	1.31	7.200	2.39	13.200	6.92	19.20	1.85
1.233	1.37	7.233	2.51	13.233	6.33	19.23	1.79
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.300	1.37	7.300	2.51	13.300	6.33	19.30	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.367	1.37	7.367	2.51	13.367	6.33	19.37	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.433	1.37	7.433	2.51	13.433	5.61	19.43	1.67
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.567	1.37	7.567	2.51	13.567	5.61	19.57	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.633	1.37	7.633	2.51	13.633	5.13	19.63	1.61
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.700	1.37	7.700	2.51	13.700	5.13	19.70	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.767	1.37	7.767	2.51	13.767	5.13	19.77	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.833	1.43	7.833	2.63	13.833	4.66	19.83	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.900	1.43	7.900	2.63	13.900	4.66	19.90	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
1.967	1.43	7.967	2.63	13.967	4.66	19.97	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.033	1.43	8.033	2.75	14.033	4.36	20.03	1.55
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.100	1.43	8.100	2.75	14.100	4.36	20.10	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.167	1.43	8.167	2.75	14.167	4.36	20.17	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.233	1.49	8.233	2.98	14.233	4.12	20.23	1.55
2.267	1.49	8.267	2.99	14.267	4.12	20.27	1.55
2.300	1.49	8.300	2.99	14.300	4.12	20.30	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.367	1.49	8.367	2.99	14.367	4.12	20.37	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.433	1.49	8.433	3.22	14.433	4.00	20.43	1.49
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.567	1.49	8.567	3.22	14.567	4.00	20.57	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.633	1.49	8.633	3.46	14.633	3.88	20.63	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.700	1.49	8.700	3.46	14.700	3.88	20.70	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.767	1.49	8.767	3.46	14.767	3.88	20.77	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.833	1.55	8.833	3.70	14.833	3.64	20.83	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.900	1.55	8.900	3.70	14.900	3.64	20.90	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
2.967	1.55	8.967	3.70	14.967	3.64	20.97	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.033	1.55	9.033	3.82	15.033	3.52	21.03	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.100	1.55	9.100	3.82	15.100	3.52	21.10	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.167	1.55	9.167	3.82	15.167	3.52	21.17	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.233	1.61	9.233	3.82	15.233	3.28	21.23	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.300	1.61	9.300	3.82	15.300	3.28	21.30	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.367	1.61	9.367	3.82	15.367	3.28	21.37	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.433	1.61	9.433	3.88	15.433	3.16	21.43	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.567	1.61	9.567	3.88	15.567	3.16	21.57	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.633	1.61	9.633	4.18	15.633	3.04	21.63	1.43
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.700	1.61	9.700	4.18	15.700	3.04	21.70	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.767	1.61	9.767	4.18	15.767	3.04	21.77	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.833	1.67	9.833	4.60	15.833	2.81	21.83	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.900	1.67	9.900	4.60	15.900	2.81	21.90	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43
3.967	1.67	9.967	4.60	15.967	2.81	21.97	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.033	1.67	10.033	5.07	16.033	2.69	22.03	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.100	1.67	10.100	5.07	16.100	2.69	22.10	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.167	1.67	10.167	5.07	16.167	2.69	22.17	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.233	1.79	10.233	5.61	16.233	2.69	22.23	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.300	1.79	10.300	5.61	16.300	2.69	22.30	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.367	1.79	10.367	5.61	16.367	2.69	22.37	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.433	1.79	10.433	6.27	16.433	2.63	22.43	1.37
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.567	1.79	10.567	6.27	16.567	2.63	22.57	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.633	1.79	10.633	7.16	16.633	2.51	22.63	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.700	1.79	10.700	7.16	16.700	2.51	22.70	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.767	1.79	10.767	7.16	16.767	2.51	22.77	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.833	1.91	10.833	8.12	16.833	2.51	22.83	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.900	1.91	10.900	8.12	16.900	2.51	22.90	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
4.967	1.91	10.967	8.12	16.967	2.51	22.97	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.033	1.91	11.033	9.73	17.033	2.39	23.03	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.100	1.91	11.100	9.73	17.100	2.39	23.10	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.167	1.91	11.167	9.73	17.167	2.39	23.17	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.233	2.03	11.233	12.06	17.233	2.33	23.23	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.300	2.03	11.300	12.06	17.300	2.33	23.30	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.367	2.03	11.367	12.06	17.367	2.33	23.37	1.37
5.400	2.03	11.400	12.07	17.400	2.33	23.40	1.37
5.433	2.03	11.433	21.07	17.433	2.33	23.43	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.567	2.03	11.567	21.07	17.567	2.33	23.57	1.37
5.600	2.03	11.600	21.14	17.600	2.33	23.60	1.37
5.633	2.03	11.633	74.03	17.633	2.21	23.63	1.31
5.667	2.03	11.667	74.03	17.667	2.21	23.67	1.31
5.700	2.03	11.700	74.03	17.700	2.21	23.70	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31
5.767	2.03	11.767	74.03	17.767	2.21	23.77	1.31
5.800	2.03	11.800	74.11	17.800	2.21	23.80	1.31
5.833	2.15	11.833	138.62	17.833	2.21	23.83	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.900	2.15	11.900	138.62	17.900	2.21	23.90	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
5.967	2.15	11.967	138.62	17.967	2.21	23.97	1.31
6.000	2.15	12.000	138.46	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.420

PEAK FLOW (cms)= 0.171 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 79.385
TOTAL RAINFALL (mm)= 119.399
RUNOFF COEFFICIENT = 0.665

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

CALIB					
NASHYD (0206)	Area (ha)=	3.23	Curve Number (CN)=	82.0	
ID= 1 DT= 4.0 min	Ia (mm)=	5.60	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.33			

NOTE: RAINFALL WAS TRANSFORMED TO 4.0 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
0.067	1.19	6.067	2.15	12.067	21.27	18.07	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.600	1.25	6.600	2.27	12.600	10.87	18.60	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85

1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.200	1.31	7.200	2.39	13.200	6.93	19.20	1.85
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.267	1.49	8.267	2.98	14.267	4.12	20.27	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.600	2.03	11.600	21.07	17.600	2.33	23.60	1.37
5.667	2.03	11.667	74.02	17.667	2.21	23.67	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31
5.800	2.03	11.800	74.03	17.800	2.21	23.80	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.374

PEAK FLOW (cms)= 0.459 (i)
TIME TO PEAK (hrs)= 12.200
RUNOFF VOLUME (mm)= 76.370
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.640

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

CALIB					
NASHYD (3002)	Area	(ha)= 112.64	Curve Number	(CN)= 83.0	
ID= 1 DT= 5.0 min	Ia	(mm)= 5.40	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 1.13				

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	1.19	6.083	2.15	12.083	21.27	18.08	2.09
0.167	1.19	6.167	2.15	12.167	21.25	18.17	2.09
0.250	1.23	6.250	2.22	12.250	18.03	18.25	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.417	1.25	6.417	2.27	12.417	14.88	18.42	2.07
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.583	1.25	6.583	2.27	12.583	10.87	18.58	1.97
0.667	1.25	6.667	2.27	12.667	9.53	18.67	1.97
0.750	1.25	6.750	2.27	12.750	9.19	18.75	1.97
0.833	1.28	6.833	2.32	12.833	8.67	18.83	1.92
0.917	1.31	6.917	2.39	12.917	7.88	18.92	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.083	1.31	7.083	2.39	13.083	6.93	19.08	1.85
1.167	1.31	7.167	2.39	13.167	6.93	19.17	1.85
1.250	1.35	7.250	2.46	13.250	6.57	19.25	1.81
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.417	1.37	7.417	2.51	13.417	6.19	19.42	1.77
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.583	1.37	7.583	2.51	13.583	5.61	19.58	1.67
1.667	1.37	7.667	2.51	13.667	5.23	19.67	1.62
1.750	1.37	7.750	2.51	13.750	5.13	19.75	1.61
1.833	1.40	7.833	2.56	13.833	4.94	19.83	1.61
1.917	1.43	7.917	2.63	13.917	4.66	19.92	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.083	1.43	8.083	2.75	14.083	4.36	20.08	1.55
2.167	1.43	8.167	2.75	14.167	4.36	20.17	1.55
2.250	1.47	8.250	2.89	14.250	4.21	20.25	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.417	1.49	8.417	3.03	14.417	4.10	20.42	1.54
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.583	1.49	8.583	3.22	14.583	4.00	20.58	1.49
2.667	1.49	8.667	3.41	14.667	3.90	20.67	1.49
2.750	1.49	8.750	3.46	14.750	3.88	20.75	1.49
2.833	1.52	8.833	3.56	14.833	3.79	20.83	1.49
2.917	1.55	8.917	3.70	14.917	3.64	20.92	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.083	1.55	9.083	3.82	15.083	3.52	21.08	1.49
3.167	1.55	9.167	3.82	15.167	3.52	21.17	1.49
3.250	1.59	9.250	3.82	15.250	3.38	21.25	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.417	1.61	9.417	3.83	15.417	3.26	21.42	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.583	1.61	9.583	3.88	15.583	3.16	21.58	1.49
3.667	1.61	9.667	4.12	15.667	3.07	21.67	1.44
3.750	1.61	9.750	4.18	15.750	3.04	21.75	1.43
3.833	1.64	9.833	4.35	15.833	2.95	21.83	1.43
3.917	1.67	9.917	4.60	15.917	2.81	21.92	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.083	1.67	10.083	5.07	16.083	2.69	22.08	1.43
4.167	1.67	10.167	5.07	16.167	2.69	22.17	1.43
4.250	1.74	10.250	5.40	16.250	2.69	22.25	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.417	1.79	10.417	5.74	16.417	2.67	22.42	1.42
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.583	1.79	10.583	6.27	16.583	2.63	22.58	1.37
4.667	1.79	10.667	6.98	16.667	2.53	22.67	1.37
4.750	1.79	10.750	7.16	16.750	2.51	22.75	1.37
4.833	1.84	10.833	7.55	16.833	2.51	22.83	1.37
4.917	1.91	10.917	8.12	16.917	2.51	22.92	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.083	1.91	11.083	9.73	17.083	2.39	23.08	1.37
5.167	1.91	11.167	9.73	17.167	2.39	23.17	1.37
5.250	1.98	11.250	11.13	17.250	2.35	23.25	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.417	2.03	11.417	13.86	17.417	2.33	23.42	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37
5.583	2.03	11.583	21.07	17.583	2.33	23.58	1.37
5.667	2.03	11.667	63.43	17.667	2.23	23.67	1.33
5.750	2.03	11.750	74.03	17.750	2.21	23.75	1.31
5.833	2.08	11.833	99.86	17.833	2.21	23.83	1.31
5.917	2.15	11.917	138.62	17.917	2.21	23.92	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 3.807

PEAK FLOW (cms)= 6.672 (i)
TIME TO PEAK (hrs)= 13.083
RUNOFF VOLUME (mm)= 78.278
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.656

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

DUHYD (0050)				
Inlet Cap.=3.950				
#of Inlets= 1				
Total(cms)= 4.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	112.64	6.67	13.08	78.28
MAJOR SYS.(ID= 2):	16.13	2.72	13.08	78.28
MINOR SYS.(ID= 3):	96.51	3.95	12.33	78.28

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0025)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0205):	0.55	0.171	12.00	79.39
+ ID2= 2 (0206):	3.23	0.459	12.20	76.37
ID = 3 (0025):	3.78	0.505	12.00	76.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0025)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0025):	3.78	0.505	12.00	76.81
+ ID2= 2 (0050):	96.51	3.950	12.33	78.28
ID = 1 (0025):	100.29	4.387	12.33	78.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0201)	Area	(ha)= 5.46	Curve Number	(CN)= 81.0	
ID= 1 DT= 5.0 min	Ia	(mm)= 5.70	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.45				

Unit Hyd Qpeak (cms)= 0.463

PEAK FLOW (cms)= 0.608 (i)
TIME TO PEAK (hrs)= 12.333
RUNOFF VOLUME (mm)= 74.600
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.625

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

CALIB					
NASHYD (3001)	Area	(ha)= 59.38	Curve Number	(CN)= 83.0	
ID= 1 DT= 5.0 min	Ia	(mm)= 5.40	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.56				

Unit Hyd Qpeak (cms)= 4.050

PEAK FLOW (cms)= 5.950 (i)
TIME TO PEAK (hrs)= 12.417
RUNOFF VOLUME (mm)= 78.276
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.656

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

DUHYD (0051)				
Inlet Cap.=3.520				
#of Inlets= 1				
Total(cms)= 3.5	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	59.38	5.95	12.42	78.28
MAJOR SYS.(ID= 2):	7.20	2.43	12.42	78.28
MINOR SYS.(ID= 3):	52.18	3.52	12.08	78.28

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0023)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0201):	5.46	0.608	12.33	74.60
+ ID2= 2 (0051):	7.20	2.430	12.42	78.28
ID = 3 (0023):	12.66	3.019	12.42	76.69

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0024) |
| 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0023):	12.66	3.019	12.42	76.69
+ ID2= 2 (0051):	52.18	3.520	12.08	78.28
ID = 3 (0024):	64.84	6.539	12.42	77.97

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD (0203)	Area (ha)= 1.76	Curve Number (CN)= 84.0		
ID= 1 DT= 2.0 min	Ia (mm)= 5.20	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.09			

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	1.19	6.033	2.15	12.033	21.25	18.03	2.09
0.067	1.19	6.067	2.15	12.067	21.25	18.07	2.09
0.100	1.19	6.100	2.15	12.100	21.25	18.10	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.167	1.19	6.167	2.15	12.167	21.25	18.17	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.233	1.25	6.233	2.27	12.233	15.88	18.23	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.300	1.25	6.300	2.27	12.300	15.88	18.30	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.367	1.25	6.367	2.27	12.367	15.88	18.37	2.09
0.400	1.25	6.400	2.27	12.400	15.87	18.40	2.09
0.433	1.25	6.433	2.27	12.433	10.87	18.43	1.97
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.567	1.25	6.567	2.27	12.567	10.87	18.57	1.97
0.600	1.25	6.600	2.27	12.600	10.86	18.60	1.97
0.633	1.25	6.633	2.27	12.633	9.19	18.63	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.700	1.25	6.700	2.27	12.700	9.19	18.70	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.767	1.25	6.767	2.27	12.767	9.19	18.77	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.833	1.31	6.833	2.39	12.833	7.88	18.83	1.85
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.900	1.31	6.900	2.39	12.900	7.88	18.90	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
0.967	1.31	6.967	2.39	12.967	7.88	18.97	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.033	1.31	7.033	2.39	13.033	6.93	19.03	1.85
1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.100	1.31	7.100	2.39	13.100	6.93	19.10	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.167	1.31	7.167	2.39	13.167	6.93	19.17	1.85
1.200	1.31	7.200	2.39	13.200	6.92	19.20	1.85
1.233	1.37	7.233	2.51	13.233	6.33	19.23	1.79
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.300	1.37	7.300	2.51	13.300	6.33	19.30	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.367	1.37	7.367	2.51	13.367	6.33	19.37	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.433	1.37	7.433	2.51	13.433	5.61	19.43	1.67
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.567	1.37	7.567	2.51	13.567	5.61	19.57	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.633	1.37	7.633	2.51	13.633	5.13	19.63	1.61
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.700	1.37	7.700	2.51	13.700	5.13	19.70	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.767	1.37	7.767	2.51	13.767	5.13	19.77	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.833	1.43	7.833	2.63	13.833	4.66	19.83	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.900	1.43	7.900	2.63	13.900	4.66	19.90	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
1.967	1.43	7.967	2.63	13.967	4.66	19.97	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.033	1.43	8.033	2.75	14.033	4.36	20.03	1.55
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.100	1.43	8.100	2.75	14.100	4.36	20.10	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.167	1.43	8.167	2.75	14.167	4.36	20.17	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.233	1.49	8.233	2.98	14.233	4.12	20.23	1.55
2.267	1.49	8.267	2.99	14.267	4.12	20.27	1.55
2.300	1.49	8.300	2.99	14.300	4.12	20.30	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.367	1.49	8.367	2.99	14.367	4.12	20.37	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.433	1.49	8.433	3.22	14.433	4.00	20.43	1.49
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.567	1.49	8.567	3.22	14.567	4.00	20.57	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.633	1.49	8.633	3.46	14.633	3.88	20.63	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.700	1.49	8.700	3.46	14.700	3.88	20.70	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.767	1.49	8.767	3.46	14.767	3.88	20.77	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.833	1.55	8.833	3.70	14.833	3.64	20.83	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.900	1.55	8.900	3.70	14.900	3.64	20.90	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
2.967	1.55	8.967	3.70	14.967	3.64	20.97	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.033	1.55	9.033	3.82	15.033	3.52	21.03	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.100	1.55	9.100	3.82	15.100	3.52	21.10	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.167	1.55	9.167	3.82	15.167	3.52	21.17	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.233	1.61	9.233	3.82	15.233	3.28	21.23	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.300	1.61	9.300	3.82	15.300	3.28	21.30	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.367	1.61	9.367	3.82	15.367	3.28	21.37	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.433	1.61	9.433	3.88	15.433	3.16	21.43	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.567	1.61	9.567	3.88	15.567	3.16	21.57	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.633	1.61	9.633	4.18	15.633	3.04	21.63	1.43
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.700	1.61	9.700	4.18	15.700	3.04	21.70	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.767	1.61	9.767	4.18	15.767	3.04	21.77	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.833	1.67	9.833	4.60	15.833	2.81	21.83	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.900	1.67	9.900	4.60	15.900	2.81	21.90	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43
3.967	1.67	9.967	4.60	15.967	2.81	21.97	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.033	1.67	10.033	5.07	16.033	2.69	22.03	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.100	1.67	10.100	5.07	16.100	2.69	22.10	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.167	1.67	10.167	5.07	16.167	2.69	22.17	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.233	1.79	10.233	5.61	16.233	2.69	22.23	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.300	1.79	10.300	5.61	16.300	2.69	22.30	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.367	1.79	10.367	5.61	16.367	2.69	22.37	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.433	1.79	10.433	6.27	16.433	2.63	22.43	1.37
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.567	1.79	10.567	6.27	16.567	2.63	22.57	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.633	1.79	10.633	7.16	16.633	2.51	22.63	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.700	1.79	10.700	7.16	16.700	2.51	22.70	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.767	1.79	10.767	7.16	16.767	2.51	22.77	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.833	1.91	10.833	8.12	16.833	2.51	22.83	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.900	1.91	10.900	8.12	16.900	2.51	22.90	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
4.967	1.91	10.967	8.12	16.967	2.51	22.97	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.033	1.91	11.033	9.73	17.033	2.39	23.03	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.100	1.91	11.100	9.73	17.100	2.39	23.10	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.167	1.91	11.167	9.73	17.167	2.39	23.17	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.233	2.03	11.233	12.06	17.233	2.33	23.23	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.300	2.03	11.300	12.06	17.300	2.33	23.30	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.367	2.03	11.367	12.06	17.367	2.33	23.37	1.37
5.400	2.03	11.400	12.07	17.400	2.33	23.40	1.37
5.433	2.03	11.433	21.07	17.433	2.33	23.43	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.567	2.03	11.567	21.07	17.567	2.33	23.57	1.37
5.600	2.03	11.600	21.14	17.600	2.33	23.60	1.37
5.633	2.03	11.633	74.03	17.633	2.21	23.63	1.31
5.667	2.03	11.667	74.03	17.667	2.21	23.67	1.31
5.700	2.03	11.700	74.03	17.700	2.21	23.70	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31
5.767	2.03	11.767	74.03	17.767	2.21	23.77	1.31
5.800	2.03	11.800	74.11	17.800	2.21	23.80	1.31
5.833	2.15	11.833	138.62	17.833	2.21	23.83	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.900	2.15	11.900	138.62	17.900	2.21	23.90	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
5.967	2.15	11.967	138.62	17.967	2.21	23.97	1.31
6.000	2.15	12.000	138.46	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.747

PEAK FLOW (cms)= 0.501 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 80.119
TOTAL RAINFALL (mm)= 119.399
RUNOFF COEFFICIENT = 0.671

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

CALIB				
NASHYD (0202)	Area (ha)= 1.37	Curve Number (CN)= 82.0		
ID= 1 DT= 4.0 min	Ia (mm)= 5.50	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.29			

NOTE: RAINFALL WAS TRANSFORMED TO 4.0 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
0.067	1.19	6.067	2.15	12.067	21.27	18.07	2.09
0.133	1.19	6.133	2.15	12.133	21.25	18.13	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.267	1.25	6.267	2.27	12.267	15.88	18.27	2.09
0.333	1.25	6.333	2.27	12.333	15.88	18.33	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.467	1.25	6.467	2.27	12.467	10.87	18.47	1.97
0.533	1.25	6.533	2.27	12.533	10.87	18.53	1.97
0.600	1.25	6.600	2.27	12.600	10.87	18.60	1.97
0.667	1.25	6.667	2.27	12.667	9.19	18.67	1.97
0.733	1.25	6.733	2.27	12.733	9.19	18.73	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.867	1.31	6.867	2.39	12.867	7.88	18.87	1.85
0.933	1.31	6.933	2.39	12.933	7.88	18.93	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.067	1.31	7.067	2.39	13.067	6.93	19.07	1.85
1.133	1.31	7.133	2.39	13.133	6.93	19.13	1.85
1.200	1.31	7.200	2.39	13.200	6.93	19.20	1.85
1.267	1.37	7.267	2.51	13.267	6.33	19.27	1.79
1.333	1.37	7.333	2.51	13.333	6.33	19.33	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.467	1.37	7.467	2.51	13.467	5.61	19.47	1.67
1.533	1.37	7.533	2.51	13.533	5.61	19.53	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.667	1.37	7.667	2.51	13.667	5.13	19.67	1.61
1.733	1.37	7.733	2.51	13.733	5.13	19.73	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.867	1.43	7.867	2.63	13.867	4.66	19.87	1.61
1.933	1.43	7.933	2.63	13.933	4.66	19.93	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.067	1.43	8.067	2.75	14.067	4.36	20.07	1.55
2.133	1.43	8.133	2.75	14.133	4.36	20.13	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.267	1.49	8.267	2.98	14.267	4.12	20.27	1.55
2.333	1.49	8.333	2.99	14.333	4.12	20.33	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.467	1.49	8.467	3.22	14.467	4.00	20.47	1.49
2.533	1.49	8.533	3.22	14.533	4.00	20.53	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.667	1.49	8.667	3.46	14.667	3.88	20.67	1.49
2.733	1.49	8.733	3.46	14.733	3.88	20.73	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.867	1.55	8.867	3.70	14.867	3.64	20.87	1.49
2.933	1.55	8.933	3.70	14.933	3.64	20.93	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.067	1.55	9.067	3.82	15.067	3.52	21.07	1.49
3.133	1.55	9.133	3.82	15.133	3.52	21.13	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.267	1.61	9.267	3.82	15.267	3.28	21.27	1.49
3.333	1.61	9.333	3.82	15.333	3.28	21.33	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.467	1.61	9.467	3.88	15.467	3.16	21.47	1.49
3.533	1.61	9.533	3.88	15.533	3.16	21.53	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.667	1.61	9.667	4.18	15.667	3.04	21.67	1.43
3.733	1.61	9.733	4.18	15.733	3.04	21.73	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.867	1.67	9.867	4.60	15.867	2.81	21.87	1.43
3.933	1.67	9.933	4.60	15.933	2.81	21.93	1.43

4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.067	1.67	10.067	5.07	16.067	2.69	22.07	1.43
4.133	1.67	10.133	5.07	16.133	2.69	22.13	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.267	1.79	10.267	5.61	16.267	2.69	22.27	1.43
4.333	1.79	10.333	5.61	16.333	2.69	22.33	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.467	1.79	10.467	6.27	16.467	2.63	22.47	1.37
4.533	1.79	10.533	6.27	16.533	2.63	22.53	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.667	1.79	10.667	7.16	16.667	2.51	22.67	1.37
4.733	1.79	10.733	7.16	16.733	2.51	22.73	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.867	1.91	10.867	8.12	16.867	2.51	22.87	1.37
4.933	1.91	10.933	8.12	16.933	2.51	22.93	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.067	1.91	11.067	9.73	17.067	2.39	23.07	1.37
5.133	1.91	11.133	9.73	17.133	2.39	23.13	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.267	2.03	11.267	12.06	17.267	2.33	23.27	1.37
5.333	2.03	11.333	12.06	17.333	2.33	23.33	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.467	2.03	11.467	21.07	17.467	2.33	23.47	1.37
5.533	2.03	11.533	21.07	17.533	2.33	23.53	1.37
5.600	2.03	11.600	21.07	17.600	2.33	23.60	1.37
5.667	2.03	11.667	74.02	17.667	2.21	23.67	1.31
5.733	2.03	11.733	74.03	17.733	2.21	23.73	1.31
5.800	2.03	11.800	74.03	17.800	2.21	23.80	1.31
5.867	2.15	11.867	138.62	17.867	2.21	23.87	1.31
5.933	2.15	11.933	138.62	17.933	2.21	23.93	1.31
6.000	2.15	12.000	138.62	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.180

PEAK FLOW (cms)= 0.212 (i)
TIME TO PEAK (hrs)= 12.133
RUNOFF VOLUME (mm)= 76.453
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.640

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

ADD HYD (0020)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0202):		1.37	0.212	12.13	76.45
+ ID2= 2 (0203):		1.76	0.501	12.00	80.12
ID = 3 (0020):		3.13	0.668	12.00	78.51

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
NASHYD (0204)	Area (ha)= 1.18	Curve Number (CN)= 82.0	
ID= 1 DT= 3.0 min	Ia (mm)= 5.50	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 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
0.050	1.19	6.050	2.15	12.050	21.25	18.05	2.09
0.100	1.19	6.100	2.15	12.100	21.25	18.10	2.09
0.150	1.19	6.150	2.15	12.150	21.25	18.15	2.09
0.200	1.19	6.200	2.15	12.200	21.25	18.20	2.09
0.250	1.25	6.250	2.27	12.250	15.88	18.25	2.09
0.300	1.25	6.300	2.27	12.300	15.88	18.30	2.09
0.350	1.25	6.350	2.27	12.350	15.88	18.35	2.09
0.400	1.25	6.400	2.27	12.400	15.88	18.40	2.09
0.450	1.25	6.450	2.27	12.450	10.87	18.45	1.97
0.500	1.25	6.500	2.27	12.500	10.87	18.50	1.97
0.550	1.25	6.550	2.27	12.550	10.87	18.55	1.97
0.600	1.25	6.600	2.27	12.600	10.86	18.60	1.97
0.650	1.25	6.650	2.27	12.650	9.19	18.65	1.97
0.700	1.25	6.700	2.27	12.700	9.19	18.70	1.97
0.750	1.25	6.750	2.27	12.750	9.19	18.75	1.97
0.800	1.25	6.800	2.27	12.800	9.19	18.80	1.97
0.850	1.31	6.850	2.39	12.850	7.88	18.85	1.85
0.900	1.31	6.900	2.39	12.900	7.88	18.90	1.85
0.950	1.31	6.950	2.39	12.950	7.88	18.95	1.85
1.000	1.31	7.000	2.39	13.000	7.88	19.00	1.85
1.050	1.31	7.050	2.39	13.050	6.93	19.05	1.85
1.100	1.31	7.100	2.39	13.100	6.93	19.10	1.85
1.150	1.31	7.150	2.39	13.150	6.93	19.15	1.85
1.200	1.31	7.200	2.39	13.200	6.92	19.20	1.85
1.250	1.37	7.250	2.51	13.250	6.33	19.25	1.79
1.300	1.37	7.300	2.51	13.300	6.33	19.30	1.79
1.350	1.37	7.350	2.51	13.350	6.33	19.35	1.79
1.400	1.37	7.400	2.51	13.400	6.33	19.40	1.79
1.450	1.37	7.450	2.51	13.450	5.61	19.45	1.67
1.500	1.37	7.500	2.51	13.500	5.61	19.50	1.67
1.550	1.37	7.550	2.51	13.550	5.61	19.55	1.67
1.600	1.37	7.600	2.51	13.600	5.61	19.60	1.67
1.650	1.37	7.650	2.51	13.650	5.13	19.65	1.61
1.700	1.37	7.700	2.51	13.700	5.13	19.70	1.61
1.750	1.37	7.750	2.51	13.750	5.13	19.75	1.61
1.800	1.37	7.800	2.51	13.800	5.13	19.80	1.61
1.850	1.43	7.850	2.63	13.850	4.66	19.85	1.61
1.900	1.43	7.900	2.63	13.900	4.66	19.90	1.61
1.950	1.43	7.950	2.63	13.950	4.66	19.95	1.61
2.000	1.43	8.000	2.63	14.000	4.66	20.00	1.61
2.050	1.43	8.050	2.75	14.050	4.36	20.05	1.55
2.100	1.43	8.100	2.75	14.100	4.36	20.10	1.55
2.150	1.43	8.150	2.75	14.150	4.36	20.15	1.55
2.200	1.43	8.200	2.75	14.200	4.36	20.20	1.55
2.250	1.49	8.250	2.99	14.250	4.12	20.25	1.55
2.300	1.49	8.300	2.99	14.300	4.12	20.30	1.55
2.350	1.49	8.350	2.99	14.350	4.12	20.35	1.55
2.400	1.49	8.400	2.99	14.400	4.12	20.40	1.55
2.450	1.49	8.450	3.22	14.450	4.00	20.45	1.49
2.500	1.49	8.500	3.22	14.500	4.00	20.50	1.49
2.550	1.49	8.550	3.22	14.550	4.00	20.55	1.49
2.600	1.49	8.600	3.22	14.600	4.00	20.60	1.49
2.650	1.49	8.650	3.46	14.650	3.88	20.65	1.49
2.700	1.49	8.700	3.46	14.700	3.88	20.70	1.49
2.750	1.49	8.750	3.46	14.750	3.88	20.75	1.49
2.800	1.49	8.800	3.46	14.800	3.88	20.80	1.49
2.850	1.55	8.850	3.70	14.850	3.64	20.85	1.49
2.900	1.55	8.900	3.70	14.900	3.64	20.90	1.49
2.950	1.55	8.950	3.70	14.950	3.64	20.95	1.49
3.000	1.55	9.000	3.70	15.000	3.64	21.00	1.49
3.050	1.55	9.050	3.82	15.050	3.52	21.05	1.49
3.100	1.55	9.100	3.82	15.100	3.52	21.10	1.49
3.150	1.55	9.150	3.82	15.150	3.52	21.15	1.49
3.200	1.55	9.200	3.82	15.200	3.52	21.20	1.49
3.250	1.61	9.250	3.82	15.250	3.28	21.25	1.49
3.300	1.61	9.300	3.82	15.300	3.28	21.30	1.49
3.350	1.61	9.350	3.82	15.350	3.28	21.35	1.49
3.400	1.61	9.400	3.82	15.400	3.28	21.40	1.49
3.450	1.61	9.450	3.88	15.450	3.16	21.45	1.49
3.500	1.61	9.500	3.88	15.500	3.16	21.50	1.49
3.550	1.61	9.550	3.88	15.550	3.16	21.55	1.49
3.600	1.61	9.600	3.88	15.600	3.16	21.60	1.49
3.650	1.61	9.650	4.18	15.650	3.04	21.65	1.43
3.700	1.61	9.700	4.18	15.700	3.04	21.70	1.43
3.750	1.61	9.750	4.18	15.750	3.04	21.75	1.43
3.800	1.61	9.800	4.18	15.800	3.04	21.80	1.43
3.850	1.67	9.850	4.60	15.850	2.81	21.85	1.43
3.900	1.67	9.900	4.60	15.900	2.81	21.90	1.43
3.950	1.67	9.950	4.60	15.950	2.81	21.95	1.43
4.000	1.67	10.000	4.60	16.000	2.81	22.00	1.43
4.050	1.67	10.050	5.07	16.050	2.69	22.05	1.43
4.100	1.67	10.100	5.07	16.100	2.69	22.10	1.43
4.150	1.67	10.150	5.07	16.150	2.69	22.15	1.43
4.200	1.67	10.200	5.07	16.200	2.69	22.20	1.43
4.250	1.79	10.250	5.61	16.250	2.69	22.25	1.43
4.300	1.79	10.300	5.61	16.300	2.69	22.30	1.43
4.350	1.79	10.350	5.61	16.350	2.69	22.35	1.43
4.400	1.79	10.400	5.61	16.400	2.69	22.40	1.43
4.450	1.79	10.450	6.27	16.450	2.63	22.45	1.37
4.500	1.79	10.500	6.27	16.500	2.63	22.50	1.37
4.550	1.79	10.550	6.27	16.550	2.63	22.55	1.37
4.600	1.79	10.600	6.27	16.600	2.63	22.60	1.37
4.650	1.79	10.650	7.16	16.650	2.51	22.65	1.37
4.700	1.79	10.700	7.16	16.700	2.51	22.70	1.37
4.750	1.79	10.750	7.16	16.750	2.51	22.75	1.37
4.800	1.79	10.800	7.16	16.800	2.51	22.80	1.37
4.850	1.91	10.850	8.12	16.850	2.51	22.85	1.37
4.900	1.91	10.900	8.12	16.900	2.51	22.90	1.37
4.950	1.91	10.950	8.12	16.950	2.51	22.95	1.37
5.000	1.91	11.000	8.12	17.000	2.51	23.00	1.37
5.050	1.91	11.050	9.73	17.050	2.39	23.05	1.37
5.100	1.91	11.100	9.73	17.100	2.39	23.10	1.37
5.150	1.91	11.150	9.73	17.150	2.39	23.15	1.37
5.200	1.91	11.200	9.73	17.200	2.39	23.20	1.37
5.250	2.03	11.250	12.06	17.250	2.33	23.25	1.37
5.300	2.03	11.300	12.06	17.300	2.33	23.30	1.37
5.350	2.03	11.350	12.06	17.350	2.33	23.35	1.37
5.400	2.03	11.400	12.06	17.400	2.33	23.40	1.37
5.450	2.03	11.450	21.07	17.450	2.33	23.45	1.37
5.500	2.03	11.500	21.07	17.500	2.33	23.50	1.37
5.550	2.03	11.550	21.07	17.550	2.33	23.55	1.37
5.600	2.03	11.600	21.10	17.600	2.33	23.60	1.37
5.650	2.03	11.650	74.03	17.650	2.21	23.65	1.31
5.700	2.03	11.700	74.03	17.700	2.21	23.70	1.31
5.750	2.03	11.750	74.03	17.750	2.21	23.75	1.31
5.800	2.03	11.800	74.06	17.800	2.21	23.80	1.31
5.850	2.15	11.850	138.62	17.850	2.21	23.85	1.31
5.900	2.15	11.900	138.62	17.900	2.21	23.90	1.31
5.950	2.15	11.950	138.62	17.950	2.21	23.95	1.31
6.000	2.15	12.000	138.56	18.000	2.21	24.00	1.31

Unit Hyd Qpeak (cms)= 0.205

PEAK FLOW (cms)= 0.217 (i)
TIME TO PEAK (hrs)= 12.100
RUNOFF VOLUME (mm)= 76.453
TOTAL RAINFALL (mm)= 119.400
RUNOFF COEFFICIENT = 0.640

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

ADD HYD (0021)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0204):		1.18	0.217	12.10	76.45
+ ID2= 2 (0050):		16.13	2.722	13.08	78.28
ID = 3 (0021):		17.31	2.745	13.05	78.15

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0022)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0020):		3.13	0.668	12.00	78.51
+ ID2= 2 (0021):		17.31	2.745	13.05	78.15
ID = 3 (0022):		20.44	2.817	13.00	78.21

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0026)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0022):		20.44	2.817	13.00	78.21
+ ID2= 2 (0024):		64.84	6.539	12.42	77.97
ID = 3 (0026):		85.28	8.154	12.60	78.02

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0026)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0026):		85.28	8.154	12.60	78.02
+ ID2= 2 (0025):		100.29	4.387	12.33	78.22
ID = 1 (0026):		185.57	12.382	12.57	78.13

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Hydraulic Calculations

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.920 cu.m/s

Design Flow: 1.790 cu.m/s

Maximum Flow: 2.740 cu.m/s

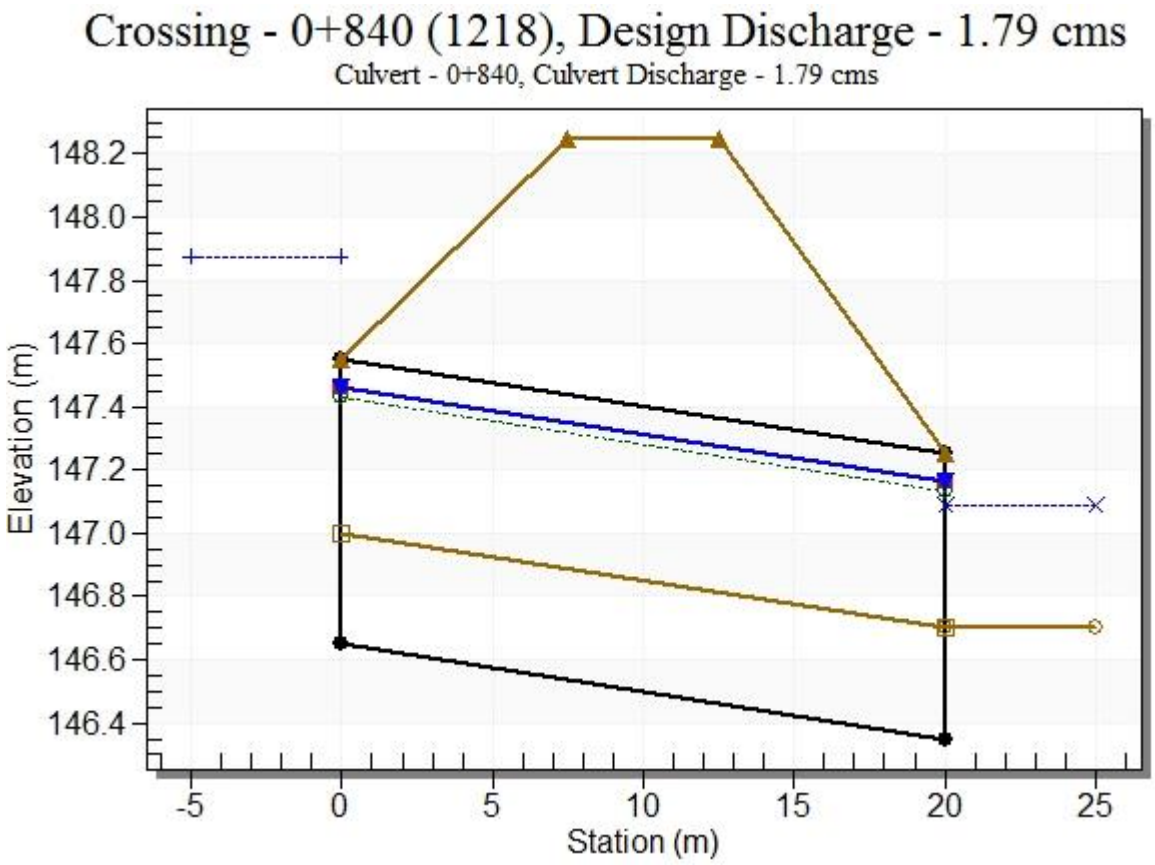
Table 1 - Summary of Culvert Flows at Crossing: 0+840 (1218)

Headwater Elevation (m)	Total Discharge (cms)	0+840 Discharge (cms)	Roadway Discharge (cms)	Iterations
147.49	0.92	0.92	0.00	1
147.56	1.10	1.10	0.00	1
147.63	1.28	1.28	0.00	1
147.71	1.47	1.47	0.00	1
147.79	1.65	1.65	0.00	1
147.87	1.79	1.79	0.00	1
148.00	2.01	2.01	0.00	1
148.14	2.19	2.19	0.00	1
148.27	2.38	2.35	0.03	10
148.32	2.56	2.40	0.15	6
148.36	2.74	2.45	0.29	5
148.25	2.32	2.32	0.00	Overtopping

Table 2 - Culvert Summary Table: 0+840

Total Discharge (cms)	Culvert Discharge (cms)	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)
0.92	0.92	147.49	0.486	0.161	1-S2n	0.289	0.297	0.289	0.304	1.610	0.994
1.10	1.10	147.56	0.560	0.259	5-S2n	0.322	0.334	0.322	0.326	1.731	1.040
1.28	1.28	147.63	0.635	0.375	5-S2n	0.353	0.370	0.353	0.345	1.837	1.080
1.47	1.47	147.71	0.712	0.503	5-S2n	0.382	0.405	0.382	0.362	1.939	1.117
1.65	1.65	147.79	0.792	0.696	5-S2n	0.410	0.437	0.410	0.379	2.031	1.150
1.79	1.79	147.87	0.873	0.800	5-S2n	0.431	0.463	0.462	0.390	1.957	1.174
2.01	2.01	148.00	0.999	0.989	7-M2c	0.550	0.501	0.501	0.408	2.233	1.209
2.19	2.19	148.14	1.133	1.139	7-M2c	0.550	0.531	0.531	0.421	2.294	1.235
2.38	2.35	148.27	1.249	1.272	6-FFc	0.550	0.550	0.550	0.434	2.373	1.260
2.56	2.40	148.32	1.290	1.320	6-FFc	0.550	0.550	0.550	0.446	2.429	1.283
2.74	2.45	148.36	1.323	1.358	6-FFc	0.550	0.550	0.550	0.458	2.471	1.306

Water Surface Profile Plot for Culvert: 0+840



Site Data - 0+840

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 m
Inlet Elevation: 146.65 m
Outlet Station: 20.00 m
Outlet Elevation: 146.35 m
Number of Barrels: 1

Culvert Data Summary - 0+840

Barrel Shape: Concrete Box
Barrel Span: 1800.00 mm
Barrel Rise: 900.00 mm
Barrel Material: Concrete
Embedment: 350.00 mm
Barrel Manning's n: 0.0130 (top and sides)
Manning's n: 0.0350 (bottom)
Culvert Type: Straight
Inlet Configuration: Thin Edge Projecting
Inlet Depression: NONE

Tailwater Channel Data - 0+840 (1218)

Tailwater Channel Option: Triangular Channel
Side Slope (H:V): 10.00 (_:1)
Channel Slope: 0.0150
Channel Manning's n: 0.0350
Channel Invert Elevation: 146.70 m

Roadway Data for Crossing: 0+840 (1218)

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 5.00 m
Crest Elevation: 148.25 m
Roadway Surface: Paved
Roadway Top Width: 5.00 m

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

CVC/TRCA Low Impact Development Planning and Design Guide – Bioretention Fact Sheet

BIORETENTION

CVC/TRCA LOW IMPACT DEVELOPMENT
PLANNING AND DESIGN GUIDE - FACT SHEET

GENERAL DESCRIPTION

As a stormwater filter and infiltration practice, bioretention temporarily stores, treats and infiltrates runoff. Depending on native soil infiltration rate and physical constraints, the system may be designed without an underdrain for full infiltration, with an underdrain for partial infiltration, or with an impermeable liner and underdrain for filtration only (i.e., a biofilter). The primary component of the practice is the filter bed which is a mixture of sand, fines and organic material. Other elements include a mulch ground cover and plants adapted to the conditions of a stormwater practice. Bioretention is designed to capture small storm events or the water quality storage requirement. An overflow or bypass is necessary to pass large storm event flows. Bioretention can be adapted to fit into many different development contexts and provide a convenient area for snow storage and treatment.

DESIGN GUIDANCE

SOIL CHARACTERISTICS

Bioretention can be constructed over any soil type, but hydrologic soil group A and B are best for achieving water balance goals. If possible, bioretention should be sited in the areas of the development with the highest native soil infiltration rates. Bioretention in soils with infiltration rates less than 15 mm/hr will require an underdrain. Designers should verify the native soil infiltration rate at the proposed location and depth through measurement of hydraulic conductivity under field saturated conditions.

GEOMETRY & SITE LAYOUT

Key geometry and site layout factors include:

- The minimum footprint of the filter bed area is based on the drainage area. Typical drainage areas to bioretention are between 100 m2 to 0.5 hectares. The maximum recommended drainage area is 0.8 hectares. Typical ratios of impervious drainage area to treatment facility area range from 5:1 to 15:1.
- Bioretention can be configured to fit into many locations and shapes. However, cells that are narrow may concentrate flow as it spreads throughout the cell and result in erosion.
- The filter bed surface should be level to encourage stormwater to spread out evenly over the surface.

PRE-TREATMENT

Pretreatment prevents premature clogging by capturing coarse sediment particles before they reach the filter bed. Where the runoff source area produces little sediment, such as roofs, bioretention can function effectively without pretreatment. To treat parking area or road runoff, a two-cell design that incorporates a forebay is recommended. Pretreatment practices that may be feasible, depending on the method of conveyance and the availability of space include:

- *Two-cell design (channel flow):* Forebay ponding volume should account for 25% of the water quality storage requirement and be designed with a 2:1 length to width ratio.
- *Vegetated filter strip (sheet flow):* Should be a minimum of three (3) metres in width. If smaller strips are used, more frequent maintenance of the filter bed can be anticipated.
- *Gravel diaphragm (sheet flow):* A small trench filled with pea gravel, which is perpendicular to the flow path between the edge of the pavement and the bioretention practice will promote settling out of sediment and maintain sheet flow into the facility. A drop of 50-150 mm into the gravel diaphragm can be used to dissipate energy and promote settling.
- *Rip rap and/or dense vegetation (channel flow):* Suitable for small bioretention cells with drainage areas less than 100 square metres.

GRAVEL STORAGE LAYER

- DEPTH: Should be a minimum of 300 mm deep and sized to provide the required storage volume. Granular material should be 50 mm diameter clear stone.
- PEA GRAVEL CHOKING LAYER: A 100 mm deep layer of pea gravel (3 to 10 mm diameter clear stone) should be placed on top of the coarse gravel storage layer as a choking layer separating it from the overlying filter media bed.

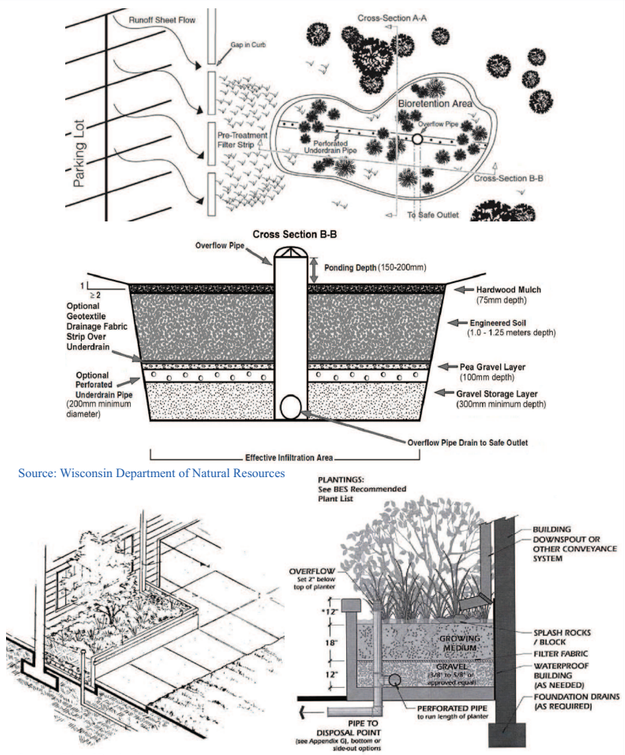
FILTER MEDIA

- COMPOSITION: To ensure a consistent and homogeneous bed, filter media should come pre-mixed from an approved vendor.
- DEPTH: Recommended depth is between 1.0 and 1.25 m. However in constrained applications, pollutant removal benefits may be achieved in beds as shallow as 500 mm. If trees are to be included in the design, bed depth must be at least 1.0 m.
- MULCH: A 75 mm layer of mulch on the surface of the filter bed enhances plant survival, suppresses weed growth and pretreats runoff before it reaches the filter bed.

CONVEYANCE AND OVERFLOW

Bioretention can be designed to be inline or offline from the drainage system. Inline bioretention accepts all flow from a drainage area and conveys larger event flows through an overflow outlet. Overflow structures must be sized to safely convey larger storm events out of the facility. The invert of the overflow should be placed at the maximum water surface elevation of the bioretention area, which is typically 150-250 mm above the filter bed surface.

Offline bioretention practices use flow splitters or bypass channels that only allow the required water quality storage volume to enter the facility. This may be achieved with a pipe, weir, or curb opening sized for the target flow, but in conjunction, create a bypass channel so that higher flows do not pass over the surface of the filter bed. Using a weir or curb opening minimizes clogging and reduces maintenance frequency.



Source: Wisconsin Department of Natural Resources

Source: City of Portland

ABILITY TO MEET SWM OBJECTIVES

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefits
Bioretention with no underdrain	Yes	Yes - size for water quality storage requirement	Partial - based on available storage volume and infiltration rates
Bioretention with underdrain	Partial - based on available storage volume beneath the underdrain and soil infiltration rate	Yes - size for water quality storage requirement	Partial - based on available storage volume beneath the underdrain and soil infiltration rate
Bioretention with underdrain and impermeable liner	Partial - some volume reduction through evapotranspiration	Yes - size for water quality storage requirement	Partial - some volume reduction through evapotranspiration

UNDERDRAIN

- Only needed where native soil infiltration rate is less than 15 mm/hr (hydraulic conductivity of less than 1x10-6 cm/s).
- Should consist of a perforated pipe embedded in the coarse gravel storage layer at least 100 mm above the bottom.
- A strip of geotextile filter fabric placed between the filter media and pea gravel choking layer over the perforated pipe is optional to help prevent fine soil particles from entering the underdrain.
- A vertical standpipe connected to the underdrain can be used as a cleanout and monitoring well.

MONITORING WELLS

A capped vertical stand pipe consisting of an anchored 100 to 150 mm diameter perforated pipe with a lockable cap installed to the bottom of the facility is recommended for monitoring drainage time between storms.

GENERAL SPECIFICATIONS

Material	Specification	Quantity
Filter Media Composition	Filter Media Soil Mixture to contain: • 85 to 88% sand • 8 to 12% soil fines • 3 to 5% organic matter (leaf compost) Other Criteria: • Phosphorus soil test index (P-Index) value between 10 to 30 ppm • Cationic exchange capacity (CEC) greater than 10 meq/100 g • Free of stones, stumps, roots and other large debris • pH between 5.5 to 7.5 • Infiltration rate greater than 25 mm/hr	Recommended depth is between 1.0 and 1.25 metres.
Mulch Layer	Shredded hardwood bark mulch	A 75 mm layer on the surface of the filter bed
Geotextile	Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics. Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging. For further guidance see CVC/TRCA LID SWM Planning and Design Guide, Table 4.5.5.	Strip over the perforated pipe underdrain (if present) between the filter media bed and gravel storage layer (stone reservoir)
Gravel	Washed 50 mm diameter clear stone should be used to surround the underdrain and for the gravel storage layer Washed 3 to 10 mm diameter clear stone should be used for pea gravel choking layer.	Volume based on dimensions, assuming a void space ratio of 0.4.
Underdrain	Perforated HDPE or equivalent, minimum 100 mm diameter, 200 mm recommended.	• Perforated pipe for length of cell. • Non-perforated pipe as needed to connect with storm drain system. • One or more caps. • T's for underdrain configuration

CONSTRUCTION CONSIDERATIONS

Ideally, bioretention sites should remain outside the limit of disturbance until construction of the bioretention begins to prevent soil compaction by heavy equipment. Locations should not be used as sediment basins during construction, as the concentration of fines will prevent post-construction infiltration. To prevent sediment from clogging the surface of a bioretention cell, stormwater should be diverted away from the bioretention until the drainage area is fully stabilized.

For further guidance regarding key steps during construction, see the CVC/TRCA LID SWM Planning and Design Guide, Section 4.5.2 - Construction Considerations)

OPERATION AND MAINTENANCE

Bioretention requires routine inspection and maintenance of the landscaping as well as periodic inspection for less frequent maintenance needs or remedial maintenance. Generally, routine maintenance will be the same as for any other landscaped area; weeding, pruning, and litter removal. Regular watering may be required during the first two years until vegetation is established.

For the first two years following construction the facility should be inspected at least quarterly and after every major storm event (> 25 mm). Subsequently, inspections should be conducted in the spring and fall of each year and after major storm events. Inspect for vegetation density (at least 80% coverage), damage by foot or vehicular traffic, channelization, accumulation of debris, trash and sediment, and structural damage to pretreatment devices.

Trash and debris should be removed from pretreatment devices, the bioretention area surface and inlet and outlets at least twice annually. Other maintenance activities include reapplying mulch, pruning, weeding replacing dead vegetation and repairing eroded areas as needed. Remove accumulated sediment on the bioretention area surface when dry and exceeding 25 mm depth.

SITE CONSIDERATIONS

Wellhead Protection

Facilities receiving road or parking lot runoff should not be located within two (2) year time-of-travel wellhead protection areas.

Available Space

Reserve open areas of about 10 to 20% of the size of the contributing drainage area.

Site Topography

Contributing slopes should be between 1 to 5%. The surface of the filter bed should be flat to allow flow to spread out. A stepped multi-cell design can also be used.

Available Head

If an underdrain is used, then 1 to 1.5 metres elevation difference is needed between the inflow point and the downstream storm drain invert.

Water Table

A minimum of one (1) metre separating the seasonally high water table or top of bedrock elevation and the bottom of the practice is necessary.

Soils

Bioretention can be located over any soil type, but hydrologic soil group A and B soils are best for achieving water balance benefits. Facilities should be located in portions of the site with the highest native soil infiltration rates. Where infiltration rates are less than 15 mm/hr (hydraulic conductivity less than 1x10-6 cm/s) an underdrain is required. Native soil infiltration rate at the proposed facility location and depth should be confirmed through measurement of hydraulic conductivity under field saturated conditions.

Drainage Area & Runoff Volume

Typical contributing drainage areas are between 100 m2 to 0.5 hectares. The maximum recommended contributing drainage area is 0.8 hectares. Typical ratios of impervious drainage area to treatment facility area range from 5:1 to 15:1.

Pollution Hot Spot Runoff

To protect groundwater from possible contamination, runoff from pollution hot spots should not be treated by bioretention facilities designed for full or partial infiltration. Facilities designed with an impermeable liner (filtration only facilities) can be used to treat runoff from pollution hot spots.

Proximity to Underground Utilities

Designers should consult local utility design guidance for the horizontal and vertical clearances required between storm drains, ditches, and surface water bodies.

Overhead Wires

Check whether the future tree canopy height in the bioretention area will interfere with existing overhead phone and power lines.

Setback from Buildings

If an impermeable liner is used, no setback is needed. If not, a four (4) metre setback from building foundations should be applied.

TORONTO AND REGION Conservation for The Living City

CVC CREDIT VALLEY CONSERVATION

FOR FURTHER DETAILS SEE SECTION 4.5 OF THE CVC/TRCA LID SWM GUIDE

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix F

Flood Control Calculations

R.J. Burnside & Associates Limited 6990 Creditview Road, Unit 2 Mississauga ON L5N 8R9 CANADA
telephone (905) 821-1800 **fax** (905) 821-1809 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Technical Memorandum

Date: January 17, 2018 **Project No.:** 300039474.0000

Project Name: Sheridan Park Drive Extension Municipal Class Environmental Assessment
Flood Control Calculations

Client Name: City of Mississauga

Submitted By: Harold Faulkner, P.Eng.

Introduction

As noted in Section 3.0, Table 3-1, of the Credit Valley Conservation Stormwater Management Criteria (August 2012), the Flood Control criteria for new development in the Sheridan Creek watershed, is to control the 1:100-year post-development peak flow rate to the 1:2-year pre-development peak flow.

To address this criteria for the proposed extension of Sheridan Park Drive, the Modified Rational Method was used to determine the maximum required storage volume.

The proposed land-use changes are limited to an 850 m length of the road right-of-way (ROW). Over this length, the ROW width is approximately 35 m; therefore, the 29,750 m^2 (850 m x 35 m) drainage area will form the basis for comparing pre and post-development flows.

1:2-year Pre-Development Peak Flow

The pre-development condition represents the existing, vegetated state. The Rational Method was used to determine the 1:2-year pre-development target peak flow rate as follows:

Area = 29,750 m^2
Runoff coefficient = 0.25 (existing vegetated condition)
Rainfall intensity = 59.89 mm/hr (15-minute time of concentration)

$Q = CIA/360$
$Q_2 = 0.25 \times 59.89 \times 29{,}750/360$
$Q_2 = 123.7$ L/s

1:100-year Post-Development Peak Flow and Required Storage

The post-development condition includes the extended roadway. The table below provides the calculations for the proposed ROW runoff coefficient. These areas are based on the average

ROW cross-section, with 9 m of paved surface, and the remaining 26 m consisting of vegetated cover.

Land Use	Area	Runoff Coefficient	C x A
Paved	9 m x 850 m = 7,650 m^2	0.90	6,885
Grassed	26 m x 850 m = 22,100 m^2	0.25	5,525
Total	29,750 m^2	0.42	12,410

The Rational Method was used to determine the 1:100-year post-development peak flow rate as follows:

Area = 29,750 m^2
Runoff coefficient = 0.42
Rainfall intensity = 140.69 mm/hr (15-minute time of concentration)

$Q = CIA/360$
$Q_{100} = 0.42 \times 1.25 \times 140.69 \times 29,750 / 360$
$Q_{100} = 606.2$ L/s

A Modified Rational Method spreadsheet was used to determine the maximum volume required to reduce the post-development 1:100-year peak flow to the pre-development 1:2-year rate. As demonstrated in the attached Excel table output, the resulting volume is 590 m^3.

These stormwater calculations are preliminary and will be finalized, together with the approach to storing/managing stormwater attributed to the road extension during the detailed design phase of the project.

R.J. Burnside & Associates Limited

Harold Faulkner, P.Eng.
Project Engineer
HF:bs

BURNSIDE

MODIFIED RATIONAL METHOD - REQUIRED STORAGE VOLUME

Project: Sheridan Park Drive Extension EA
Project No: 300039474

1:100-year Post Development to 1:2-year Pre-Development

By: H.Faulkner
Date: 17-Jan-18

100-Year				
Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Storage (m^3)
15	141	606.2	123.73	434.25
17	131	562.6	123.73	455.07
19	122	525.5	123.73	472.90
21	115	493.6	123.73	488.30
23	108	465.8	123.73	501.72
25	102	441.3	123.73	513.46
27	97	419.6	123.73	523.78
29	93	400.1	123.73	532.89
31	89	382.6	123.73	540.93
33	85	366.8	123.73	548.06
35	82	352.4	123.73	554.36
37	79	339.2	123.73	559.94
39	76	327.1	123.73	564.87
41	73	315.9	123.73	569.22
43	71	305.6	123.73	573.03
45	69	296.0	123.73	576.37
47	67	287.0	123.73	579.27
49	65	278.7	123.73	581.76
51	63	270.9	123.73	583.88
53	61	263.5	123.73	585.67
55	60	256.7	123.73	587.14
57	58	250.2	123.73	588.31
59	57	244.0	123.73	589.21
61	55	238.2	123.73	589.86
63	54	232.7	123.73	590.26
65	53	227.5	123.73	**590.45**
67	52	222.6	123.73	590.42
69	51	217.9	123.73	590.19
71	50	213.4	123.73	589.78
73	49	209.1	123.73	589.20
75	48	205.0	123.73	588.44
77	47	201.1	123.73	587.53
79	46	197.3	123.73	586.47
81	45	193.7	123.73	585.26
83	44	190.3	123.73	583.92
85	43	187.0	123.73	582.45
87	43	183.8	123.73	580.85

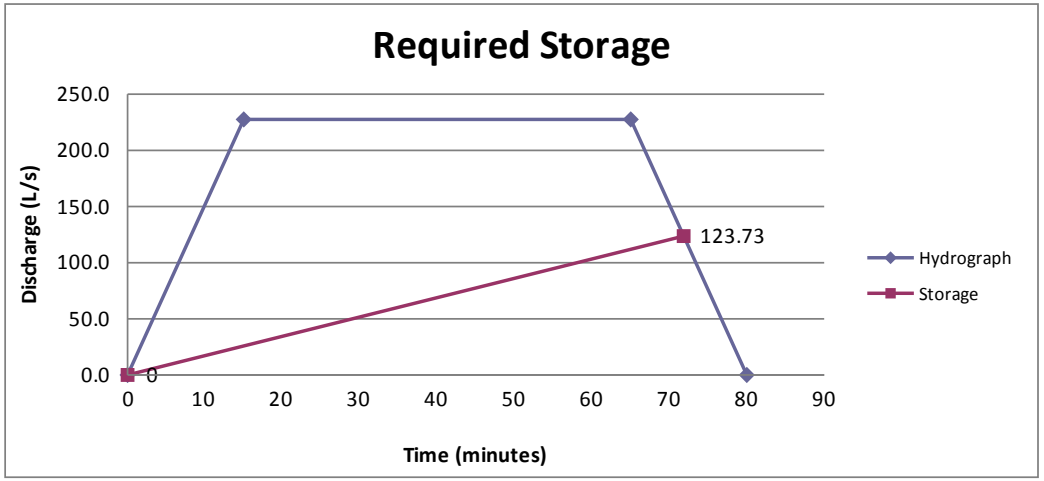
Catchment Area	29,750	m^2
Time of Concentration	15	minutes
Time Step	2	minutes
Post-Development Runoff Coefficient	0.42	

$Q = CIA/360$

$I = A/(T+B)^c$

$Storage = Q_{in} \times T - Q_{out} \times [(T_c + T) / 2]$

Storm Return Period (years)	A	B	c	Proposed Runoff Coefficient	Target Discharge (L/s)	Initial Time (min)
100	1450.0	4.900	0.780	0.52	123.73	15



Required storage to attain target discharge rate is equal to the area above the "storage" line.

Trapezoid Area	887,401	L/s * s
Triangle Area	296,955	L/s * s
Trapezoid - Triangle	**590.45**	**m^3**

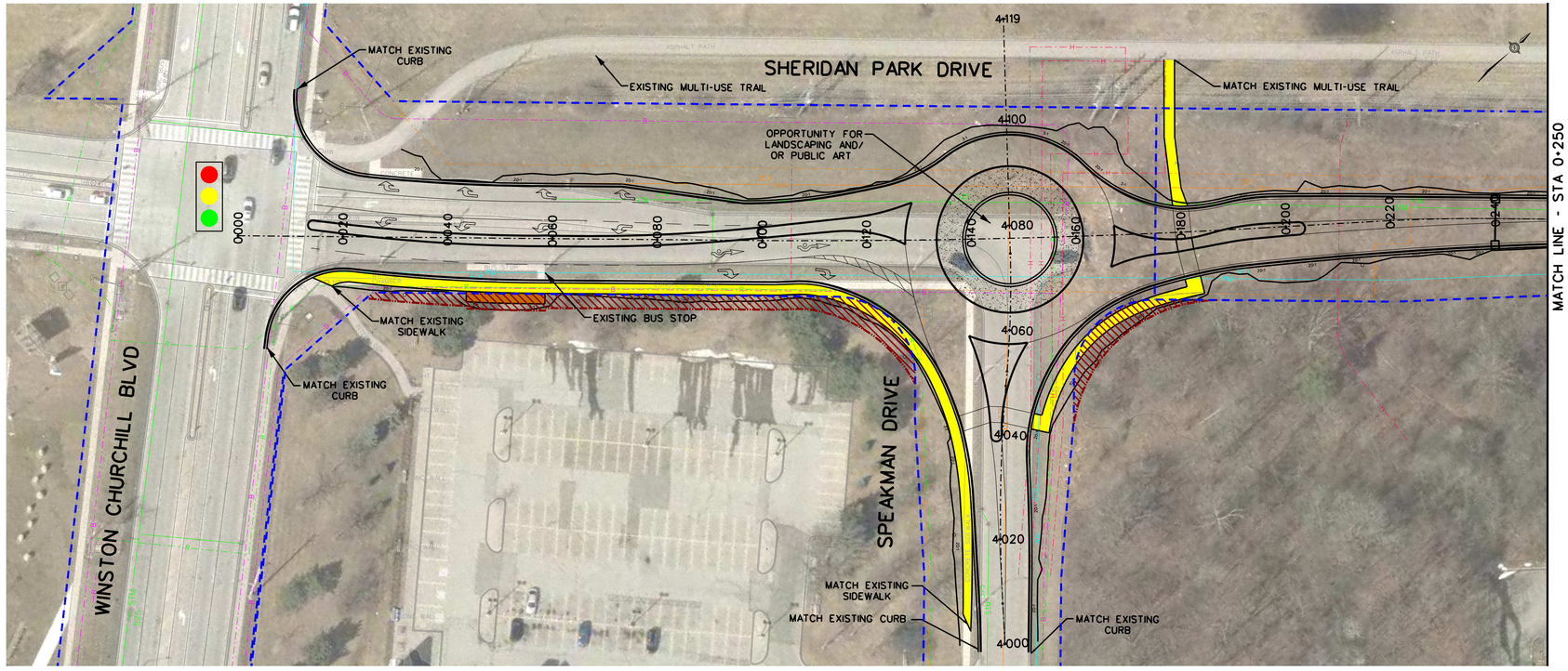
Source: ASCE Manuals and Reports on Engineering Practice No. 28, Hydrology Handbook, Second Edition, Copyright 1996, ISBN 0-7844-0138-2

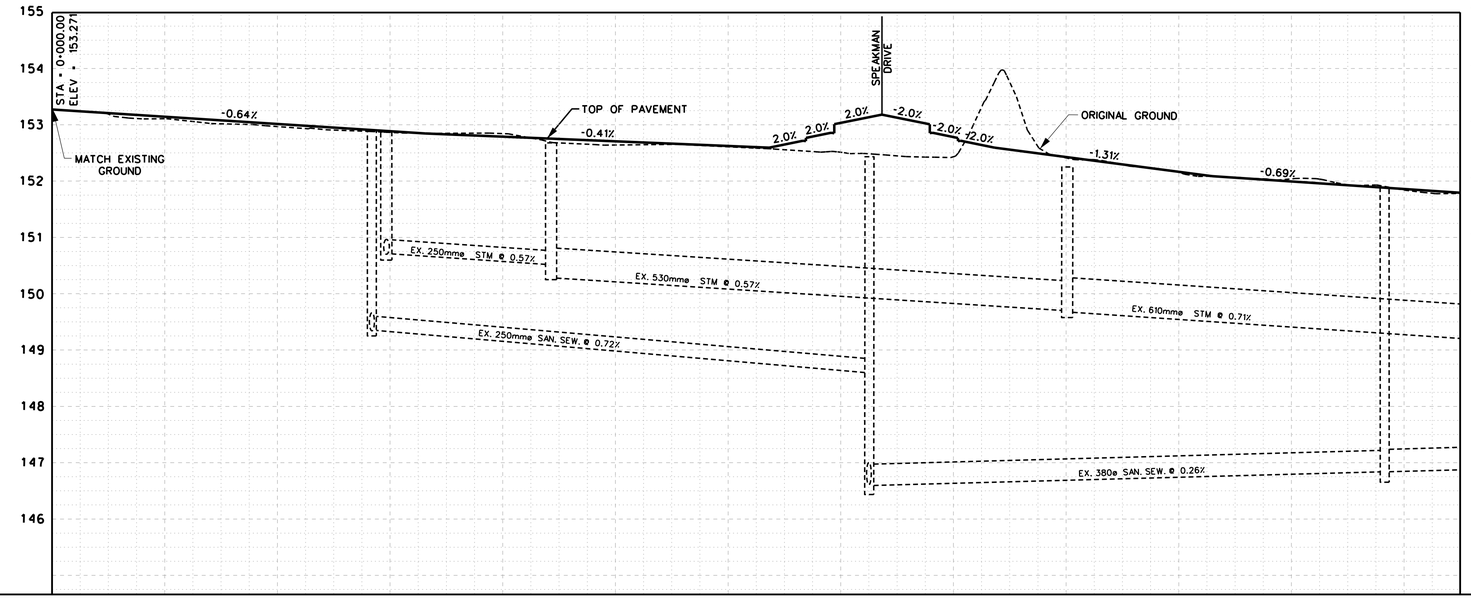
BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Plan C

Drainage Management Plans





TOP OF PAV'T	153.27	153.11	152.97	152.87	152.84	152.64	152.61	152.51	152.43	152.41	152.16	152.04	151.84		TOP OF PAV'T
ORIG. GROUND	153.271	153.108	152.968	152.865	152.843	152.641	152.609	152.512	152.432	152.411	152.156	152.040	151.841		ORIG. GROUND
CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+250	CHAINAGE

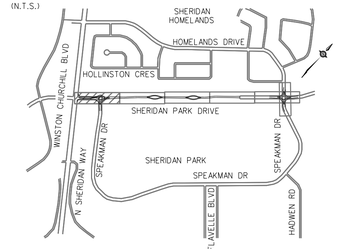
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STM. SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
M.O.E.			ROGERS U/G CABLE		

REVISIONS

DATE	DETAILS	INIT.

KEY PLAN: (N.T.S.)



LEGEND:

- EXISTING ROAD RIGHT OF WAY
- PROPOSED ROAD RIGHT OF WAY
- PROPERTY REQUIRED FOR ROAD EXTENSION
- GRADING LIMIT
- WATERCOURSE
- HEADWATER DRAINAGE FEATURE
- PROPOSED SIDEWALK
- PROPOSED BUS STOP
- PROPOSED CATCH BASIN
- PROPOSED MANHOLE CATCH BASIN
- TRAFFIC SIGNAL
- H — HYDRO
- G — GAS
- B — BELL
- SAN — EXISTING SANITARY SEWER
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN
- R — ROGERS

DESIGN BY	APPROVED BY
_____ C.E.T.	
DEPARTMENTAL APPROVAL	
_____ SILVIO CESARIO P.ENG.	_____

BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2, Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 fax (905) 821-1809
web www.rjburnside.com

RJB Project No. 300039474

MISSISSAUGA

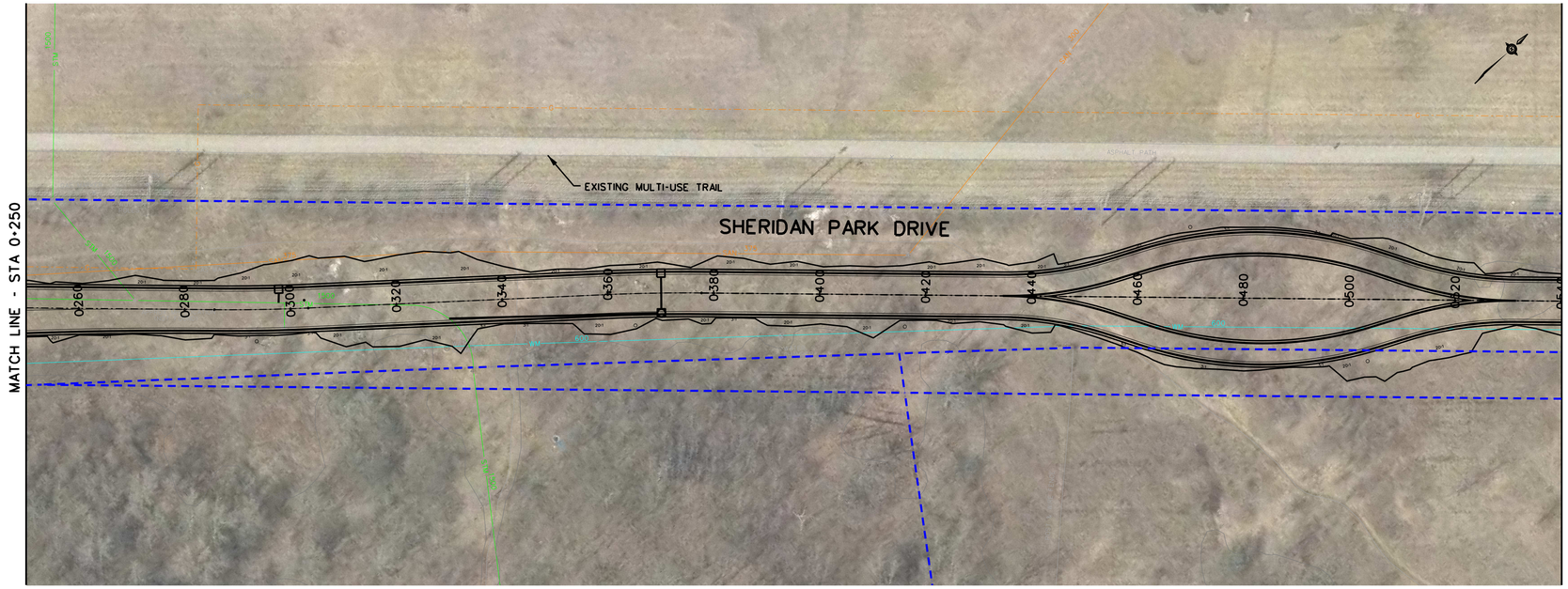
PRODUCED FOR - T&W, ENGINEERING AND WORKS

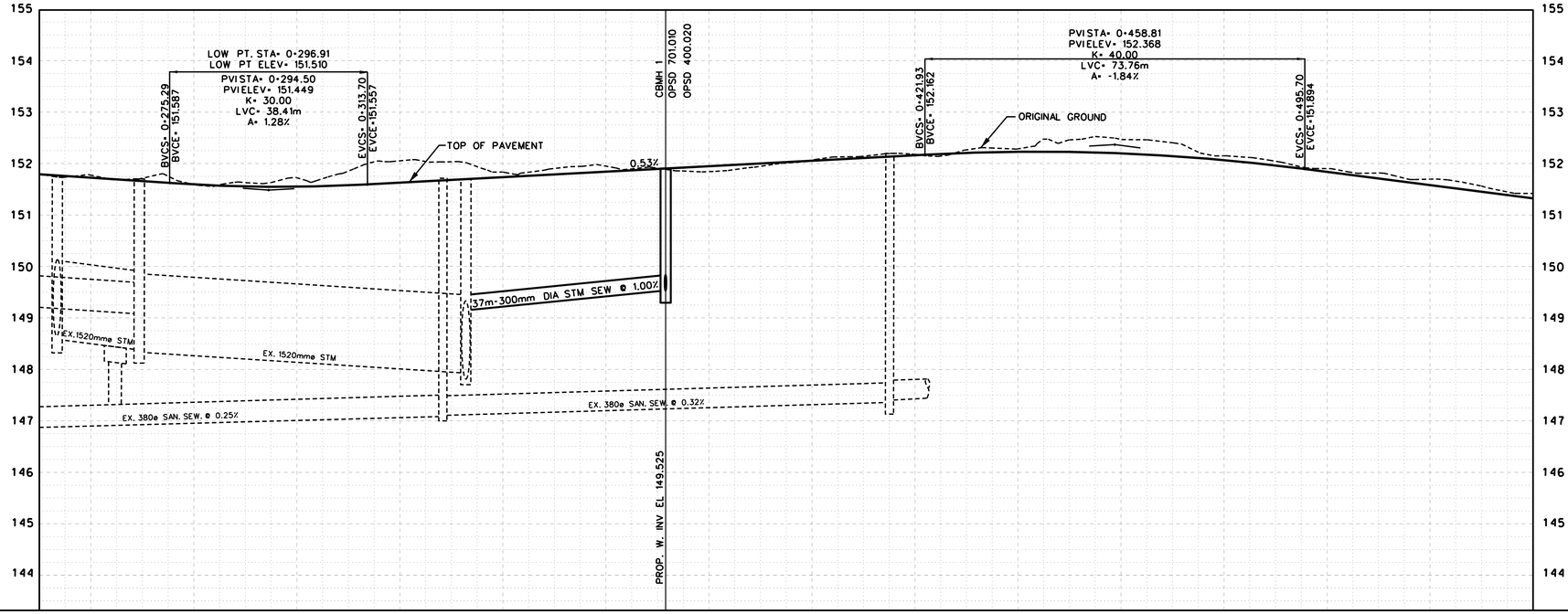
SHERIDAN PARK DRIVE EXTENSION

DRAINAGE MANAGEMENT PLAN

STA 0+000 TO STA 0+250

SCALE	HOR. 1:1000 VERT. 1:100	AREA	PROJECT No.
DRAWN BY	K.Y.	CHECKED BY H.F.	PLAN No.
DATE	DECEMBER 2017	SHEET 1 OF 4	





151.80	151.77	151.59	151.72	152.05	151.83	151.95	151.84	152.06	152.18	152.29	152.47	152.15	151.90	151.70	151.42	TOP OF PAV'T
151.860	151.775	151.595	151.724	152.053	151.833	151.950	151.843	152.064	152.178	152.286	152.469	152.150	151.901	151.697	151.419	ORIG. GROUND
0+250	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540	CHAINAGE

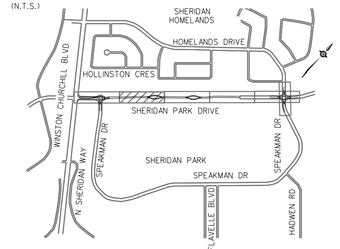
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STM. SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
M.O.E.			ROGERS U/G CABLE		

REVISIONS

DATE	DETAILS	INIT.

KEY PLAN:
(N.T.S.)



LEGEND:

- EXISTING ROAD RIGHT OF WAY
- PROPOSED ROAD RIGHT OF WAY
- PROPERTY REQUIRED FOR ROAD EXTENSION
- GRADING LIMIT
- WATERCOURSE
- HEADWATER DRAINAGE FEATURE
- PROPOSED SIDEWALK
- PROPOSED BUS STOP
- PROPOSED CATCH BASIN
- PROPOSED MANHOLE CATCH BASIN
- TRAFFIC SIGNAL
- H — HYDRO
- G — GAS
- B — BELL
- SAN — EXISTING SANITARY SEWER
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN
- R — ROGERS

DESIGN BY	APPROVED BY
C.E.T.	
DEPARTMENTAL APPROVAL	
SILVIO CESARIO P.ENG.	

BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2, Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 fax (905) 821-1809
web www.rjburnside.com
RJB Project No. 300039474

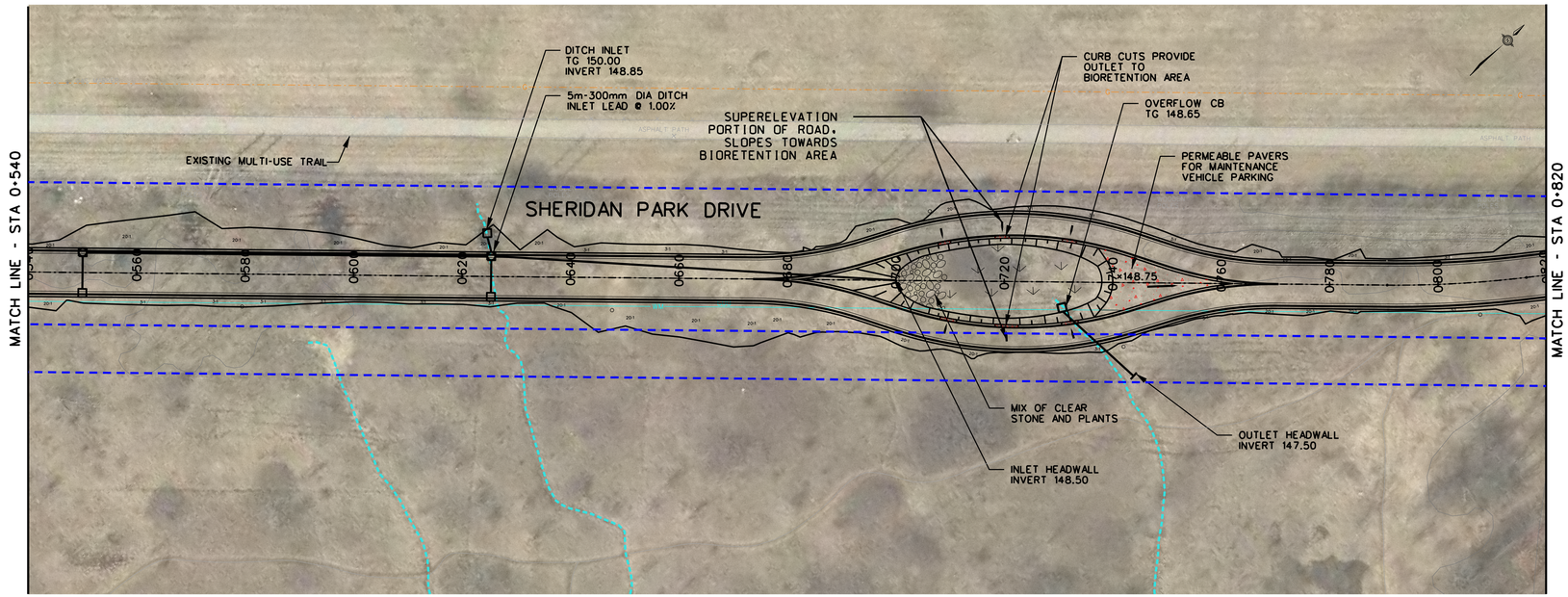
MISSISSAUGA
PRODUCED FOR - T&W, ENGINEERING AND WORKS

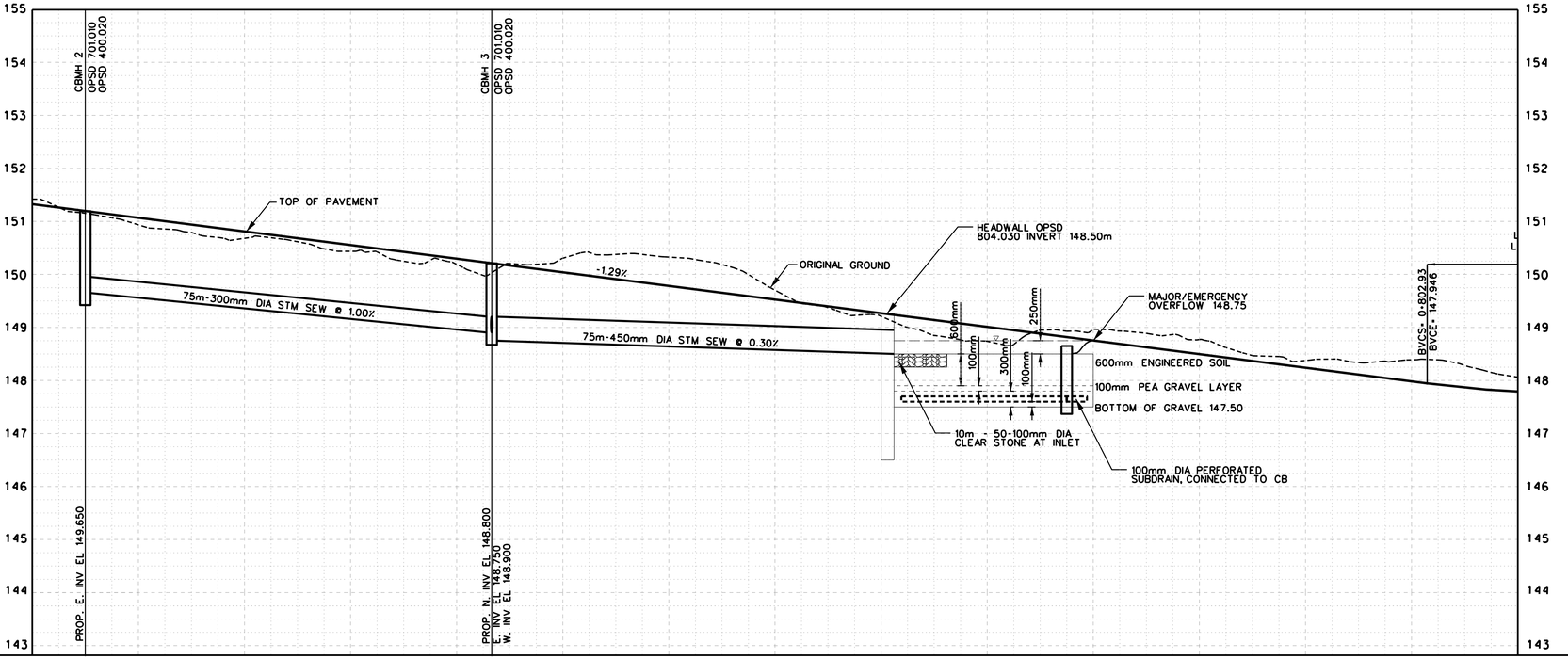
SHERIDAN PARK DRIVE EXTENSION

DRAINAGE MANAGEMENT PLAN

STA 0+250 TO STA 0+540

SCALE	HOR. 1:1000 VERT. 1:100	AREA	PROJECT No.
DRAWN BY	K.Y.	CHECKED BY H.F.	PLAN No.
DATE	DECEMBER 2017	SHEET 2 OF 4	





TOP OF PAV'T	151.42	150.94	150.68	150.43	150.19	150.31	150.33	149.70	149.21	148.74	148.96	148.77	148.38	148.39	148.06	TOP OF PAV'T
ORIG. GROUND	151.419	150.935	150.681	150.434	150.189	150.305	150.326	149.703	149.210	148.738	148.957	148.772	148.377	148.390	148.063	ORIG. GROUND
CHAINAGE	0+540	0+560	0+580	0+600	0+620	0+640	0+660	0+680	0+700	0+720	0+740	0+760	0+780	0+800	0+820	CHAINAGE

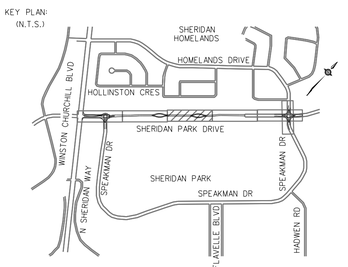
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STM. SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
M.O.E.			ROGERS U/G CABLE		

REVISIONS

DATE	DETAILS	INIT.

KEY PLAN:
(N.T.S.)



LEGEND:

- EXISTING ROAD RIGHT OF WAY
- PROPOSED ROAD RIGHT OF WAY
- PROPERTY REQUIRED FOR ROAD EXTENSION
- GRADING LIMIT
- WATERCOURSE
- HEADWATER DRAINAGE FEATURE
- PROPOSED SIDEWALK
- PROPOSED BUS STOP
- PROPOSED CATCH BASIN
- PROPOSED MANHOLE CATCH BASIN
- TRAFFIC SIGNAL
- H — HYDRO
- G — GAS
- B — BELL
- SAN — EXISTING SANITARY SEWER
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN
- R — ROGERS

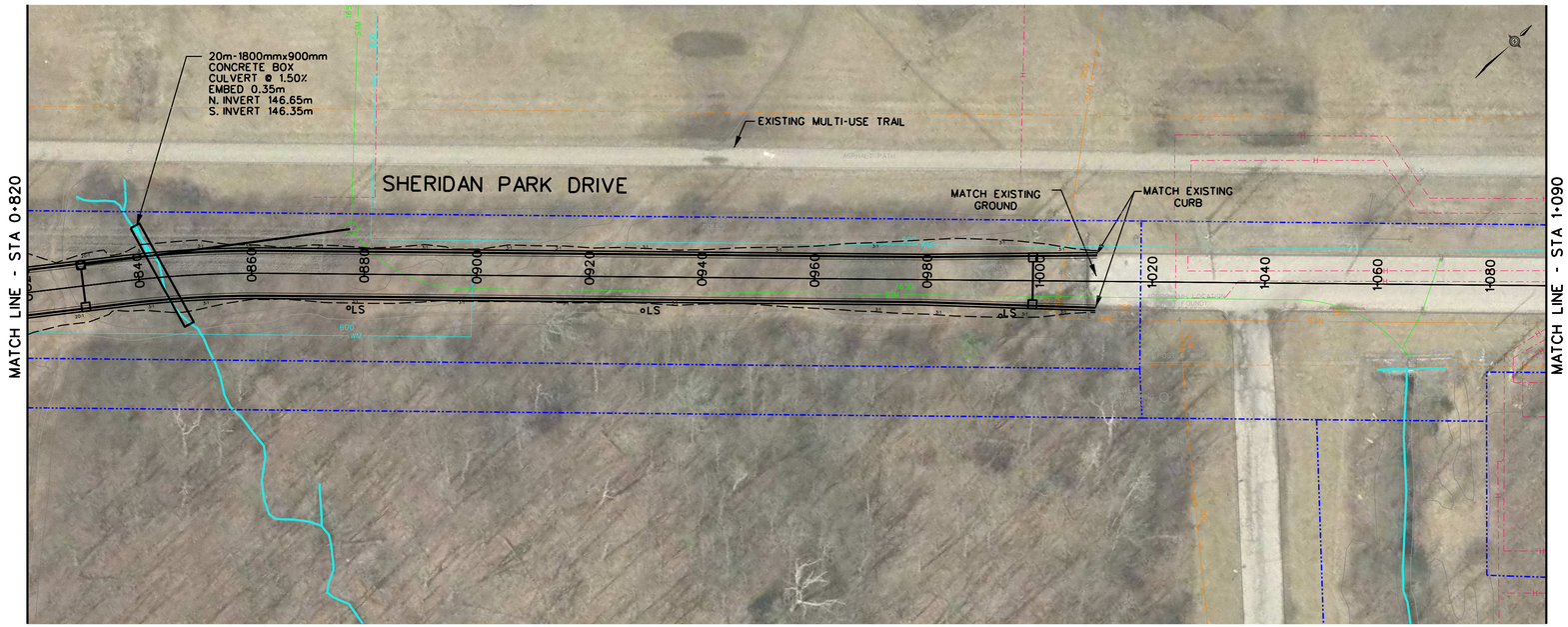
DESIGN BY	APPROVED BY
C.E.T.	
DEPARTMENTAL APPROVAL	
SILVIO CESARIO P.ENG.	

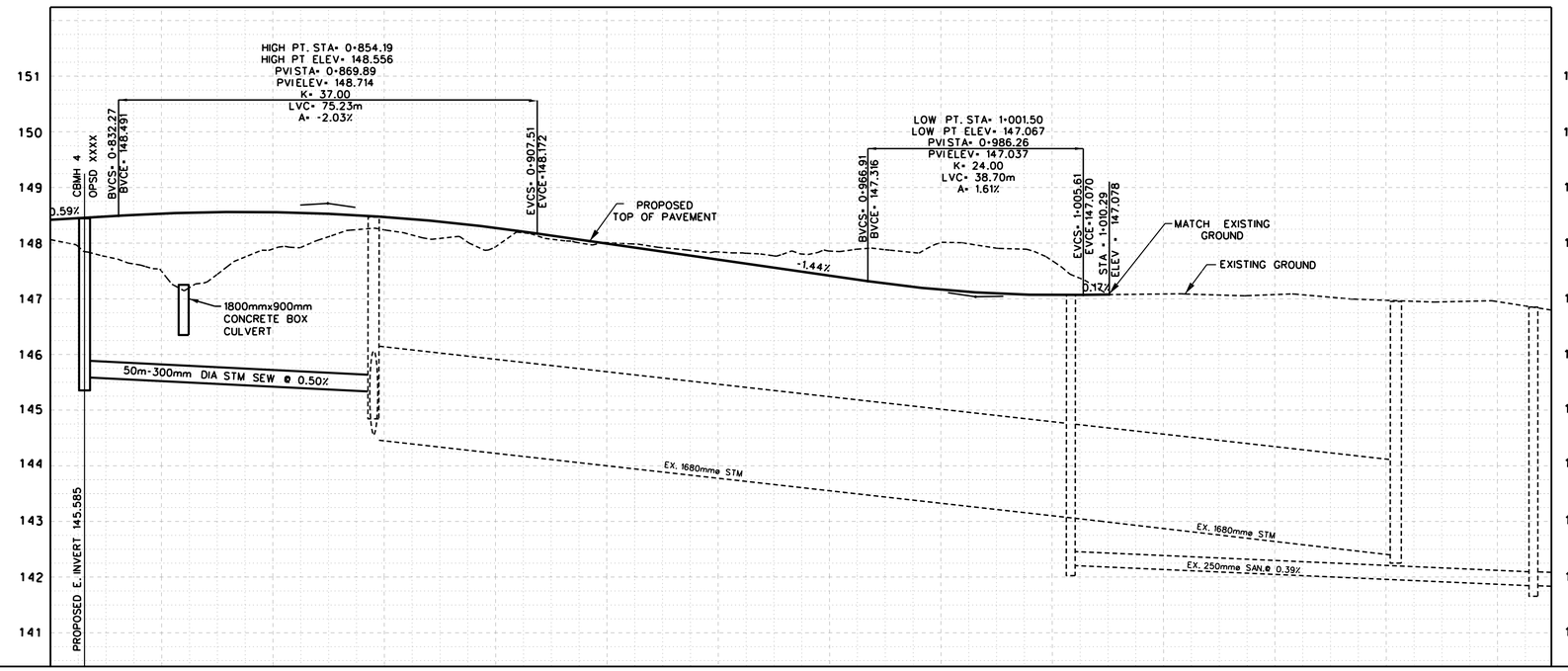
BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2, Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 fax (905) 821-1809
web www.rjburnside.com
RJB Project No. 300039474

MISSISSAUGA
PRODUCED FOR - T&W, ENGINEERING AND WORKS

SHERIDAN PARK DRIVE EXTENSION
DRAINAGE MANAGEMENT PLAN
STA 0+540 TO STA 0+820

SCALE	HOR. 1:1000 VERT. 1:100	AREA	PROJECT No.
DRAWN BY	K.Y.	CHECKED BY	H.F.
DATE	DECEMBER 2017	SHEET	3 OF 4





TOP OF PAV'T	148.06	147.50	147.89	148.24	147.93	148.01	147.84	147.86	148.01	147.69	147.09	147.08	146.97	146.95	TOP OF PAV'T
ORIG. GROUND	148.063	147.497	147.895	148.239	147.933	148.009	147.842	147.857	148.010	147.687	147.087	147.076	146.973	146.949	ORIG. GROUND
CHAINAGE	0+820	0+840	0+860	0+880	0+900	0+920	0+940	0+960	0+980	1+000	1+020	1+040	1+060	1+080	CHAINAGE

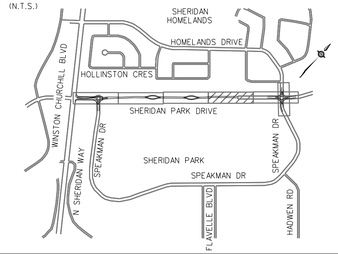
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STM. SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
M.O.E.			ROGERS U/G CABLE		

REVISIONS

DATE	DETAILS	INIT.

KEY PLAN:
(N.T.S.)



LEGEND:

- EXISTING ROAD RIGHT OF WAY
- PROPOSED ROAD RIGHT OF WAY
- PROPERTY REQUIRED FOR ROAD EXTENSION
- GRADING LIMIT
- WATERCOURSE
- HEADWATER DRAINAGE FEATURE
- PROPOSED SIDEWALK
- PROPOSED BUS STOP
- PROPOSED CATCH BASIN
- PROPOSED MANHOLE CATCH BASIN
- TRAFFIC SIGNAL
- H — HYDRO
- G — GAS
- B — BELL
- SAN — EXISTING SANITARY SEWER
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN
- R — ROGERS

DESIGN BY	APPROVED BY
C.E.T.	
DEPARTMENTAL APPROVAL	
SILVIO CESARIO P.ENG.	

BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2, Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 fax (905) 821-1809
web www.rjburnside.com
RJB Project No. 300039474

MISSISSAUGA
PRODUCED FOR - T&W, ENGINEERING AND WORKS

SHERIDAN PARK DRIVE EXTENSION
DRAINAGE MANAGEMENT PLAN
STA 0+820 TO STA 1+090

SCALE	HOR. 1:1000 VERT. 1:100	AREA	PROJECT No.
DRAWN BY	K.Y.	CHECKED BY H.F.	PLAN No.
DATE	DECEMBER 2017	SHEET 4 OF 4	