Prepared for:
Grand Niagara Co-Owners and
City of Niagara Falls

STORMWATER MANAGEMENT PLAN

GRAND NIAGARA SECONDARY PLAN

14.15039.001 | November 2016

WSP | MMM GROUP

Contents

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1 INTRODUCTION

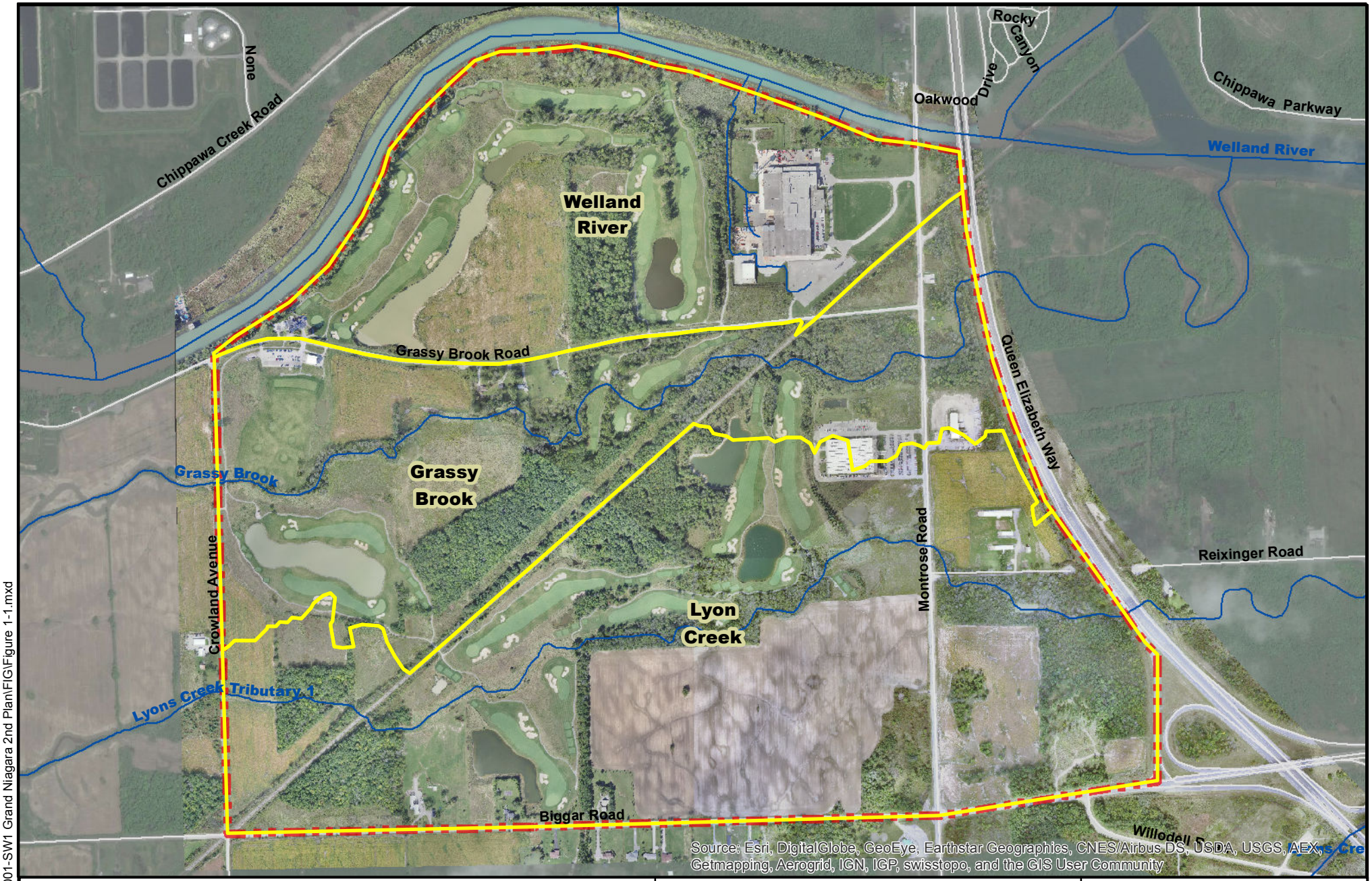
WSP/MMM Group Limited was retained by the Grand Niagara Co-Owners to provide professional services to obtain the approval of a Secondary Plan for the lands currently occupied by the Grand Niagara golf course in the City of Niagara Falls. The project - Grand Niagara Secondary Plan Area (Grand Niagara, in brief) is boundary by Welland River at the north, Biggar Road to the south, Crowland Avenue to the west and Queen Elizabeth Way (QEW) to the east (see Figure 1.1). The proposed development mainly consists of residential, commercial, employment and a hospital.

As shown in Figure 1.1, three watercourses – Welland River, Grassy Brook and Lyons Creek Tributary 1 drain the Grand Niagara from west to east. These watercourses are located within the jurisdiction of Niagara Peninsula Conservation Authority (NPCA).

This Stormwater Management Report is one of the technical documents required to support the Secondary Plan approval. The report was prepared to include the following contents:

- Review background
- Summary of the existing hydrology conditions
- Floodplain limit delineation – existing and proposed conditions
- Development of stormwater management (SWM) criteria
- Proposed SWM strategy to mitigate the development impacts on watercourses.

The preliminary land use of Grand Niagara development is included in Appendix A.



Legend

- Drainage Catchment
- Grand Niagara Limit
- Watercourse
- Roads

N
W E
S

0 70 140 280 420 560
Meters

CLIENT
GRAND NIAGARA CO-OWNERS

TITLE
GRAND NIAGARA SECONDARY PLAN AREA

SITE LOCATION

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2 REVIEW OF BACKGROUND

2.1 General

The majority of Grand Niagara is situated in the South Niagara Falls Watershed and located within Grassy Brook sub-watershed and Lyons Creek sub-watershed. The remaining area of the subject project is located in Lower Welland River Watershed. The following documents were collected and reviewed:

- Soils of Regional Niagara (Kigston and Present 1989) by the Ontario Ministry of Agriculture and Food and Agriculture Canada
- South Niagara Falls Watershed Report dated 2008 by NPCA
- Lower Welland River Characterization Report dated May 2011 by NPCA
- Stormwater Management Guidelines dated March 17, 2010 prepared by AECOM for NPCA
- Flood Plain Mapping – Lyon Creek including Tee Creek dated December 2009 Revised March 2011 by NPCA
- Floodline Analysis for the Grand Niagara Resort dated October 2000 prepared by Burnside Golf Services
- Letter Re: Grand Niagara Golf Resort Additional Hydraulic Analyses at Watercourse Crossings dated April 20, 2004 from Burside to NPCA

2.2 Soil Information

The soil map (Figure 2.1) was prepared based on the Soils of Regional Niagara. The majority of the study area is covered by soils – Niagara and Welland. These type soils have combined problems of imperfectly or poor drainage and high water table. They fall in Hydraulic Soil Group D, which means high runoff volume generation from a storm.

2.3 Watershed Reports

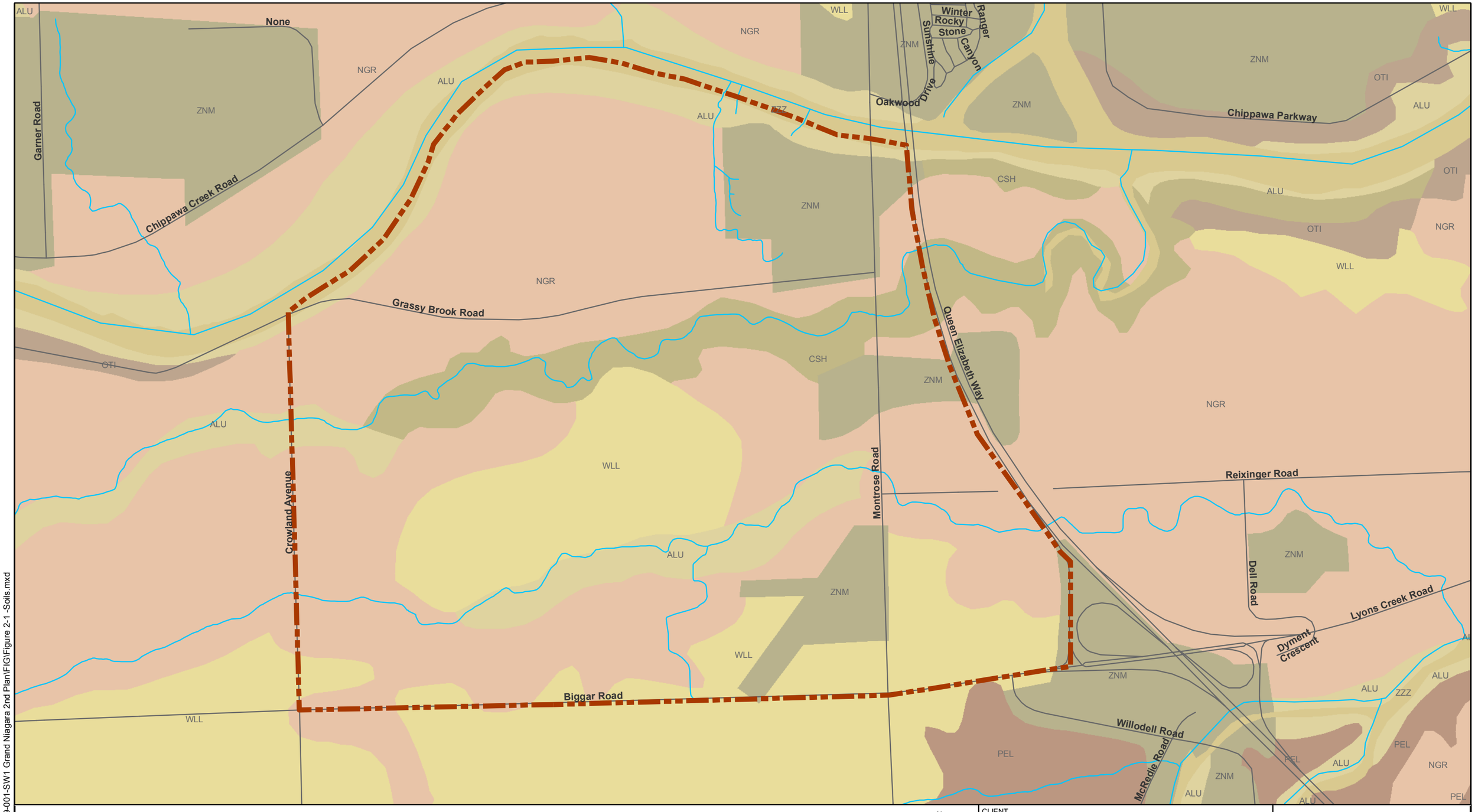
The South Niagara Falls Watershed Report and Lower Welland River Characterization Report were reviewed. The main information relevant to the drainage conditions of Grand Niagara were outlined below.

South Niagara Falls Watershed Report

- The primary physiographic region is the Haldimand Clay Plain, which was overlaid by post-glacial Lake Warren and much of it is covered by lacustrine clay deposits.
- Grassy Brook subwatershed is primarily agricultural in nature. The main channel have been classed as Type 1 Fish Habitat where requires the highest level of protection. It is reported to be experiencing exceedances of phosphorus and algae were observed at Crowland Avenue and Montrose Road during the summer months. The Restoration Strategy indicates that a riparian planting program at Grassy Brook north of Carl Road would to assist in the enhancement of water quality and fish habitat.
- No hydrology analysis was provided in the report.

Lower Welland River Characterization Report

- The river drains 800 km^2 from Ancaster to Niagara Falls. The watershed is located at the Haldimand Clay Plain.
- Due to climate change, changes are expected to the hydrologic cycle



Legend

- GRAND NIAGARA LIMIT
- ROADS
- WATERCOURSE

Soils

ALU, CSH, NGR, OTI, PEL, WLL, ZNM, ZZZ

N W E S

0 62.5 125 250 375 500 Meters

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SOILS

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- Winter runoff expected to increase; total runoff expected to decrease
- Groundwater recharge expected to decrease
- Water temperature expected to rise
- Decreased runoff may lead to reduced water quality
- No Significant Groundwater Recharge Areas are identified in the Lower Welland River study area but it exists in an area south of the study area in the Grassy Brook subwatershed but is outside the Grand Niagara limit
- The watercourse in the Grand Niagara Secondary Plan Area falls under a “Critical: Type 1” fish habitat

2.4 NPCA Stormwater Management Guidelines

General policy slated on the guidelines is “Sufficient SWM controls are required by the NPCA to ensure that flooding, pollution, surface erosion and conservation of land impacts due to development do not occur.” Detailed requirements with regards to Flood/Quality Control, Quality Control, Water Balance, Erosion/Geomorphologic Consideration, etc. are included in the Appendix A. Note, with regard to flooding/quantity control, “Consideration may be given to not requiring peak flow controls if the assessment of receiving system capacity demonstrates little or no benefit to such controls. This would include situations such as discharge to major river systems or directly to a Lake. Pre-consultation with the NPCA and additional approval requirements are necessary for this to be considered”.

2.5 NPCA Flood Plain Mapping – Lyon Creek

The NPCA conducted hydrologic and hydraulic analyses to investigate the 100-year peak flow rates and floodplain limits of Lyons Creek and its tributaries.
Lyons Creek Tributary 1 drains the south portion of Grand Niagara in an easterly direction to join the main branch of Lyons Creek at the east of QEW. Figure 2.2 shows the locations of Tributary 1 catchments and the boundary of Grand Niagara. Grand Niagara occupies about 49.5% of the total area of the Catchment Trib1_10.

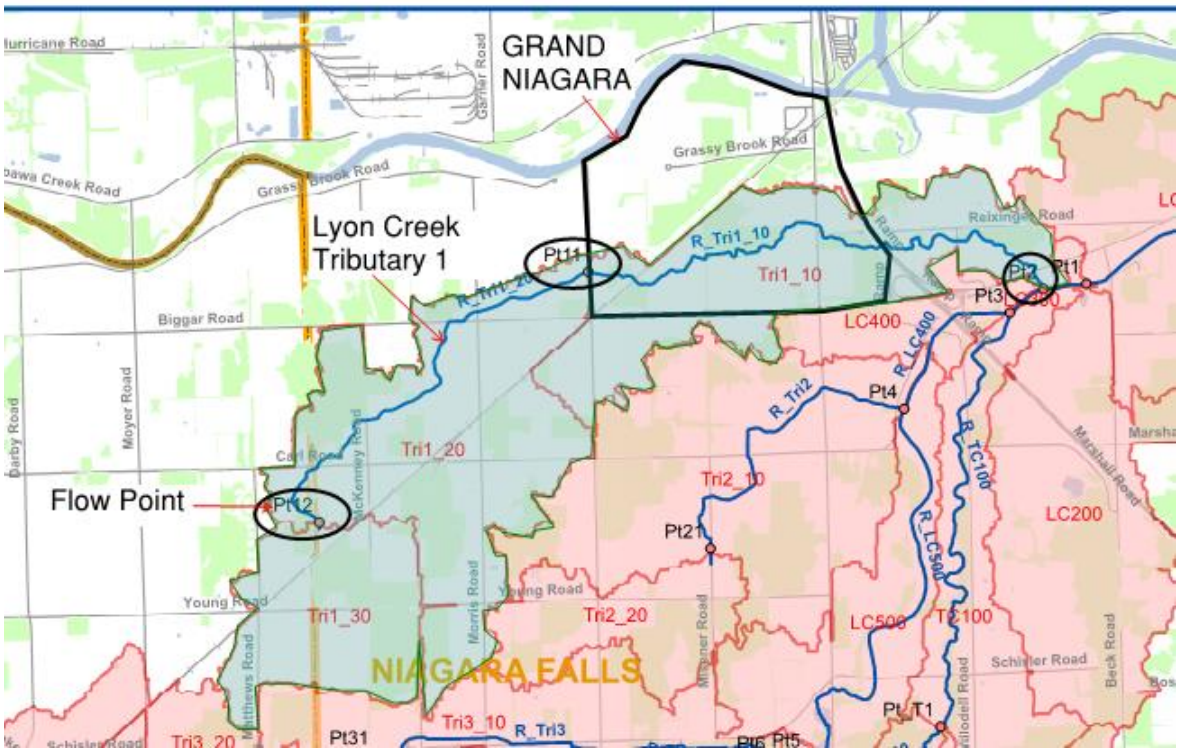


Figure 2.2 CATCHMENTS AND FLOW POINTS OF LYON CREEK TRIBUTARY 1

The general information of the NPCA study was summarized as below:

- Rainfall Data: Intensity-Duration-Frequency (IDF) of Niagara Falls (#6135638)
- Design Storm: 12 hour AES distribution and 100-year rainfall depth is 89.9 mm
- Hydrology Model: Hydrologic Engineering Center – Hydrologic Modelling System (HEC-HMS) was selected to investigate the flows.
- Catchment Parameters: the parameters used in the hydrology modeling for the catchments of Tributary 1 were copied from the report and shown in Table 2.1.

Table 2.1 Parameters of Catchments to Lyon Creek Tributary 1

Sub-Watershed	Area (km^2)	Imperviousness (%)	Initial Abstraction (mm)	SCS Curve Number	Time of Concentration (hour)	Channel Slope (%)
Trib1_10	3.02	6.844	10.64	82.69	2.85	0.06
Trib1_20	3.79	3.832	10.70	82.61	2.62	0
Trib1_30	1.66	2.4384	11.54	81.49	2.02	0

- Hydrologic Model Results: the 100-year flood rates (i.e. the regulatory flood) of Tributary 1 are shown in Table 2.2.

Table 2.2 100-year Peak Flow Rates

Flow Point	Drainage Area (km^2)	Peak Flow Rate (m^3/s)
Pt12	1.66	4.5
Pt11	5.45	10.3
Confluence to Main Branch*	8.47	13.4

Note: *- the flow point was added to the original model.

- Crossings of Lyon Creek Tributary 1: Culverts at the creek were inspected and surveyed in NPCA study. The detailed information excerpted from the report is included in Appendix B.

- Hydraulic Model and Results: a HEC-RAS model was used to investigate the 100-year flood elevations of Tributary 1. The modelling results are provided in Appendix B. Note, the flow rate of flow point Pt_11 (at the Crownland Avenue) was used for the river reach from Crownland Ave. to QEW.

- The model results demonstrate that crossings – at the railway (Model ID 107) and Carl Road (Model ID 113) have insufficient conveyance capacity (i.e. aggravate flooding).

2.6 Floodplain Analysis for the Grand Niagara Resort

Burnside conducted the hydrology and hydraulic analyses for Grassy Brook to support the Grand Niagara Golf Resort development. Per the report, the total drainage area of Grass Brook is 12.83 km^2. A 11.92 km^2 parcel (catchments 401,402, 403, 404 and 405) is located at the upstream of Grand Niagara. The NPCA verified that the Regulatory design storm is a 100-year storm (i.e. a storm that has the possibility of occurring one in every one hundred years). A HEC-RAS model was obtained from the NPCA. The information provided in the report is summarized below:

- Hydrology Model: SWM-HYMO
- Design Storm: SCS 24-hour storm, 100-year rainfall depth is 98.5 mm
- Catchment Parameters: the drainage area, time of peak, etc. are excerpted from the report and tabulated in Table 2.3. The highlighted catchments cover the study area. Note, the initial abstraction used in the model is 1.5 mm per the model output.

Table 2.3 Catchment Information

Catchment	Area (ha)	Length (m)	Slope (%)	Tc (min)	Tp (hr)	CN
401	288.8	2650	0.36	200	2.23	77
402	500.2	5910	0.19	366	4.08	78
403	149.4	1500	0.13	209	2.33	79
404	197.3	2300	0.20	226	2.52	81
405	56.1	878	0.17	147	1.64	81
406	65.3	1593	0.13	219	2.45	81
407	16.7	415	0.12	113	1.27	81
408	9.3	255	0.10	95	1.06	81

* highlighted areas are located in Grand Niagara.

- Hydrologic Modeling Results: the 100-year flow rates obtained from the modelling were copied from the report and shown in Table 2.4.

Table 2.4 Peak Flow Rates (100-year Storm)

Location (Flow Point)	Area (ha)	Flow Rate (m^3/s)
At Confluence (NPAC pt 327005) -411	938	16.0
At Site Limit (NPCA pt 227003)-412	1136	16.7
at Culvert – 413	1192	16.9
At CON rail line – 414	1257	16.7
At Morris Road – 415	1273	16.7
At QEW (NPCA pt 227002) -416	1283	16.7

* highlighted areas are located in Grand Niagara.

- Hydraulic Model: a HEC-RAS model (Version 2.1) was developed to investigate flood elevations.

- Crossing Information: the dimensions and parameters of culverts used in the hydraulic model (HEC-RAS) are provided in Appendix B. Note, the crossing at QEW is excluded from the HEC-RAS model.

- Floodplain Mapping: The flood elevations copied from the report is provided in Appendix B.

- In year 2004, Burnside updated the HEC-RAS model to demonstrate that the construction of two pedestrian crossings (designed for a 5-year flood) in golf resorts would not impact the upstream and downstream floodplain limits. The HEC-RAS model obtained from the NPCA doesn't have the two crossings.

3 FLOODPLAIN LIMITS

3.1 Existing Flood Plain Limits

Three watercourses – Welland River, Grassy Brook and Lyon Creek Tributary drain Grand Niagara from west to east. The floodplain limits of the Grassy Brook and Lyon Creek Tributary 1 had been determined by the following studies and are illustrated in the NPCA's online information system:

- Flood Plain Mapping – Lyon Creek including Tee Creek, NPCA, December 2009 (revised March 2011)
- Floodline Analysis for the Grand Niagara Resort , Burnside Golf Services, October 2000

The floodplain limits of Welland River are also available on the NPAC's online database. Figure 3.1 shows the flood limits downloaded from the NPCA's online information system.

3.2 Development Impacts on Floodplain Limits

The urbanization in Grand Niagara will increase the impervious coverage, therefore, the investigation of the development impacts on the current floodplain limits was carried out.

3.2.1 Lyon Creek Tributary 1

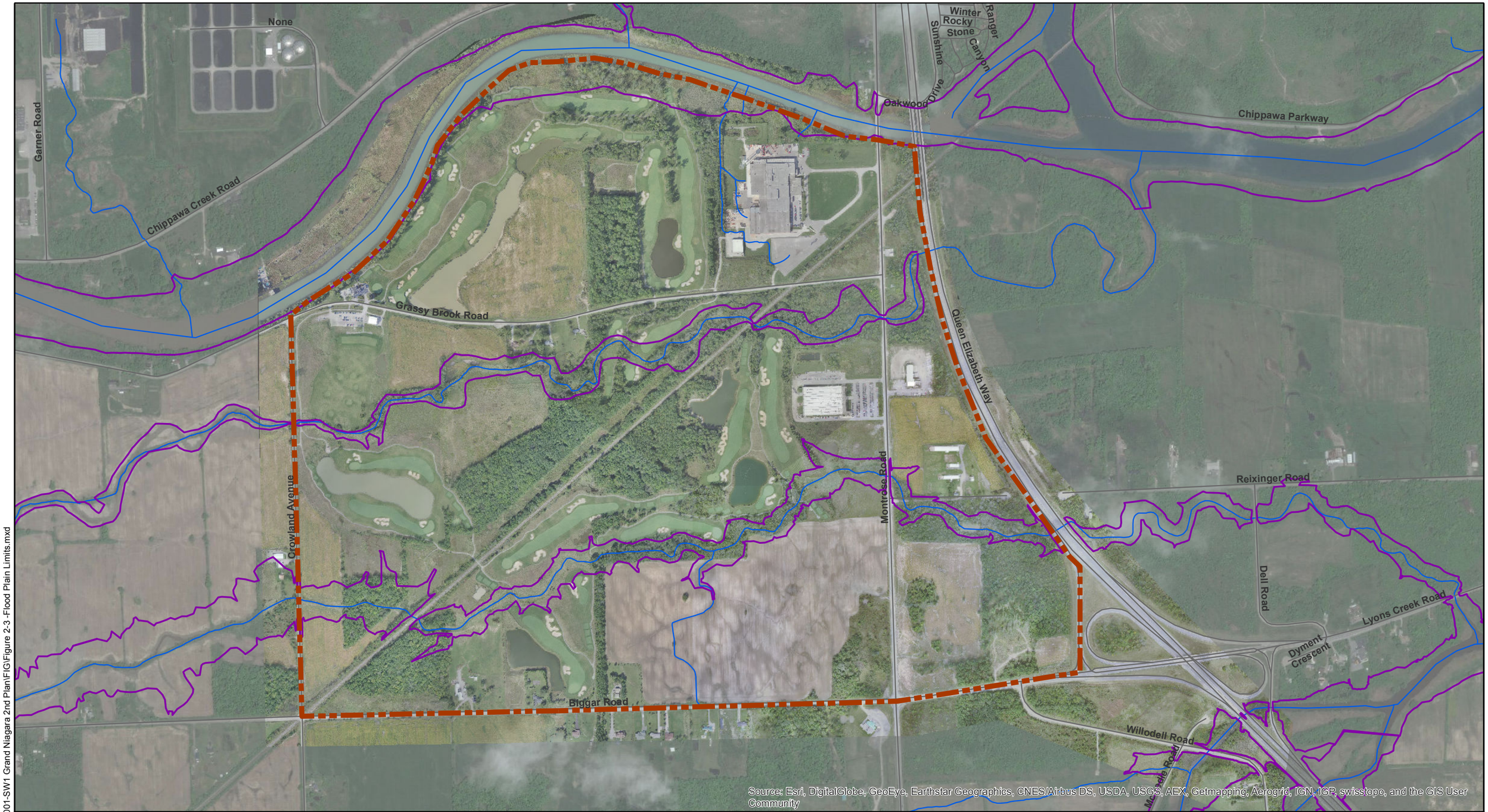
As mentioned in Section 2.4, Grand Niagara is situated in Catchment Trib_10 and covers about 50% area of this catchment. In the future, the 150 ha Grand Niagara in the catchment will be hospital, commercial, mixed and residential (see preliminary land use plan in Appendix A) . The estimate imperviousness level of the development is 80%. With the alteration of land use, the overall imperviousness of Catchment Trib_10 will increase. The revision of imperviousness is shown in Table 3.1.

Table 3.1 Revision of Catchment Imperviousness

Catchment	Area (ha)	Current Imperviousness (%)	Future Imperviousness (%)
Trib1_10	302	6.844	43.1

The HEC-HMS model used for the NPCA's hydrology study was revised to reflect the imperviousness increase of Catchment Trib1_10. The other parameters of the model remained. At the Tributary confluence to the Lyon Creek, the 100-year flow rate is 14.0 m^3/s. Compare to the original model result 13.4 m^3/s, the 4% flow increase is minor. At the confluence of Tributary 1 to Lyon Creek (flow point Pt2) and the downstream (flow point Pt1), the flow alterations are more negligible. For example, the flow rate at the confluence is originally 88.9 m^3/s; with Grand Niagara development, it is 89.2 m^3/s. The revised HEC-HMS model output is included in Appendix B.

As per the NPCA's hydraulic analysis (i.e. HEC-RAS model), the flood elevations of Catchment Trib_10 were computed with the flow rate of Catchment Trib1_20 which is located at the upstream of Trib_10. Therefore, the minor flow change in Catchment Trib_10 will not impact the current floodplain limits. It was confirmed that the minor change of flow rates at the confluence and the downstream will not impact the flood elevations at Tributary 1. The detailed HEC-RAS model results are provided in Appendix B.



Legend

- GRAND NIAGARA LIMIT
- 100 YR FLOODLINE
- ROADS
- WATERCOURSE

N
W E
S

0 62.5 125 250 375 500 Meters

CLIENT
GRAND NIAGARA CO-OWNERS

TITLE
GRAND NIAGARA SECONDARY PLAN AREA

FLOOD PLAIN LIMITS

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3.2.2 Grassy Brook

The Grand Niagara within the Grass Brook drainage basin is 88.4 ha. As per the Burnside Floodline Analysis, the total area of Catchments 406, 407 and 408 is 91.3 ha. The proposed Grand Niagara development will impact the imperviousness level of these catchments.

A SWMHYMO model was used in the Burnside Floodline Analysis to investigate the flow rates of the drainage catchments. This model was converted to a state-of-art window interface model - VisualHYMO (VO2) as both programs have the same core processor -HYMO (hydrologic simulation method). Using the same hydrologic parameters of original model, the flow rates obtained from the VO2 model match up to the original model results. The model output is included in Appendix B. The comparison of flow rates obtained from these two models is shown in Table 3.2.

The proposed Grand Niagara development within Grassy Brook watershed will be residential and employment (see preliminary land use plan in Appendix A), therefore an imperviousness of 70% ~ 85% is appropriate to represent the future landuse conditions. Under the future conditions, the estimate of imperviousness in catchments 406 and 407 is to be 70%; and 85% in catchment 408. The VO2 model was revised to reflect the future conditions in these catchments. The model results are shown in Table 3.2. The model output is included in Appendix B. It demonstrates that the 100-year peak flows used in the floodplain limit delineation will not be impacted by the proposed development in Grand Niagara.

Table 3.2 Comparison of 100-Year Flow Rates (m^3/s)

Location	Area (ha)	Original Model Results used in Floodplain Delineation	Converted VO2 Model Results – Existing Conditions	Converted VO2 Model – Proposed Conditions
Crownland Ave	1191.8	16.86	16.88	16.88
CN Railway	1257.1	16.72	16.73	16.44
Montrose Road	1273.8	16.74	16.75	16.23
QEW	1283.1	16.73	16.70	16.15

Although the increase in the proposed impervious land surface (proposed Grand Niagara development) will increase the frequency and magnitude of the flows, the peak flow rate in the receiving Grassy Brook will not increase. This is primarily due to the timing effects. Figure 3.1 provides an explanation of this hydrograph mechanism. The majority of the Grassy Brook watershed is located upstream of the study area. Thus, the peak flow in the Grassy Brook through the study area occurs well after the peak intensity of the storm event. Following development, the increase in impervious area results in local increases in peak flows, but also tends to decrease the time to peak of these areas in response to a rainfall event. As a result, the peak flows from the developed areas are discharged to the watercourses earlier compared to the pre-development condition, considerably ahead of the time of the peak flows in the receiving water course.

3.2.2 Lower Welland River

The total drainage area of the watercourse is 20.7 km^2. The Grand Niagara development within the watershed is 82 hectares, it covers a negligible downstream portion of the overall drainage catchment, the development will not impact the current floodplain limits.

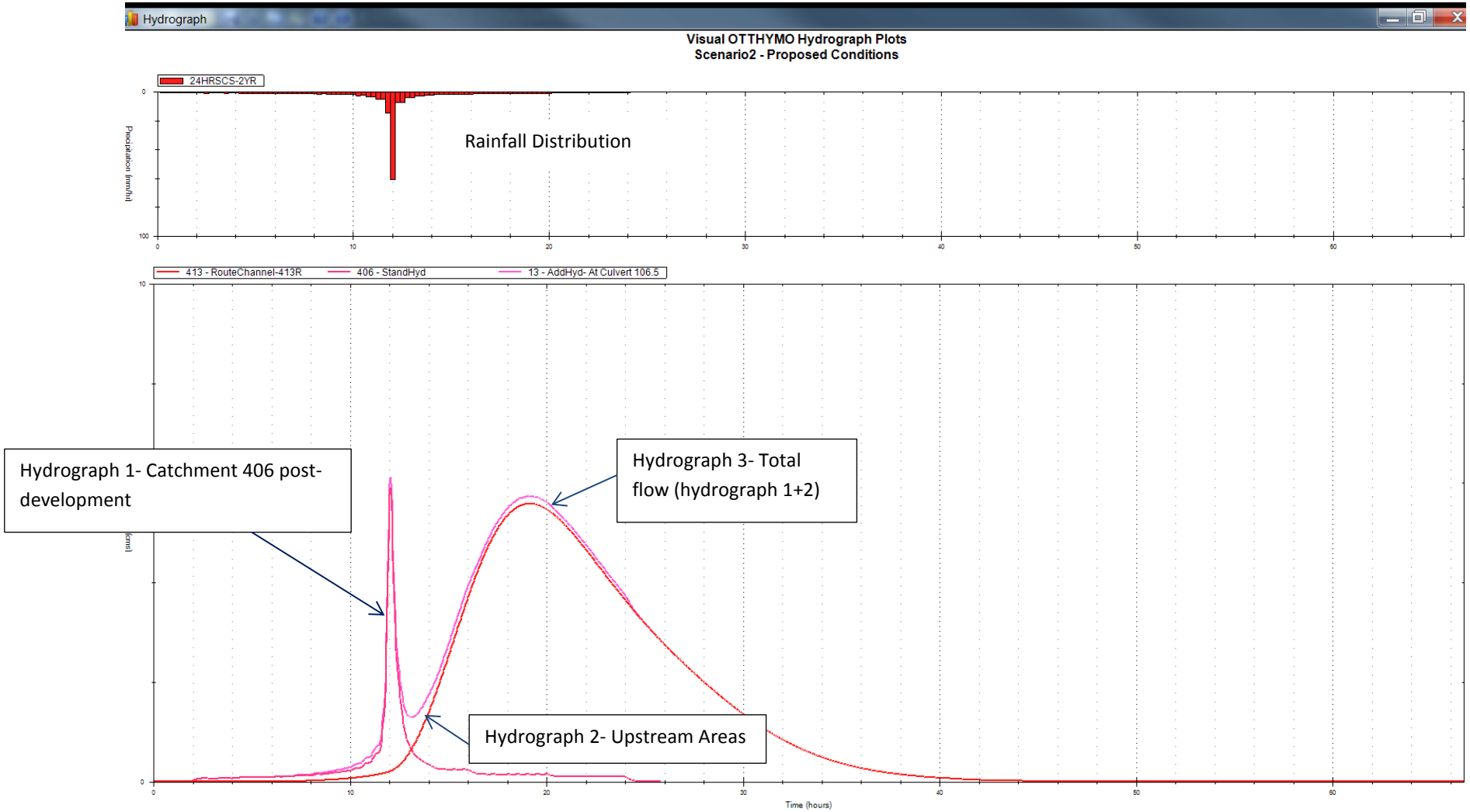


FIGURE 3.1 COMPARISON OF HYDROGRAPH

4 STORMWATER MANAGEMENT

4.1 Drainage Conditions

Total 318 hectares Grand Niagara situates in three drainage basins, namely Lower Welland River, Grass Brook and Lyon Creek Tributary 1 watershed. Currently the land use of these watersheds is mainly agricultural. The site is located over Clay Plain. The imperfect or poor drainage soils at the site location imply the high water table and high runoff volume. Soil CN value ranges from 78 to 82.

Except the Welland River, hydrologic studies for the other two streams had been carried out. Generally, the site is located at the downstream end of the watercourses and occupies a limited portion of the entire drainage areas (see Table 4.1). With respect to hydrology regime, the drainage areas at the upstream of Grand Niagara have the dominant impacts.

Table 4.1 Areas of Grand Niagara and Drainage Basins

Watershed	Watershed Area (ha)	Area (ha) within Grand Niagara	Percentage (%)
Lower Welland River	2070	82.3	4.0
Grassy Brook	1283	88.4	7.0
Lyon Creek Tributary 1	847	147.6	17

As per the previous hydrological analyses, the floodplain limits are determined by a 100-year flood at Grassy Brook and Lyon Creek Tributary 1. As discussed in Section 3.0, the impacts to the peak flows rates of the three receiving water courses are negligible. Therefore the floodplain limits will remain unchanged.

4.2 Investigation of Water Quantity Control Strategy

4.2.1 General

Conventionally, water quantity control, in other words, limit post-development flow rates to pre-development levels, is required to mitigate the runoff increase due to the impervious cover increase by the development. However, the Grand Niagara development is located at the downstream of the receiving watercourses and covers relatively small portion of the entire watershed. Therefore, generally speaking, the flow characteristics such as the timing of flow peak and peak flow rates at the Grand Niagara outlet are dominated by the upstream areas. An investigation of the detailed strategy of water quantity control was carried out and discussed in the following sections.

4.2.2 Lyon Creek Tributary 1

About 147 hectares parcel of Grand Niagara is situated in Catchment Trib_10. To investigate the flood control strategy, this catchment was split into three areas based on the upstream/downstream of Grand Niagara. Two flow points were added into the NPCA's HEC-HMS model: one (Junction-1) is the total flow of three split areas of Catchment Trib1_10; the other one (Pt Trib1 confluence) is the total flow of Tributary 1. This revised HEC-HMS model was used to examine the proposed storage needed for flood control. The following model scenarios were investigated:

- Scenario 1: pre-development condition
- Scenario 2: without flood control
- Scenario 3: control post-development flow to pre-development level
- Scenario 4: provide 25 mm rainfall-runoff detention for 24 hours

The modelling results are summarized in Table 4.2. Model output is provided in Appendix B.

Table 4.2 Comparison of Modelling Results

Flow Point	100-Year Peak Flow Rate (m^3/s)			
	Sc 1: Pre-development	Sc 2: No Flood Control	Sc 3: Control Post- to Pre-	Sc 4: 25mm Runoff Detention
Junction-1	8.9	10.7	7.8	10.7
Pt Trib 1 confluence	11.2	11.5	13.2	11.9
Pt2	87.8	87.9	89.7	88.1

The results of Sc.3 indicate that although the post-development flow is lower than the pre-development flow level (flow point “Junction-1”), the peak flows in the downstream receiving water courses are increased (at flow points “Pt Trib 1 confluence” and “Pt2”). This is because the flood control would delay the flow “time to peak” from the development area, which will then add up with the peak flow of the receiving watercourse. Without any quantity controls, the sediment and pollutant loaded from the development area will be directly washed into the creek. As per the MOE design manual, the detention of 25 mm rainfall-runoff for 24 hours in a wet pond (Sc.4) can effectively remove sediment from stormwater and mitigate the erosion potential to the receiving watercourse, therefore, it is proposed for the subject study area within Lyon Creek watershed.

4.2.3 Grassy Brook

As mentioned in Section 3, Grand Niagara development in Grassy Brook catchments 406-408 will not cause flood flow increase due to the timing of peak flow between the upstream areas and development areas is different and the peak flows from the upstream areas are the greatest. To establish an appropriate plan of water quantity control, for investigating purposes, the following VO2 modelling scenarios were used:

- Scenario 1: pre-development condition
- Scenario 2: without flood control
- Scenario 3: control post-development flow to pre-development level
- Scenario 4: provide 25 mm rainfall-runoff detention for 24 hours

The modelling results compare to the pre-development conditions are summarized in Table 4.3. Model output is provided in Appendix B.

Table 4.3 Modelling Results – Grassy Brook

Flow Point	100-Year Peak Flow Rate (m^3/s)			
	Sc 1 Pre-development	Sc 2 No Flood Control	Sc 3 Control Post- to Pre-	Sc 4 25mm Runoff Detention
CN Railway - 415	16.73	16.44	16.84	16.44
Montrose Rd – 416	16.75	16.23	16.93	16.45
QEW – 417	16.74	16.15	16.97	16.44

The table shows that the significant upstream areas govern the stream flow rates. To control the post-development flows from the study area (Sc 3) would result in the increases of the peak flow rates in the downstream receiving water course. Therefore, it is recommended that providing detention storage for runoff from a 25 mm rainfall event for erosion control (Sc 4), i.e. providing treatment for the first flush, be implemented in the wet ponds servicing development areas within Grassy Brook watershed.

4.2.4 Welland River

As the development is only a negligible portion of the watershed, the development will not alter the stream hydrology regime. In addition, the site is close to the outlet of a major river, water quantity control is not required per the NPCA guidelines.

Based on the above investigation, water quantity control is not required for this development.

4.3 Summary

4.3.1 Stormwater Management Criteria

Based on the section 4.2 investigation, water quantity control is not required for this development. In compliance with the NPCA's SWM Stormwater Management Guidelines approved by NPCA on March 2010, and the MOE Stormwater Management Planning and Design Manual (2003), the following criteria were development for this development:

- Quantity / Flood Control
  - Flood control, i.e. control post-development flow to the pre-development levels is not recommended.
  - Major overland flow routes are to be designed to have sufficient capacity for the Regulatory event (100-year storm)
  - A 3-hour Chicago Storm and a 12-hour AES distribution storm should be used to calculate peak flows, the greater results should be used for check convey capacity

- Erosion Control
  - Detention and release of the 25mm, 4-hour Chicago design storm over a 24-hour period shall be provided for all receiving systems.

- Water Quality Control
  - "Enhanced" level (Level I) of water quality treatment (80% TSS reduction) will be required for all development area draining to the receiving watercourses (e.g., Grassy Brook, Lyons Creek and associated section of Welland River)
  - Properly sized oil/grit separators for stormwater treatment may be considered for commercial, industrial, or infill developments.

- Water Balance
  - Water balance impacts should be evaluated during the design of a site stormwater management system. Best efforts should be made to match pre-development infiltration volumes to the practically feasible extent
  - Hydrogeologically sensitive areas shall be identified as part of the SWM plan.

- Untreated stormwater shall be prevented from being directly infiltrated.

4.3.2 Stormwater Management Implementation Plan

The key objectives of stormwater management are:

- To provide water quality control to meet MOE Level I protection ;
- To maintain the existing watershed hydrological features, and avoid downstream flooding and potential erosion problems;
- To evaluate the site conditions and develop potential Low Impact Development (LID) strategy for the proposed site, in order to maintain the existing water balance to a feasible degree ;
- To integrate the stormwater management system with the overall grading and storm drainage plan for the site; and
- To ensure that the design of the stormwater management facilities conform to the stormwater management objectives and criteria

The flowing measures are proposed be implemented to achieve the objectives:

1. LID Practices

Low impact development (LID) is a sustainable stormwater management strategy that emphasizes conservation and use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial and industrial settings. A variety of sustainable stormwater management techniques, including the controls at the lot-level and through conveyance followed by end-of-pipe controls, should be examined to evaluate the feasibility of implementation of these controls. Some feasible SWM practices for the proposed study area are listed as follows:

- Implement flat grading (1%~2%) wherever feasible at the development to promote natural infiltration;
- Direct roof leaders to pervious areas where possible, such as lawns/gardens prior to being collected by storm sewers, in order to enhance infiltration and runoff retention;
- Implement the infiltration practices such as using infiltration trenches and thicker topsoil placement in order to maximize the groundwater recharge and preserve water balance. Infiltration trenches can be located at the rear yards of properties backing onto watercourses
- Implement bioswale and permeable pavers at parking areas to remove sediment and pollutant and enhance groundwater recharge.

Due to the soil conditions imply high water table and low infiltration rate, the site may have the challenge of employing the LID practices that depends on infiltration mechanism. Pending on future detail geotechnical investigation, should recharge groundwater would be impelled by high water table, bioswale, permeable pavers still can be used with sub-drains to address water quality prior to discharge to watercourses.

The characterization of water balance under pre-development conditions should be also evaluated. The post-development plan should maintain the hydrogeological regime to the maximum feasible extent. Rain water reuse (grey water system) and/or green roofs would be considered in the development of commercial, industrial and institute areas. Furthermore, the policies of encourage using rain barrels at lot level will also help to enhance water balance.

2. Wet Ponds

The end-of-pipe SWM facilities are required to only provide water quality control and erosion control for the development area. It is proposed that the wet ponds be designed to detain 25 mm rainfall – runoff for at least 24 hours. The details of pond configuration such as length-width ratio, depth, safety bench, etc. should conform to the MOE's design manual. The preliminary analyses show that the pond footprint will be about 5%-10% of the drainage area.

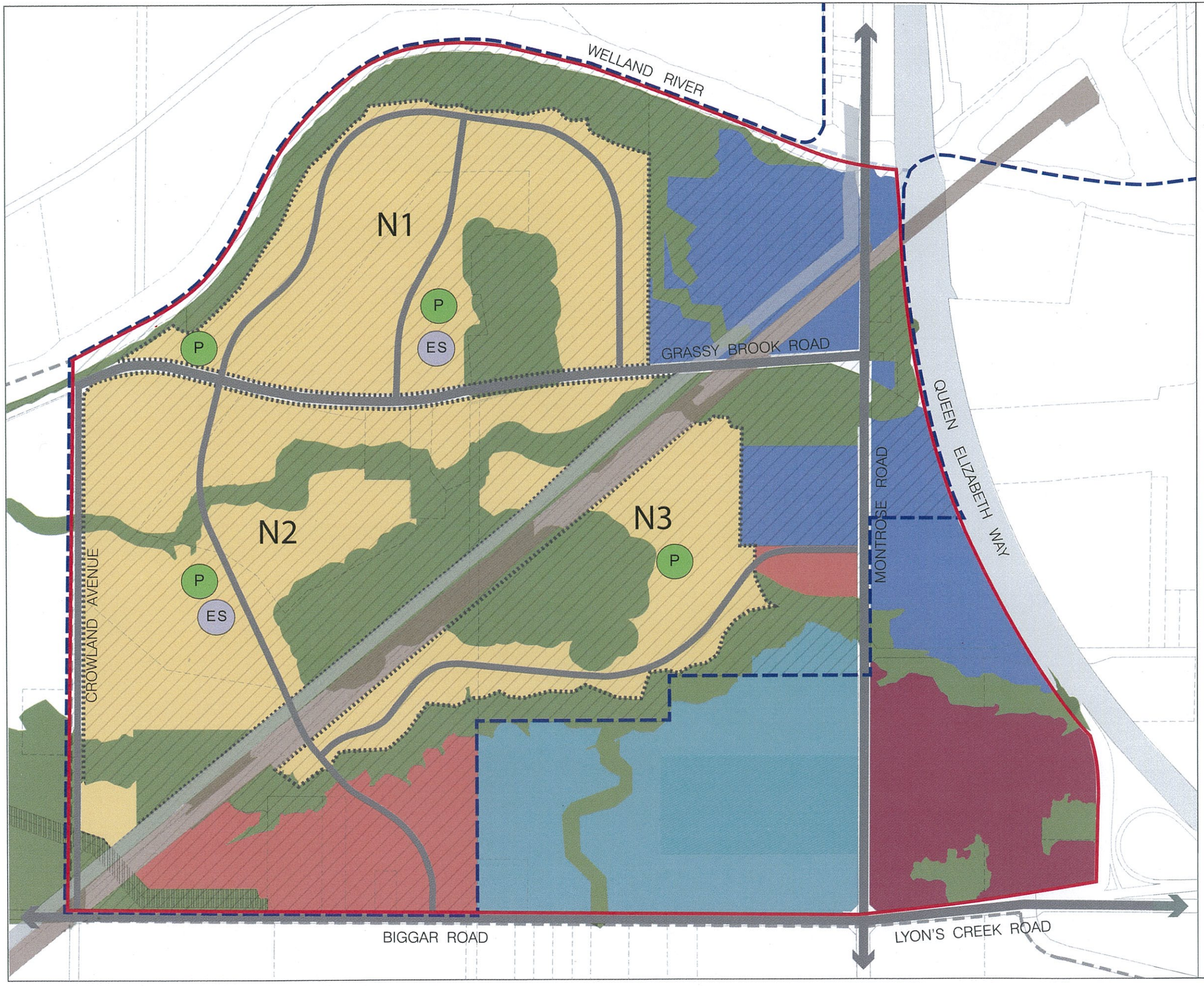
3. Water Quality Treatment Devices

Oil- grit separator (OGS) units that achieve 80% TSS removal can be used for the areas where water can't be practically directed to wet ponds. Efforts should be taken to prove pre-treatment prior to the OGS unit or the followed treatment at the OGS outlet prior to the receiving watercourses.

The integration of these SWM practices should be reflected in the site development plan. In addition, a mitigation plan to minimize the development impacts on the Provincial Significant Wetland (PSW) should be considered in the next design stage. A feature based water balance study may need to determine if the reduction in surface flows to the wetland caused by the proposed development would have significant impact to the wetland. It would be necessary to direct post-development surface runoff to the wetland to maintain surface flow contribution, if the wetland is mainly fed by surface water.

APPNEDIX A

Background Information



NiagaraFalls CANADA

Schedule A to the Official Plan Land Use

GRAND NIAGARA SECONDARY PLAN

Legend

- Grand Niagara Secondary Plan
- Urban Area Boundary
- Lands within the Built Boundary
- residential low / medium density
- mixed use
- ES proposed elementary
- P open space / parkland
- tourist commercial
- hospital employment campus
- employment
- natural heritage system (see Appendix C)
- N1 Neighbourhoods
- roads
- rail line
- utility corridor
- pipeline easement

DRAFT

Scale 1:8,000

0 100 200 300 400 500m

7.6 Summary

Table 7.6.1 below contains a summary of the stormwater management policies and technical guidelines presented throughout this section.

Table 7.6.1 - Summary of SWM Policies and Technical Guidelines

Topic	General Policy Statement	Technical Guidelines		
Stormwater Management Control	Sufficient SWM controls are required by the NPCA to ensure that flooding, pollution, surface erosion and conservation of land impacts due to development do not occur.	Flooding/Quantity Control		• Generally, the SWM controls required are to match or reduce post-development peak flows to pre-development peak flows for a range of design storm events (2, 5, 25 and 100-year storm events, unless directed otherwise). • Different design storm distributions and durations shall be assessed in order to determine the critical storm that yields the lowest pre-development peak flow and the highest post-development peak flow. At a minimum, the 3-hour Chicago, 12-hour AES and 24-hour SCS distributions should be considered. • All SWM plans are to assess the capacity of the receiving system in order to indentify hydraulic constraints or existing flooding hazards. These existing constraints/risks may require additional quantity controls over and above the typical post to pre peak flow controls. • Consideration may be given to not requiring peak flow controls if the assessment of receiving system capacity demonstrates little or no benefit to such controls. This would include situations such as discharge to major river systems or directly to a Lake. Pre-consultation with the NPCA and additional approval requirements are necessary for this to be considered. • Major overland flow routes are to be designed to have sufficient capacity for the Regulatory event (100-year or Regional storm event, as applicable).
		Quality Control	TSS	• A minimum of “Normal” level of water quality treatment, as defined in the MOE design guidelines (2003) is required for all SWM facilities. This is equivalent to a 70% TSS reduction. • “Enhanced” level of water quality treatment (80% TSS reduction) will be required on all watercourses containing Type 1 – critical fish habitat. • A detailed assessment of the receiving system will be mandatory for any proposed reduction in the level of water quality treatment required on a development site. The assessment contents must be appraised and approved by the NPCA prior to completion.
			Temperature	• The SWMP for a development site is required to include measures to eliminate or mitigate adverse temperature impacts due to the increase in impervious surfaces and the ponding of water in SWM facilities. Particular attention is to be given to those systems discharging to coolwater or coldwater receiving systems. • Post-development water temperature regime is to mimic or enhance the pre-development regime.

Topic	General Policy Statement	Technical Guidelines		
			Total Phosphorus	• Phosphorus removal targets will be typically provided for in the TSS removal targets, unless specific targets are developed through a management strategy.
			Spills	• SWM facility outlets are to be designed to allow the outlet to facilitate the containment of a spill. • Ensure sufficient access to SWM facility in order to allow spills to be cleaned.
		Water Balance		• As per the SWM Design Manual (MOE, 2003), water balance impacts should be evaluated during the design of a site stormwater management system. All efforts should be made to match pre- and post-development infiltration volumes in order to maintain groundwater recharge. • Hydrogeologically sensitive areas shall be identified as part of the SWM plan. • Untreated stormwater shall be prevented from being directly infiltrated.
		Erosion/Geomorphologic Considerations		• Quantity control to detain and release the 25mm, 4-hour Chicago design storm over a 24-hour period shall be provided for all receiving systems that are demonstrated to be stable watercourses or for proposed development that comprise less than 10% of the total area that drains to the receiving system. • The geomorphologic assessments and criteria contained in the SWM Design Manual (MOE, 2003) shall be used for all receiving systems that are unstable under existing conditions or for proposed developments that comprise a significant proportion of the total area draining to the receiving system. • Criteria identified in larger-scale studies that have directly evaluated the receiving systems, such as Subwatershed Studies or Master Drainage Plans, shall take precedence over the criteria presented herein.
		Construction Erosion and Sediment Control		• All applicants must include an Erosion and Sediment Control plan demonstrating that fish habitat and water quality are not affected by sediment from the property during or following site construction. • Guidelines and strategies to develop Erosion and Sediment Control plans can be found in the *Erosion and Sediment Control Guidelines for Urban Construction* manual (GGHA CA, 2006).
		Planting Considerations		• As part of SWM facility designs, planting strategies are required to address functional treatment aspects, including operations, public safety, and to help the facility blend in with the natural environment. • Native vegetation is to be used in the facility design (see **Appendix S** for the approved plant species list). • Consideration of nearby natural heritage features should be made in developing a planting strategy. • The different moisture zones within a SWM facility should be considered in choosing vegetation species: deep water, shallow water, shoreline/fringe zone (extended detention), flood fringe and upland areas.

Topic	General Policy Statement	Technical Guidelines	
		Oil/Grit Separators	• Oil/grit separators for stormwater treatment are discouraged for use in Greenfield residential development. • The use of oil/grit separators may be considered for commercial, industrial, or infill developments. • Consultation with the NPCA and the municipality is required in order to consider the use of oil/grit separators.
Location of Stormwater Management Facilities	The NPCA does not support the following SWM practices: 1. On-line SWM facilities for water quality; 2. Using natural wetlands as a SWM facility; 3. Locating SWM facilities in natural hazard areas, such as floodplains or erosion hazards, except outlets; and 4. Locating SWM facilities in Significant Natural Heritage Features.	• The discouragement of locating SWM facilities within natural hazard/regulated areas arises from the fact that SWM facilities are considered development, and as such are subject to the same development regulatory processes. Outlet works are the sole exception, since they must be located close to a receiving waterbody, most likely within its floodplain. • In certain circumstances, the NPCA is prepared to acknowledge that due to technical, economic and/or environmental considerations and constraints, SWM facilities may be required to be located within or close to natural hazard areas. Such an allowance would depend on the demonstration that the SWM facility would not impact the natural hazard area (i.e., no increase to flooding risks, etc.) and that the hazard area would not impact the function or lifespan of the SWM facility. Note that these facilities may be subject to additional detailed design requirements above and beyond those described in this manual or prescribed by the municipality. • SWM facilities are not permitted to be located within the 100-year floodplain or the hydraulic floodway, whichever is greater.	
Large-scale Stormwater Planning	The planning and implementation of SWM systems are encouraged by the NPCA to be performed on a catchment-scale basis, through the completion of Subwatershed Plans, Master Drainage Plans or other such strategies.	• Large-scale stormwater planning at the watershed, subwatershed or community plan level facilitate the most effective management strategies to reduce the impact of development on the natural environment. These studies can guide future development in ways that protect surface water features, groundwater features and natural areas. Refer to Section 2.3 and 2.4 of the SWM Design Manual (MOE, 2003) for an overview of the contents and benefits of large-scale SWM planning.	

Data Excerpted from Previous Flood Mapping Analyses

Lyon Creek Tributary 1

Table 1 Culvert Information

Crossing ID	Cross Section ID	Roadway/Location	Dimension		Barrel	Invert (m)	Shape	100-year Flow (m3/s)	Material
			Span/Diameter (m)	Rise (m)					
101	159	Lyons Creek Road	2.4	1.5	2	171.185	Box	10.3	Concrete
102	1000	Dell Road	4.9	1.7	1	172.293	Box	10.3	Concrete
103	1902	QEW	4.85	1.75	1	173.76	Box	10.3	Concrete
104	2422	Rexinger Road	0.78		3	174	Circular	10.3	Corrugated Steel
105	2516.895	Montrose Road	4.26	1.42	1	174.408	Box	10.3	Concrete
106	3601.181	Grand Niagar G.C. Trail	3.7	0.85	1	174.553	Box	10.3	Concrete
107	4265.65	Railway	2.15	1.8	1	174.952	Box	10.3	Concrete
108	4648.479	Crowland Ave.	3.1	1	1	175.956	Box	10.3	Concrete
109	5605	Morris Road	3.05	1.25	1	176.325	Box	4.5	Concrete
110	5865	Biggar Road	1.55		2	176.638	Circular	4.5	Corrugated Steel
111	7038	McKenney Road	2.55	0.8	1	177.455	Box	4.5	Concrete
112	7335	Carl Road (Farm Crossing)	0.65	0.55	2	177.493	Circular	4.5	Corrugated Steel
113	7651	Carl Road	3.1	0.65	1	178.045	Box	4.5	Concrete

Table 2 Flood Elevations of Lyon Creek Tributary 1

Cross Section	Flow Rate (m^3/s) / Culvert Location	Water Surface Elevation (m)
4648.479	Culvert at Crownland Ave	
4616.001	10.3	177.46
4536.524	10.3	177.45
4403.044	10.3	177.43
4286.07	10.3	177.43
4265.65	Culvert at Railway	
4246.332	10.3	176.80
4137.727	10.3	176.62
3871.727	10.3	176.39
3601.181	Culvert at Grand Niagara G.C. Trail	
3564.127	10.3	176.36
3337.745	10.3	176.18
3087.466	10.3	176.07
2856.012	10.3	175.99
2637.887	10.3	175.92
2549.065	10.3	175.91
2516.895	Culvert at Montrose Road	
2492.859	10.3	175.48
2461.156	10.3	175.48
2438.779	10.3	175.48
2422.041	Culvert at Rexinger Road	
2407.338	10.3	175.35
2379.392	10.3	175.34
2234.089	10.3	175.3
2041.769	10.3	175.26
1941.032	10.3	175.25
1902.218	Culvert at QEW	

Grassy Brook

Table 3 Grassy Creek Crossing Details and Parameters

Crossing Location	Length (m)	Span (m)	Rise (m)	Manning's n	Entrance/ Exit Loss
Crowland Road - 112	15.1	4.25	1.52	0.013	0.5 / 1.0
CPR Railway - 106	11.8	7.1	3.8	0.035	2.6 *
Montrose Road Double Box - 102	18.8	3.10	2.13	0.013	0.5 / 1.0
		2.43	1.80	0.013	
QEW - 99	78.5	6.1	1.29	0.035	2.6 *

* Indicates HEC-RAS weir flow parameter

Table 4 Flood Elevations

Cross Section	Flow Rate (m3/s)	Water Surface Elevation (m)
112.5	Culvert at Crownland Ave.	
112	16.86	174
111	16.72	173.9
110	16.72	173.8
109.5	16.72	173.7
109	16.72	173.7
108	16.72	173.6
107	16.72	173.3
106.5	Bridge at Railway	
106	16.72	173.1
105	16.74	173
104	16.74	173
103	16.74	172.8
102.5	Culvert at Montrose Road	
102	16.74	172.8
101	16.73	172.8
100	16.73	172.6
99.5	Bridge at QEW	

RAINFALL DATA

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Environment Canada/Environnement Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2014/12/21

NIAGARA FALLS ON 6135638

Latitude: 43 8'N Longitude: 79 5'W Elevation/Altitude: 182 m

Years/Années : 1965 - 1990 # Years/Années : 26

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

Year / Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1965	14.0	16.8	19.3	20.8	23.9	26.7	30.5	34.0	44.4
1966	6.1	12.2	13.7	15.7	15.7	17.5	24.6	34.0	34.0
1967	6.9	11.7	12.2	17.5	17.5	18.0	27.2	42.7	63.0
1968	5.1	6.1	7.4	11.7	21.8	26.4	58.2	70.1	75.7
1969	6.3	12.7	18.8	18.8	18.8	19.8	37.6	41.7	47.5
1970	8.6	9.4	13.5	14.5	15.7	19.0	29.2	29.2	37.3
1971	9.1	12.2	15.7	19.6	27.2	48.3	53.8	53.8	53.8
1972	9.4	15.5	21.1	31.0	39.1	47.8	48.0	48.0	48.8
1973	6.6	11.4	15.0	25.7	31.5	35.6	37.8	37.8	38.9
1974	5.6	7.4	9.9	14.2	14.7	22.4	30.7	30.7	36.8
1975	8.9	13.0	16.0	19.0	19.0	30.7	36.1	45.7	46.0
1976	6.9	11.7	14.5	17.8	18.8	21.6	39.1	40.9	50.3
1977	8.4	14.2	18.8	27.9	31.2	34.8	46.7	63.5	83.1
1978	8.6	12.8	15.8	21.0	26.1	31.5	52.2	52.2	56.2
1979	6.1	10.3	12.8	16.6	17.8	26.4	48.4	81.6	86.2
1980	6.7	9.0	12.9	22.1	24.3	24.8	25.4	35.2	41.0
1981	6.5	9.0	11.9	15.8	22.4	31.7	46.3	68.9	68.9
1982	3.9	6.0	6.4	8.7	11.6	15.1	20.8	25.2	29.8
1983	12.6	18.1	23.5	26.0	47.0	47.4	53.0	54.4	57.4
1984	7.6	8.6	12.5	13.9	14.4	19.8	33.0	38.8	41.0
1985	7.5	10.6	13.5	17.2	20.2	21.7	30.2	37.0	42.7
1986	9.6	10.2	11.4	14.7	18.5	23.2	34.9	34.9	51.7
1987	12.2	14.4	18.2	30.2	36.9	36.9	50.8	54.4	66.4
1988	3.8	6.3	8.8	15.6	21.2	25.4	33.7	59.6	62.1
1989	3.9	5.5	7.3	11.8	19.2	23.3	38.6	41.6	42.0
1990	5.1	8.6	9.6	11.3	12.3	18.2	27.0	39.3	45.8
# Yrs. / Années	26	26	26	26	26	26	26	26	26
Mean / Moyenne	7.5	10.9	13.9	18.4	22.6	27.5	38.2	46.0	52.0
Std. Dev. / Écart-type	2.6	3.3	4.3	5.8	8.6	9.5	10.5	14.0	14.8
Skew. / Dissymétrie	0.81	0.24	0.27	0.68	1.30	1.04	0.29	0.88	0.84
Kurtosis	3.80	2.90	2.99	3.16	4.74	3.59	2.23	3.54	3.36

*-99.9 Indicates Missing Data/Données manquantes

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

Duration/Durée	2	5	10	25	50	100	#Years

idf_v2-3_2014_12_21_613_ON_6135638_NIAGARA_FALLS_downloaded from Environment Canada 20160314

	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	Années
5 min	7.1	9.4	10.9	12.9	14.3	15.7	26
10 min	10.4	13.3	15.3	17.7	19.6	21.4	26
15 min	13.2	17.0	19.5	22.8	25.1	27.5	26
30 min	17.5	22.6	26.1	30.4	33.6	36.8	26
1 h	21.2	28.7	33.8	40.1	44.8	49.5	26
2 h	25.9	34.3	39.9	46.9	52.1	57.3	26
6 h	36.5	45.8	52.0	59.8	65.5	71.3	26
12 h	43.7	56.0	64.2	74.6	82.3	89.9	26
24 h	49.5	62.6	71.3	82.3	90.4	98.5	26

****

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

****

Duration/Durée	2	5	10	25	50	100	#Years
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	Années
5 min	85.3	112.9	131.2	154.3	171.4	188.4	26
	+/- 11.0	+/- 18.6	+/- 25.1	+/- 33.8	+/- 40.4	+/- 47.1	26
10 min	62.2	79.9	91.6	106.3	117.3	128.2	26
	+/- 7.1	+/- 11.9	+/- 16.0	+/- 21.6	+/- 25.9	+/- 30.2	26
15 min	52.6	68.0	78.2	91.0	100.6	110.0	26
	+/- 6.1	+/- 10.3	+/- 14.0	+/- 18.8	+/- 22.5	+/- 26.2	26
30 min	34.9	45.3	52.1	60.8	67.2	73.5	26
	+/- 4.1	+/- 6.9	+/- 9.4	+/- 12.7	+/- 15.1	+/- 17.6	26
1 h	21.2	28.7	33.8	40.1	44.8	49.5	26
	+/- 3.0	+/- 5.1	+/- 6.9	+/- 9.3	+/- 11.1	+/- 13.0	26
2 h	13.0	17.1	19.9	23.4	26.1	28.6	26
	+/- 1.7	+/- 2.8	+/- 3.8	+/- 5.1	+/- 6.2	+/- 7.2	26
6 h	6.1	7.6	8.7	10.0	10.9	11.9	26
	+/- 0.6	+/- 1.0	+/- 1.4	+/- 1.9	+/- 2.3	+/- 2.6	26
12 h	3.6	4.7	5.4	6.2	6.9	7.5	26
	+/- 0.4	+/- 0.7	+/- 0.9	+/- 1.3	+/- 1.5	+/- 1.8	26
24 h	2.1	2.6	3.0	3.4	3.8	4.1	26
	+/- 0.2	+/- 0.4	+/- 0.5	+/- 0.7	+/- 0.8	+/- 0.9	26

****

Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)
RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
T = Rainfall duration (h) / Durée de la pluie (h)

****

Statistics/Statistiques	2	5	10	25	50	100
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans
Mean of RR/Moyenne de RR	31.2	40.8	47.1	55.1	61.0	66.9
Std. Dev. /Écart-type (RR)	29.7	38.8	44.9	52.6	58.3	63.9
Std. Error/Erreur-type	6.8	8.9	10.3	12.1	13.5	14.8
Coefficient (A)	19.5	25.3	29.2	34.0	37.6	41.2
Exponent/Exposant (B)	-0.668	-0.673	-0.676	-0.678	-0.680	-0.681
Mean % Error/% erreur moyenne	8.1	8.6	8.9	9.3	9.5	9.7

APPNEDIX B

Modelling Results

Lyon Creek Tributary 1

HEC-HMS Model Output

Project: Lyon_Trib1 Simulation Run: Run 100yr

Start of Run:	02Jun2009, 00:00	Basin Model:	Lyons Creek
End of Run:	03Jun2009, 00:00	Meteorologic Model:	Met 100yr
Compute Time:	10Nov2016, 10:12:46	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Tri1_10	3.018300	9.9	02Jun2009, 05:30	62.10
Pt Trib1 conflence	8.466836	14.0	02Jun2009, 07:40	48.55
Pt2	Not Specified	89.2	02Jun2009, 08:50	n/a

Original model was revised to reflect the future Grand Niagara development

Project: Project 3 Simulation Run: Run 100yr

Start of Run: 02Jun2009, 00:00 Basin Model: Lyons Creek
End of Run: 03Jun2009, 00:00 Meteorologic Model: Met 100yr
Compute Time: 10Nov2016, 10:27:20 Control Specifications: Control 1

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Grand Niagara	1.470000	4.3	02Jun2009, 05:20	46.95
Trib1_10-2	0.863000	2.6	02Jun2009, 05:05	46.95
Tri1_10-1	0.687000	2.1	02Jun2009, 05:00	46.95
Junction-1	3.020000	8.9	02Jun2009, 05:10	46.95
Pt Trib1 conflence	8.468536	11.2	02Jun2009, 07:55	43.15
Pt2	Not Specified	87.8	02Jun2009, 09:00	n/a

Catchment Trib1_10 was split into three areas - the existing conditions

Project: Without Control Simulation Run: Run 100yr

Start of Run: 02Jun2009, 00:00 Basin Model: Lyons Creek
End of Run: 03Jun2009, 00:00 Meteorologic Model: Met 100yr
Compute Time: 10Nov2016, 10:30:16 Control Specifications: Control 1

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Grand Niagara	1.470000	6.0	02Jun2009, 04:50	77.52
Trib1_10-2	0.863000	2.6	02Jun2009, 05:05	46.95
Tri1_10-1	0.687000	2.1	02Jun2009, 05:00	46.95
Junction-1	3.020000	10.7	02Jun2009, 04:55	61.83
Pt Trib1 conflence	8.468536	11.5	02Jun2009, 07:45	48.46
Pt2	Not Specified	87.9	02Jun2009, 08:55	n/a

Grand Niagara development without control

Project: Qantity Control Simulation Run: Run 100yr

Start of Run:	02Jun2009, 00:00	Basin Model:	Lyons Creek
End of Run:	03Jun2009, 00:00	Meteorologic Model:	Met 100yr
Compute Time:	10Nov2016, 10:32:36	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Grand Niagara	1.470000	6.0	02Jun2009, 04:50	77.52
Reservoir-1	1.470000	4.1	02Jun2009, 06:45	69.83
Trib1_10-2	0.863000	2.6	02Jun2009, 05:05	46.95
Tri1_10-1	0.687000	2.1	02Jun2009, 05:00	46.95
Junction-1	3.020000	7.8	02Jun2009, 06:10	58.09
Pt Trib1 conflence	8.468536	13.2	02Jun2009, 08:10	47.12
Pt2	Not Specified	89.7	02Jun2009, 08:55	n/a

Grand Niagara development with flood control

Project: With 25mm control Simulation Run: Run 100yr

Start of Run: 02Jun2009, 00:00 Basin Model: Lyons Creek
End of Run: 03Jun2009, 00:00 Meteorologic Model: Met 100yr
Compute Time: 10Nov2016, 10:41:46 Control Specifications: Control 1

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Grand Niagara	1.470000	6.0	02Jun2009, 04:50	77.52
Reservoir-1	1.470000	6.0	02Jun2009, 05:05	68.02
Trib1_10-2	0.863000	2.6	02Jun2009, 05:05	46.95
Tri1_10-1	0.687000	2.1	02Jun2009, 05:00	46.95
Junction-1	3.020000	10.7	02Jun2009, 05:00	57.21
Pt Trib1 conflence	8.468536	11.9	02Jun2009, 07:40	46.81
Pt2	Not Specified	88.1	02Jun2009, 08:55	n/a

Grand Niagara development with 25mm control

Lyon Creek Tributary 1

HEC-RAS Model Output

HEC-RAS Plan: ProposedGN Profile: PF 1

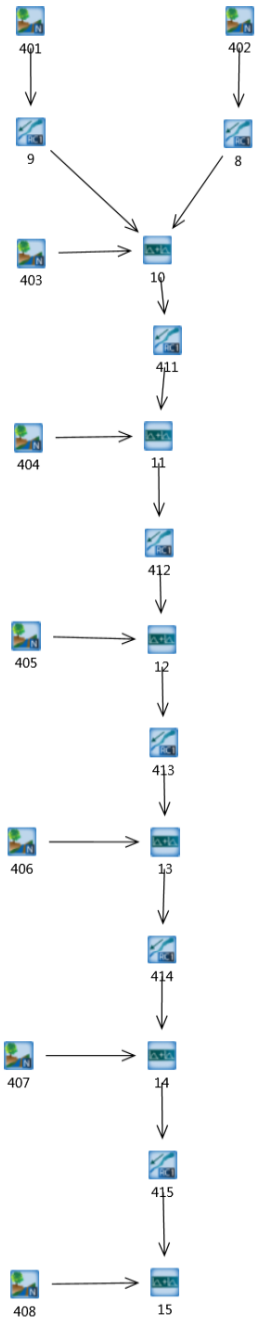
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary1	Tri1	7789.768	PF 1	4.5	178.10	179.35	178.67	179.35	0.0000	0.09	58.16	483.4	0.04
Tributary1	Tri1	7744.823	PF 1	4.5	178.05	179.35	178.61	179.35	0.0000	0.09	69.55	623.8	0.04
Tributary1	Tri1	7651.344		Culvert									
Tributary1	Tri1	7621.192	PF 1	4.5	178.05	178.88	178.66	178.92	0.0091	0.84	5.36	111.2	0.43
Tributary1	Tri1	7560.950	PF 1	4.5	177.80	178.58	178.47	178.64	0.0027	1.13	3.97	60.8	0.67
Tributary1	Tri1	7377.502	PF 1	4.5	177.60	178.59	178.28	178.59	0.0001	0.13	56.05	172.0	0.07
Tributary1	Tri1	7341.778	PF 1	4.5	177.49	178.59	178.14	178.59	0.0000	0.19	27.38	241.7	0.09
Tributary1	Tri1	7335.908		Culvert									
Tributary1	Tri1	7328.592	PF 1	4.5	177.49	178.58	178.14	178.58	0.0000	0.12	67.88	266.0	0.06
Tributary1	Tri1	7307.579	PF 1	4.5	177.48	178.58	178.15	178.58	0.0000	0.09	80.12	256.8	0.04
Tributary1	Tri1	7225.856	PF 1	4.5	177.47	178.57	178.16	178.57	0.0004	0.19	24.92	222.3	0.09
Tributary1	Tri1	7063.057	PF 1	4.5	177.46	178.51	178.07	178.52	0.0004	0.16	28.50	189.7	0.08
Tributary1	Tri1	7044.979	PF 1	4.5	177.46	178.51	178.03	178.51	0.0001	0.11	45.59	93.9	0.05
Tributary1	Tri1	7038.415		Culvert									
Tributary1	Tri1	7032.110	PF 1	4.5	177.45	178.37	178.05	178.37	0.0001	0.13	37.82	124.0	0.06
Tributary1	Tri1	7024.667	PF 1	4.5	177.45	178.37	178.11	178.37	0.0004	0.24	22.08	114.5	0.13
Tributary1	Tri1	6850.556	PF 1	4.5	177.35	178.33	177.87	178.33	0.0002	0.16	29.39	278.8	0.09
Tributary1	Tri1	6593.302	PF 1	4.5	177.25	178.23	178.06	178.23	0.0012	0.24	19.14	151.4	0.16
Tributary1	Tri1	6361.413	PF 1	4.5	177.15	178.13	177.89	178.13	0.0002	0.13	43.19	319.7	0.09
Tributary1	Tri1	6189.798	PF 1	4.5	177.00	178.09	177.31	178.10	0.0002	0.18	28.10	137.3	0.10
Tributary1	Tri1	6064.257	PF 1	4.5	176.95	178.09	177.23	178.09	0.0000	0.05	122.10	398.3	0.02
Tributary1	Tri1	5931.696	PF 1	4.5	176.85	178.09	177.14	178.09	0.0000	0.02	267.12	385.7	0.01
Tributary1	Tri1	5891.930	PF 1	4.5	176.64	178.09	177.02	178.09	0.0000	0.13	35.29	521.0	0.04
Tributary1	Tri1	5865.146		Culvert									
Tributary1	Tri1	5853.850	PF 1	4.5	176.64	177.91	177.10	177.91	0.0000	0.19	23.66	397.2	0.07
Tributary1	Tri1	5812.069	PF 1	4.5	176.60	177.88	177.44	177.90	0.0003	0.68	6.60	327.9	0.31
Tributary1	Tri1	5735.987	PF 1	4.5	176.55	177.89	177.22	177.89	0.0000	0.13	37.83	207.6	0.05
Tributary1	Tri1	5664.414	PF 1	4.5	176.50	177.89	177.15	177.89	0.0000	0.09	55.51	301.2	0.04
Tributary1	Tri1	5623.081	PF 1	4.5	176.33	177.89	177.03	177.89	0.0001	0.14	32.55	197.3	0.06
Tributary1	Tri1	5605.481		Culvert									
Tributary1	Tri1	5561.648	PF 1	4.5	176.33	177.76	177.04	177.76	0.0001	0.19	26.25	136.3	0.07
Tributary1	Tri1	5510.467	PF 1	4.5	176.30	177.75	176.90	177.75	0.0000	0.09	57.70	124.4	0.03
Tributary1	Tri1	5319.687	PF 1	4.5	176.25	177.75	177.02	177.75	0.0000	0.09	58.86	228.8	0.03
Tributary1	Tri1	5067.767	PF 1	4.5	176.20	177.75	176.94	177.75	0.0000	0.05	118.71	312.1	0.02
Tributary1	Tri1	4897.336	PF 1	4.5	176.00	177.75	176.57	177.75	0.0000	0.05	95.34	206.2	0.02
Tributary1	Tri1	4742.385	PF 1	10.3	175.96	177.74	176.62	177.75	0.0000	0.10	101.85	277.6	0.04
Tributary1	Tri1	4684.578	PF 1	10.3	175.96	177.74	176.65	177.74	0.0000	0.10	108.35	276.5	0.04
Tributary1	Tri1	4648.479		Culvert									
Tributary1	Tri1	4616.001	PF 1	10.3	175.96	177.41	176.68	177.41	0.0002	0.23	44.99	156.0	0.10
Tributary1	Tri1	4536.524	PF 1	10.3	175.75	177.39	176.64	177.39	0.0002	0.24	46.25	138.5	0.10
Tributary1	Tri1	4403.044	PF 1	10.3	175.40	177.37	176.60	177.37	0.0002	0.15	75.67	194.0	0.06
Tributary1	Tri1	4286.070	PF 1	10.3	174.95	177.36	176.24	177.36	0.0001	0.11	99.02	168.5	0.04
Tributary1	Tri1	4265.65		Culvert									
Tributary1	Tri1	4246.332	PF 1	10.3	174.95	176.80	176.39	176.82	0.0021	0.62	16.75	41.1	0.28
Tributary1	Tri1	4137.727	PF 1	10.3	174.75	176.62	176.41	176.63	0.0014	0.44	23.45	117.6	0.25
Tributary1	Tri1	3871.727	PF 1	10.3	174.55	176.39	175.67	176.40	0.0006	0.37	27.70	59.8	0.17
Tributary1	Tri1	3601.181		Culvert									
Tributary1	Tri1	3564.127	PF 1	10.3	174.55	176.36		176.36	0.0006	0.27	38.66	86.6	0.13
Tributary1	Tri1	3337.745	PF 1	10.3	174.55	176.18	175.68	176.19	0.0010	0.36	28.99	69.5	0.17
Tributary1	Tri1	3087.466	PF 1	10.3	174.50	176.07	175.41	176.07	0.0002	0.18	58.01	93.3	0.07
Tributary1	Tri1	2856.012	PF 1	10.3	174.45	175.99	175.22	176.00	0.0004	0.28	37.09	74.0	0.11
Tributary1	Tri1	2637.887	PF 1	10.3	174.43	175.92		175.92	0.0003	0.25	42.13	58.5	0.09
Tributary1	Tri1	2549.065	PF 1	10.3	174.41	175.91	174.91	175.91	0.0001	0.15	70.85	96.3	0.05
Tributary1	Tri1	2516.895		Culvert									
Tributary1	Tri1	2492.859	PF 1	10.3	174.00	175.48	174.68	175.49	0.0002	0.29	35.19	56.4	0.11
Tributary1	Tri1	2461.156	PF 1	10.3	174.00	175.48	174.67	175.48	0.0001	0.19	55.02	89.5	0.07
Tributary1	Tri1	2438.779	PF 1	10.3	174.00	175.48	174.71	175.48	0.0002	0.24	43.30	83.7	0.10
Tributary1	Tri1	2422.041		Culvert									
Tributary1	Tri1	2407.338	PF 1	10.3	174.00	175.35		175.35	0.0005	0.30	34.73	65.1	0.13
Tributary1	Tri1	2379.392	PF 1	10.3	173.95	175.34		175.34	0.0002	0.20	49.83	75.0	0.07
Tributary1	Tri1	2234.089	PF 1	10.3	173.90	175.30		175.30	0.0003	0.22	47.45	60.2	0.08
Tributary1	Tri1	2041.769	PF 1	10.3	173.85	175.26		175.26	0.0002	0.22	48.08	59.7	0.07
Tributary1	Tri1	1941.032	PF 1	10.3	173.76	175.25	174.67	175.25	0.0001	0.15	69.27	103.6	0.06
Tributary1	Tri1	1902.218		Culvert									
Tributary1	Tri1	1759.792	PF 1	10.3	173.76	174.55		174.55	0.0009	0.30	34.52	73.3	0.14
Tributary1	Tri1	1616.643	PF 1	10.3	173.40	174.47		174.48	0.0004	0.22	47.31	83.2	0.09
Tributary1	Tri1	1347.931	PF 1	10.3	173.00	174.31		174.32	0.0012	0.34	30.58	58.4	0.15
Tributary1	Tri1	1129.775	PF 1	10.3	172.80	173.95		173.96	0.0024	0.45	23.02	44.7	0.20
Tributary1	Tri1	1044.681	PF 1	10.3	172.29	173.79	173.30	173.80	0.0015	0.35	29.71	58.8	0.16
Tributary1	Tri1	1000.484		Culvert									
Tributary1	Tri1	954.9207	PF 1	10.3	172.29	173.55	173.25	173.57	0.0050	0.69	15.03	39.5	0.35
Tributary1	Tri1	805.8472	PF 1	10.3	172.00	173.46		173.47	0.0002	0.28	36.74	91.4	0.14
Tributary1	Tri1	637.4803	PF 1	10.3	171.85	173.40		173.40	0.0007	0.29	36.14	79.4	0.14
Tributary1	Tri1	533.2161	PF 1	10.3	171.70	173.28	172.72	173.29	0.0019	0.50	20.68	48.6	0.23
Tributary1	Tri1	414.3692	PF 1	10.3	171.55	173.24		173.24	0.0002	0.28	37.07	48.7	0.10
Tributary1	Tri1	296.4332	PF 1	10.3	171.40	173.23		173.23	0.0001	0.19	53.84	58.5	0.06
Tributary1	Tri1	205.6848	PF 1	10.3	171.30	173.22		173.22	0.0000	0.15	68.45	74.9	0.05
Tributary1	Tri1	182.0854	PF 1	10.3	171.20	173.22	171.82	173.22	0.0000	0.14	73.08	67.1	0.04
Tributary1	Tri1	158.8010		Culvert									
Tributary1	Tri1	145.6467	PF 1	10.3	171.00	173.03		173.03	0.0000	0.17	59.26	62.8	0.06
Tributary1	Tri1	110.5441	PF 1	10.3	170.00	173.03		173.03	0.0000	0.12	87.82	69.5	0.03
LyonsCreek	LC100 to LC200	3964.832	PF 1	89.2	169.30	173.01		173.02	0.0001	0.41	221.20	157.2	0.10
LyonsCreek	LC100 to LC200	3750.190	PF 1	89.2	169.15	172.99	170.95	173.00	0.0002	0.46	208.38	155.7	0.11
LyonsCreek	LC100 to LC200	3568.336	PF 1	90.8	169.00	172.95	170.79	172.96	0.0003	0.43	211.04	137.7	0.11

HEC-RAS Plan: ProposedGN Profile: PF 1 (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
LyonsCreek	LC100 to LC200	3522.307	PF 1	90.8	168.92	172.93	171.29	172.95	0.0002	0.53	171.94	131.3	0.15
LyonsCreek	LC100 to LC200	3496.484		Bridge									
LyonsCreek	LC100 to LC200	3453.680	PF 1	90.8	168.90	172.85	171.79	172.88	0.0005	0.71	128.30	100.6	0.20
LyonsCreek	LC100 to LC200	3386.932	PF 1	90.8	168.90	172.83		172.85	0.0004	0.63	145.54	127.2	0.18
LyonsCreek	LC100 to LC200	3022.639	PF 1	90.8	168.84	172.69		172.72	0.0003	0.75	123.94	104.5	0.21
LyonsCreek	LC100 to LC200	2763.101	PF 1	90.8	168.80	172.66	170.66	172.67	0.0001	0.48	190.59	138.7	0.13
LyonsCreek	LC100 to LC200	2356.097	PF 1	90.8	168.77	172.60		172.62	0.0001	0.59	155.37	119.1	0.16
LyonsCreek	LC100 to LC200	2158.768	PF 1	90.8	168.74	172.57	170.74	172.59	0.0002	0.62	148.23	113.3	0.16
LyonsCreek	LC100 to LC200	2077.514	PF 1	90.8	168.70	172.53	170.72	172.57	0.0002	0.89	101.74	69.8	0.24
LyonsCreek	LC100 to LC200	2053.019		Bridge									
LyonsCreek	LC100 to LC200	2006.389	PF 1	90.8	168.70	172.51	170.62	172.54	0.0002	0.74	121.97	98.5	0.19
LyonsCreek	LC100 to LC200	1915.754	PF 1	90.8	168.70	172.50		172.52	0.0002	0.64	143.09	106.1	0.17
LyonsCreek	LC100 to LC200	1663.789	PF 1	90.8	168.70	172.46		172.48	0.0001	0.58	156.62	116.2	0.16
LyonsCreek	LC100 to LC200	1453.349	PF 1	90.8	168.70	172.41		172.44	0.0002	0.71	133.85	107.6	0.19
LyonsCreek	LC100 to LC200	1197.256	PF 1	90.8	168.70	172.30	170.71	172.35	0.0006	1.06	85.72	45.4	0.24
LyonsCreek	LC100 to LC200	986.0563	PF 1	90.8	168.70	172.19		172.24	0.0004	1.01	90.23	46.3	0.23
LyonsCreek	LC100 to LC200	730.7623	PF 1	90.8	168.70	172.08		172.14	0.0004	1.05	86.31	49.8	0.26
LyonsCreek	LC100 to LC200	585.8952	PF 1	90.8	168.70	171.99		172.06	0.0006	1.19	76.02	47.4	0.30
LyonsCreek	LC100 to LC200	389.9610	PF 1	90.8	168.70	171.88		171.95	0.0005	1.12	81.13	45.3	0.27
LyonsCreek	LC100 to LC200	334.1241	PF 1	90.8	168.70	171.82	170.71	171.91	0.0008	1.33	68.10	39.8	0.33
LyonsCreek	LC100 to LC200	275.3651		Bridge									
LyonsCreek	LC100 to LC200	233.6884	PF 1	90.8	168.70	171.74	170.66	171.83	0.0007	1.34	67.75	118.2	0.33
LyonsCreek	LC100 to LC200	194.9776	PF 1	90.8	168.70	171.73	170.56	171.80	0.0006	1.16	78.11	134.4	0.29
LyonsCreek	LC100 to LC200	81.94830	PF 1	90.8	168.70	171.64	170.56	171.72	0.0008	1.24	73.35	178.8	0.31

Grassy Brook VO2 Model Ouput

Scenario1 - Existing Conditions (Burnside)



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

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

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O    Company
        OOO     T      T    H   H    Y    M   M   OOO              Serial

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


  Input   filename: C:\Program Files (x86)\Visual Otthymo 2.4\VO2\voin.dat
  Output  filename: C:\Users\dingm\AppData\Local\Temp\19f5d657-da79-4530-97fd-44e60e92b3d4\Scenario.out
  Summary filename: C:\Users\dingm\AppData\Local\Temp\19f5d657-da79-4530-97fd-44e60e92b3d4\Scenario.sum


DATE: 11/10/2016                          TIME: 09:36:47

USER:


COMMENTS: _____________________________________________

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

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| MASS STORM       |     Filename: C:\Users\dingm\AppD
|                  |               ata\Local\Temp\
|                  |               19f5d657-da79-4530-97fd-44e60e92b3d4\bd78fa12
| Ptotal= 98.50 mm |     Comments: 24 HOUR SCS TYPE II MASS CURVE: 15 MIN S
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min

      TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |   TIME    RAIN
       hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |    hrs   mm/hr
      0.25    1.18 |   6.25    1.97 |'  12.25   14.18 |  18.25    1.58
      0.50    1.18 |   6.50    1.58 |'  12.50   14.18 |  18.50    1.97
      0.75    0.79 |   6.75    1.97 |'  12.75    7.49 |  18.75    1.58
      1.00    1.18 |   7.00    1.58 |'  13.00    7.09 |  19.00    1.97
      1.25    1.18 |   7.25    2.36 |'  13.25    5.52 |  19.25    1.58
      1.50    1.18 |   7.50    1.97 |'  13.50    5.12 |  19.50    1.97
      1.75    0.79 |   7.75    2.36 |'  13.75    4.33 |  19.75    1.58
      2.00    1.18 |   8.00    1.97 |'  14.00    3.94 |  20.00    1.97
      2.25    1.18 |   8.25    2.76 |'  14.25    3.15 |  20.25    1.18
      2.50    1.58 |   8.50    2.36 |'  14.50    2.76 |  20.50    1.18
      2.75    1.18 |   8.75    2.76 |'  14.75    3.15 |  20.75    1.18
      3.00    1.18 |   9.00    2.76 |'  15.00    2.76 |  21.00    1.18
      3.25    1.18 |   9.25    3.15 |'  15.25    3.15 |  21.25    1.18
      3.50    1.58 |   9.50    3.15 |'  15.50    2.76 |  21.50    1.18
      3.75    1.18 |   9.75    3.55 |'  15.75    3.15 |  21.75    1.18
      4.00    1.18 |  10.00    3.55 |'  16.00    2.76 |  22.00    1.18
      4.25    1.58 |  10.25    4.73 |'  16.25    1.97 |  22.25    1.18
      4.50    1.58 |  10.50    4.33 |'  16.50    1.58 |  22.50    1.18
      4.75    1.58 |  10.75    6.30 |'  16.75    1.97 |  22.75    1.18
      5.00    1.58 |  11.00    5.91 |'  17.00    1.58 |  23.00    1.18
      5.25    1.58 |  11.25    9.46 |'  17.25    1.97 |  23.25    1.18
      5.50    1.58 |  11.50    9.46 |'  17.50    1.58 |  23.50    1.18
      5.75    1.58 |  11.75   29.16 |'  17.75    1.58 |  23.75    1.18
      6.00    1.58 |  12.00  120.56 |'  18.00    1.97 |  24.00    1.18

------------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0408) |   Area    (ha)=   9.30   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.02

        NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 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
0.033    1.18 | 6.033    1.97 |'12.033   14.18 | 18.03    1.58
0.067    1.18 | 6.067    1.97 |'12.067   14.18 | 18.07    1.58
0.100    1.18 | 6.100    1.97 |'12.100   14.18 | 18.10    1.58
0.133    1.18 | 6.133    1.97 |'12.133   14.18 | 18.13    1.58
0.167    1.18 | 6.167    1.97 |'12.167   14.18 | 18.17    1.58
0.200    1.18 | 6.200    1.97 |'12.200   14.18 | 18.20    1.58
0.233    1.18 | 6.233    1.97 |'12.233   14.18 | 18.23    1.58
0.267    1.18 | 6.267    1.77 |'12.267   14.18 | 18.27    1.77
0.300    1.18 | 6.300    1.58 |'12.300   14.18 | 18.30    1.97
0.333    1.18 | 6.333    1.58 |'12.333   14.18 | 18.33    1.97
0.367    1.18 | 6.367    1.58 |'12.367   14.18 | 18.37    1.97
0.400    1.18 | 6.400    1.58 |'12.400   14.18 | 18.40    1.97
0.433    1.18 | 6.433    1.58 |'12.433   14.18 | 18.43    1.97
0.467    1.18 | 6.467    1.58 |'12.467   14.18 | 18.47    1.97
0.500    1.18 | 6.500    1.58 |'12.500   14.17 | 18.50    1.97
0.533    0.79 | 6.533    1.97 |'12.533    7.49 | 18.53    1.58
0.567    0.79 | 6.567    1.97 |'12.567    7.49 | 18.57    1.58
0.600    0.79 | 6.600    1.97 |'12.600    7.49 | 18.60    1.58
0.633    0.79 | 6.633    1.97 |'12.633    7.49 | 18.63    1.58
0.667    0.79 | 6.667    1.97 |'12.667    7.49 | 18.67    1.58
0.700    0.79 | 6.700    1.97 |'12.700    7.49 | 18.70    1.58
0.733    0.79 | 6.733    1.97 |'12.733    7.49 | 18.73    1.58
0.767    0.99 | 6.767    1.77 |'12.767    7.29 | 18.77    1.77
0.800    1.18 | 6.800    1.58 |'12.800    7.09 | 18.80    1.97
0.833    1.18 | 6.833    1.58 |'12.833    7.09 | 18.83    1.97
0.867    1.18 | 6.867    1.58 |'12.867    7.09 | 18.87    1.97
0.900    1.18 | 6.900    1.58 |'12.900    7.09 | 18.90    1.97
0.933    1.18 | 6.933    1.58 |'12.933    7.09 | 18.93    1.97
0.967    1.18 | 6.967    1.58 |'12.967    7.09 | 18.97    1.97
1.000    1.18 | 7.000    1.58 |'13.000    7.09 | 19.00    1.97
1.033    1.18 | 7.033    2.36 |'13.033    5.52 | 19.03    1.58
1.067    1.18 | 7.067    2.36 |'13.067    5.52 | 19.07    1.58
1.100    1.18 | 7.100    2.36 |'13.100    5.52 | 19.10    1.58
1.133    1.18 | 7.133    2.36 |'13.133    5.52 | 19.13    1.58
1.167    1.18 | 7.167    2.36 |'13.167    5.52 | 19.17    1.58
1.200    1.18 | 7.200    2.36 |'13.200    5.52 | 19.20    1.58
1.233    1.18 | 7.233    2.36 |'13.233    5.52 | 19.23    1.58
1.267    1.18 | 7.267    2.17 |'13.267    5.32 | 19.27    1.77
1.300    1.18 | 7.300    1.97 |'13.300    5.12 | 19.30    1.97
1.333    1.18 | 7.333    1.97 |'13.333    5.12 | 19.33    1.97
1.367    1.18 | 7.367    1.97 |'13.367    5.12 | 19.37    1.97
1.400    1.18 | 7.400    1.97 |'13.400    5.12 | 19.40    1.97
1.433    1.18 | 7.433    1.97 |'13.433    5.12 | 19.43    1.97
1.467    1.18 | 7.467    1.97 |'13.467    5.12 | 19.47    1.97
1.500    1.18 | 7.500    1.97 |'13.500    5.12 | 19.50    1.97
1.533    0.79 | 7.533    2.36 |'13.533    4.33 | 19.53    1.58
1.567    0.79 | 7.567    2.36 |'13.567    4.33 | 19.57    1.58
1.600    0.79 | 7.600    2.36 |'13.600    4.33 | 19.60    1.58
1.633    0.79 | 7.633    2.36 |'13.633    4.33 | 19.63    1.58
1.667    0.79 | 7.667    2.36 |'13.667    4.33 | 19.67    1.58
1.700    0.79 | 7.700    2.36 |'13.700    4.33 | 19.70    1.58
1.733    0.79 | 7.733    2.36 |'13.733    4.33 | 19.73    1.58
1.767    0.98 | 7.767    2.17 |'13.767    4.14 | 19.77    1.77
1.800    1.18 | 7.800    1.97 |'13.800    3.94 | 19.80    1.97
1.833    1.18 | 7.833    1.97 |'13.833    3.94 | 19.83    1.97
1.867    1.18 | 7.867    1.97 |'13.867    3.94 | 19.87    1.97
1.900    1.18 | 7.900    1.97 |'13.900    3.94 | 19.90    1.97
1.933    1.18 | 7.933    1.97 |'13.933    3.94 | 19.93    1.97
1.967    1.18 | 7.967    1.97 |'13.967    3.94 | 19.97    1.97
2.000    1.18 | 8.000    1.97 |'14.000    3.94 | 20.00    1.97
2.033    1.18 | 8.033    2.76 |'14.033    3.15 | 20.03    1.18
2.067    1.18 | 8.067    2.76 |'14.067    3.15 | 20.07    1.18
2.100    1.18 | 8.100    2.76 |'14.100    3.15 | 20.10    1.18
2.133    1.18 | 8.133    2.76 |'14.133    3.15 | 20.13    1.18
2.167    1.18 | 8.167    2.76 |'14.167    3.15 | 20.17    1.18
2.200    1.18 | 8.200    2.76 |'14.200    3.15 | 20.20    1.18
2.233    1.18 | 8.233    2.76 |'14.233    3.15 | 20.23    1.18
2.267    1.58 | 8.267    2.56 |'14.267    2.95 | 20.27    1.18
2.300    1.58 | 8.300    2.36 |'14.300    2.76 | 20.30    1.18
2.333    1.58 | 8.333    2.36 |'14.333    2.76 | 20.33    1.18
2.367    1.58 | 8.367    2.36 |'14.367    2.76 | 20.37    1.18
2.400    1.58 | 8.400    2.36 |'14.400    2.76 | 20.40    1.18
2.433    1.58 | 8.433    2.36 |'14.433    2.76 | 20.43    1.18
2.467    1.58 | 8.467    2.36 |'14.467    2.76 | 20.47    1.18
2.500    1.58 | 8.500    2.36 |'14.500    2.76 | 20.50    1.18
2.533    1.18 | 8.533    2.76 |'14.533    3.15 | 20.53    1.18
2.567    1.18 | 8.567    2.76 |'14.567    3.15 | 20.57    1.18
2.600    1.18 | 8.600    2.76 |'14.600    3.15 | 20.60    1.18
2.633    1.18 | 8.633    2.76 |'14.633    3.15 | 20.63    1.18
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2.667    1.18 | 8.667    2.76 |'14.667    3.15 | 20.67    1.18
2.700    1.18 | 8.700    2.76 |'14.700    3.15 | 20.70    1.18
2.733    1.18 | 8.733    2.76 |'14.733    3.15 | 20.73    1.18
2.767    1.18 | 8.767    2.76 |'14.767    2.95 | 20.77    1.18
2.800    1.18 | 8.800    2.76 |'14.800    2.76 | 20.80    1.18
2.833    1.18 | 8.833    2.76 |'14.833    2.76 | 20.83    1.18
2.867    1.18 | 8.867    2.76 |'14.867    2.76 | 20.87    1.18
2.900    1.18 | 8.900    2.76 |'14.900    2.76 | 20.90    1.18
2.933    1.18 | 8.933    2.76 |'14.933    2.76 | 20.93    1.18
2.967    1.18 | 8.967    2.76 |'14.967    2.76 | 20.97    1.18
3.000    1.18 | 9.000    2.76 |'15.000    2.76 | 21.00    1.18
3.033    1.18 | 9.033    3.15 |'15.033    3.15 | 21.03    1.18
3.067    1.18 | 9.067    3.15 |'15.067    3.15 | 21.07    1.18
3.100    1.18 | 9.100    3.15 |'15.100    3.15 | 21.10    1.18
3.133    1.18 | 9.133    3.15 |'15.133    3.15 | 21.13    1.18
3.167    1.18 | 9.167    3.15 |'15.167    3.15 | 21.17    1.18
3.200    1.18 | 9.200    3.15 |'15.200    3.15 | 21.20    1.18
3.233    1.18 | 9.233    3.15 |'15.233    3.15 | 21.23    1.18
3.267    1.58 | 9.267    3.15 |'15.267    2.95 | 21.27    1.18
3.300    1.58 | 9.300    3.15 |'15.300    2.76 | 21.30    1.18
3.333    1.58 | 9.333    3.15 |'15.333    2.76 | 21.33    1.18
3.367    1.58 | 9.367    3.15 |'15.367    2.76 | 21.37    1.18
3.400    1.58 | 9.400    3.15 |'15.400    2.76 | 21.40    1.18
3.433    1.58 | 9.433    3.15 |'15.433    2.76 | 21.43    1.18
3.467    1.58 | 9.467    3.15 |'15.467    2.76 | 21.47    1.18
3.500    1.58 | 9.500    3.15 |'15.500    2.76 | 21.50    1.18
3.533    1.18 | 9.533    3.55 |'15.533    3.15 | 21.53    1.18
3.567    1.18 | 9.567    3.55 |'15.567    3.15 | 21.57    1.18
3.600    1.18 | 9.600    3.55 |'15.600    3.15 | 21.60    1.18
3.633    1.18 | 9.633    3.55 |'15.633    3.15 | 21.63    1.18
3.667    1.18 | 9.667    3.55 |'15.667    3.15 | 21.67    1.18
3.700    1.18 | 9.700    3.55 |'15.700    3.15 | 21.70    1.18
3.733    1.18 | 9.733    3.55 |'15.733    3.15 | 21.73    1.18
3.767    1.18 | 9.767    3.55 |'15.767    2.95 | 21.77    1.18
3.800    1.18 | 9.800    3.55 |'15.800    2.76 | 21.80    1.18
3.833    1.18 | 9.833    3.55 |'15.833    2.76 | 21.83    1.18
3.867    1.18 | 9.867    3.55 |'15.867    2.76 | 21.87    1.18
3.900    1.18 | 9.900    3.55 |'15.900    2.76 | 21.90    1.18
3.933    1.18 | 9.933    3.55 |'15.933    2.76 | 21.93    1.18
3.967    1.18 | 9.967    3.55 |'15.967    2.76 | 21.97    1.18
4.000    1.18 |10.000    3.55 |'16.000    2.76 | 22.00    1.18
4.033    1.58 |10.033    4.73 |'16.033    1.97 | 22.03    1.18
4.067    1.58 |10.067    4.73 |'16.067    1.97 | 22.07    1.18
4.100    1.58 |10.100    4.73 |'16.100    1.97 | 22.10    1.18
4.133    1.58 |10.133    4.73 |'16.133    1.97 | 22.13    1.18
4.167    1.58 |10.167    4.73 |'16.167    1.97 | 22.17    1.18
4.200    1.58 |10.200    4.73 |'16.200    1.97 | 22.20    1.18
4.233    1.58 |10.233    4.73 |'16.233    1.97 | 22.23    1.18
4.267    1.58 |10.267    4.53 |'16.267    1.77 | 22.27    1.18
4.300    1.58 |10.300    4.33 |'16.300    1.58 | 22.30    1.18
4.333    1.58 |10.333    4.33 |'16.333    1.58 | 22.33    1.18
4.367    1.58 |10.367    4.33 |'16.367    1.58 | 22.37    1.18
4.400    1.58 |10.400    4.33 |'16.400    1.58 | 22.40    1.18
4.433    1.58 |10.433    4.33 |'16.433    1.58 | 22.43    1.18
4.467    1.58 |10.467    4.33 |'16.467    1.58 | 22.47    1.18
4.500    1.58 |10.500    4.34 |'16.500    1.58 | 22.50    1.18
4.533    1.58 |10.533    6.30 |'16.533    1.97 | 22.53    1.18
4.567    1.58 |10.567    6.30 |'16.567    1.97 | 22.57    1.18
4.600    1.58 |10.600    6.30 |'16.600    1.97 | 22.60    1.18
4.633    1.58 |10.633    6.30 |'16.633    1.97 | 22.63    1.18
4.667    1.58 |10.667    6.30 |'16.667    1.97 | 22.67    1.18
4.700    1.58 |10.700    6.30 |'16.700    1.97 | 22.70    1.18
4.733    1.58 |10.733    6.30 |'16.733    1.97 | 22.73    1.18
4.767    1.58 |10.767    6.11 |'16.767    1.77 | 22.77    1.18
4.800    1.58 |10.800    5.91 |'16.800    1.58 | 22.80    1.18
4.833    1.58 |10.833    5.91 |'16.833    1.58 | 22.83    1.18
4.867    1.58 |10.867    5.91 |'16.867    1.58 | 22.87    1.18
4.900    1.58 |10.900    5.91 |'16.900    1.58 | 22.90    1.18
4.933    1.58 |10.933    5.91 |'16.933    1.58 | 22.93    1.18
4.967    1.58 |10.967    5.91 |'16.967    1.58 | 22.97    1.18
5.000    1.58 |11.000    5.91 |'17.000    1.58 | 23.00    1.18
5.033    1.58 |11.033    9.46 |'17.033    1.97 | 23.03    1.18
5.067    1.58 |11.067    9.46 |'17.067    1.97 | 23.07    1.18
5.100    1.58 |11.100    9.46 |'17.100    1.97 | 23.10    1.18
5.133    1.58 |11.133    9.46 |'17.133    1.97 | 23.13    1.18
5.167    1.58 |11.167    9.46 |'17.167    1.97 | 23.17    1.18
5.200    1.58 |11.200    9.46 |'17.200    1.97 | 23.20    1.18
5.233    1.58 |11.233    9.46 |'17.233    1.97 | 23.23    1.18
5.267    1.58 |11.267    9.46 |'17.267    1.77 | 23.27    1.18
5.300    1.58 |11.300    9.46 |'17.300    1.58 | 23.30    1.18
5.333    1.58 |11.333    9.46 |'17.333    1.58 | 23.33    1.18
5.367    1.58 |11.367    9.46 |'17.367    1.58 | 23.37    1.18
5.400    1.58 |11.400    9.46 |'17.400    1.58 | 23.40    1.18
5.433    1.58 |11.433    9.46 |'17.433    1.58 | 23.43    1.18
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5.467    1.58 |11.467    9.46 |'17.467    1.58 | 23.47    1.18
5.500    1.58 |11.500    9.48 |'17.500    1.58 | 23.50    1.18
5.533    1.58 |11.533   29.16 |'17.533    1.58 | 23.53    1.18
5.567    1.58 |11.567   29.16 |'17.567    1.58 | 23.57    1.18
5.600    1.58 |11.600   29.16 |'17.600    1.58 | 23.60    1.18
5.633    1.58 |11.633   29.16 |'17.633    1.58 | 23.63    1.18
5.667    1.58 |11.667   29.16 |'17.667    1.58 | 23.67    1.18
5.700    1.58 |11.700   29.16 |'17.700    1.58 | 23.70    1.18
5.733    1.58 |11.733   29.16 |'17.733    1.58 | 23.73    1.18
5.767    1.58 |11.767   74.98 |'17.767    1.77 | 23.77    1.18
5.800    1.58 |11.800  120.56 |'17.800    1.97 | 23.80    1.18
5.833    1.58 |11.833  120.56 |'17.833    1.97 | 23.83    1.18
5.867    1.58 |11.867  120.56 |'17.867    1.97 | 23.87    1.18
5.900    1.58 |11.900  120.56 |'17.900    1.97 | 23.90    1.18
5.933    1.58 |11.933  120.56 |'17.933    1.97 | 23.93    1.18
5.967    1.58 |11.967  120.56 |'17.967    1.97 | 23.97    1.18
6.000    1.58 |12.000  120.41 |'18.000    1.97 | 24.00    1.18

     Unit Hyd Qpeak  (cms)=   0.348

     PEAK FLOW       (cms)=   0.447 (i)
     TIME TO PEAK    (hrs)=  12.967
     RUNOFF VOLUME    (mm)=  60.090
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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--------------------
| CALIB            |
| NASHYD    (0402) |   Area    (ha)= 500.20   Curve Number   (CN)= 78.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   4.08

     Unit Hyd Qpeak  (cms)=   4.683

     PEAK FLOW       (cms)=   7.582 (i)
     TIME TO PEAK    (hrs)=  16.533
     RUNOFF VOLUME    (mm)=  55.202
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.560

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

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--------------------
| ROUTE CHN (0008) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
                  <------ DATA FOR SECTION (   1.1) ------>
                 Distance      Elevation        Manning
                     0.00         179.00          0.0450
                    10.00         179.00   0.0450 /0.0300  Main Channel
                    10.50         178.50          0.0300    Main Channel
                    11.00         179.00   0.0300 /0.0450  Main Channel
                    21.00         179.00          0.0450

       <---------------------- TRAVEL TIME TABLE ----------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
          (m)      (m)     (cu.m.)       (cms)         (m/s)        (min)
         0.03   178.52    .531E+00         0.0          0.07       194.95
         0.05   178.55    .213E+01         0.0          0.12       122.81
         0.08   178.58    .478E+01         0.0          0.15        93.72
         0.10   178.60    .850E+01         0.0          0.18        77.36
         0.13   178.63    .133E+02         0.0          0.21        66.67
         0.15   178.65    .191E+02         0.0          0.24        59.04
         0.18   178.68    .260E+02         0.0          0.27        53.27
         0.20   178.70    .340E+02         0.0          0.29        48.74
         0.23   178.73    .430E+02         0.0          0.31        45.06
         0.25   178.75    .531E+02         0.0          0.34        42.00
         0.28   178.78    .644E+02         0.0          0.36        39.41
         0.30   178.80    .765E+02         0.0          0.38        37.19
         0.33   178.83    .898E+02         0.0          0.40        35.26
         0.35   178.85    .104E+03         0.1          0.42        33.56
         0.38   178.88    .120E+03         0.1          0.44        32.05
         0.40   178.90    .136E+03         0.1          0.46        30.70
         0.43   178.93    .154E+03         0.1          0.48        29.49
         0.45   178.95    .172E+03         0.1          0.50        28.38
         0.48   178.98    .192E+03         0.1          0.52        27.38

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <----- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
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```
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (0402)  500.20     7.58   16.53  55.20      0.47      0.52
    OUTFLOW: ID= 1 (0008)  500.20     7.51   17.07  55.79      0.48      0.52


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--------------------
| CALIB            |
| NASHYD    (0401) |   Area    (ha)= 288.80   Curve Number    (CN)= 77.0
| ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.23

     Unit Hyd Qpeak  (cms)=   4.947

     PEAK FLOW       (cms)=   6.857 (i)
     TIME TO PEAK    (hrs)=  14.367
     RUNOFF VOLUME    (mm)=  54.414
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.552

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

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0009) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                 0.00         179.00        0.0450
                10.00         179.00    0.0450 /0.0300  Main Channel
                10.50         178.50        0.0300      Main Channel
                11.00         179.00    0.0300 /0.0450  Main Channel
                21.00         179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.03    178.52    .844E+00        0.0         0.05      437.87
       0.05    178.55    .338E+01        0.0         0.08      275.84
       0.08    178.58    .760E+01        0.0         0.11      210.51
       0.10    178.60    .135E+02        0.0         0.13      173.77
       0.13    178.63    .211E+02        0.0         0.15      149.75
       0.15    178.65    .304E+02        0.0         0.17      132.61
       0.18    178.68    .414E+02        0.0         0.19      119.66
       0.20    178.70    .540E+02        0.0         0.21      109.47
       0.23    178.73    .684E+02        0.0         0.22      101.20
       0.25    178.75    .844E+02        0.0         0.24       94.34
       0.28    178.78    .102E+03        0.0         0.25       88.53
       0.30    178.80    .122E+03        0.0         0.27       83.54
       0.33    178.83    .143E+03        0.0         0.28       79.20
       0.35    178.85    .165E+03        0.0         0.30       75.38
       0.38    178.88    .190E+03        0.0         0.31       71.99
       0.40    178.90    .216E+03        0.1         0.33       68.96
       0.43    178.93    .244E+03        0.1         0.34       66.23
       0.45    178.95    .273E+03        0.1         0.35       63.75
       0.48    178.98    .305E+03        0.1         0.37       61.49

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0401)  288.80     6.86   14.37  54.41      0.47      0.36
     OUTFLOW: ID= 1 (0009)  288.80     6.01   15.50  54.43      0.48      0.37


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0403) |   Area    (ha)= 149.40   Curve Number    (CN)= 79.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.33

     Unit Hyd Qpeak  (cms)=   2.449

     PEAK FLOW       (cms)=   3.615 (i)
     TIME TO PEAK    (hrs)=  14.467
     RUNOFF VOLUME    (mm)=  57.170
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.580

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

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

```
--------------------
| ADD HYD   (0010) |
|   1 +  2 =   3   |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0008):   500.20   7.509    17.07     55.79
      + ID2= 2 (0009):   288.80   6.010    15.50     54.43
        ==========================================
        ID = 3 (0010):   789.00  13.037    16.17     55.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0010) |
|   3 +  2 =   1   |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (0010):   789.00  13.037    16.17     55.29
      + ID2= 2 (0403):   149.40   3.615    14.47     57.17
        ==========================================
        ID = 1 (0010):   938.40  16.000    15.77     55.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0411) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                 0.00         179.00        0.0450
                10.00         179.00    0.0450 /0.0300  Main Channel
                10.50         178.75        0.0300      Main Channel
                11.00         179.00    0.0300 /0.0450  Main Channel
                21.00         179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.01    178.76    .610E+00        0.0         0.05      692.07
       0.03    178.77    .244E+01        0.0         0.07      435.98
       0.04    178.79    .549E+01        0.0         0.10      332.71
       0.05    178.80    .975E+01        0.0         0.12      274.65
       0.06    178.81    .152E+02        0.0         0.14      236.68
       0.08    178.82    .219E+02        0.0         0.16      209.59
       0.09    178.84    .299E+02        0.0         0.17      189.12
       0.10    178.85    .390E+02        0.0         0.19      173.02
       0.11    178.86    .494E+02        0.0         0.20      159.95
       0.13    178.88    .610E+02        0.0         0.22      149.10
       0.14    178.89    .737E+02        0.0         0.23      139.92
       0.15    178.90    .878E+02        0.0         0.25      132.04
       0.16    178.91    .103E+03        0.0         0.26      125.18
       0.18    178.93    .119E+03        0.0         0.27      119.14
       0.19    178.94    .137E+03        0.0         0.29      113.79
       0.20    178.95    .156E+03        0.0         0.30      108.99
       0.21    178.96    .176E+03        0.0         0.31      104.68
       0.23    178.98    .197E+03        0.0         0.32      100.76
       0.24    178.99    .220E+03        0.0         0.33       97.19

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0010)  938.40    16.00   15.77  55.59      0.24      0.33
     OUTFLOW: ID= 1 (0411)  938.40    13.55   17.77  55.59      0.24      0.33


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0404) |   Area    (ha)= 197.30   Curve Number    (CN)= 81.0
| ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   3.10

     Unit Hyd Qpeak  (cms)=   2.431

     PEAK FLOW       (cms)=   4.018 (i)
     TIME TO PEAK    (hrs)=  15.333
     RUNOFF VOLUME    (mm)=  59.949
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.609
```

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

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

--------------------
| ADD HYD   (0011) |
|   1 +  2 =   3   |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0404):   197.30   4.018    15.33     59.95
      + ID2= 2 (0411):   938.40  13.550    17.77     55.59
        ==========================================
        ID = 3 (0011):  1135.70  16.761    17.27     56.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0412) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                 0.00         179.00        0.0450
                10.00         179.00    0.0450 /0.0300  Main Channel
                10.50         178.75        0.0300      Main Channel
                11.00         179.00    0.0300 /0.0450  Main Channel
                21.00         179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.01    178.76    .266E+00        0.0         0.05      269.82
       0.03    178.77    .106E+01        0.0         0.08      169.98
       0.04    178.79    .239E+01        0.0         0.11      129.72
       0.05    178.80    .425E+01        0.0         0.13      107.08
       0.06    178.81    .664E+01        0.0         0.15       92.28
       0.08    178.82    .956E+01        0.0         0.17       81.72
       0.09    178.84    .130E+02        0.0         0.19       73.74
       0.10    178.85    .170E+02        0.0         0.21       67.46
       0.11    178.86    .215E+02        0.0         0.23       62.36
       0.13    178.88    .266E+02        0.0         0.24       58.13
       0.14    178.89    .321E+02        0.0         0.26       54.55
       0.15    178.90    .383E+02        0.0         0.28       51.48
       0.16    178.91    .449E+02        0.0         0.29       48.80
       0.18    178.93    .521E+02        0.0         0.30       46.45
       0.19    178.94    .598E+02        0.0         0.32       44.36
       0.20    178.95    .680E+02        0.0         0.33       42.49
       0.21    178.96    .768E+02        0.0         0.35       40.81
       0.23    178.98    .861E+02        0.0         0.36       39.29
       0.24    178.99    .959E+02        0.0         0.37       37.89

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0011) 1135.70    16.76   17.27  56.38      0.24      0.37
     OUTFLOW: ID= 1 (0412) 1135.70    16.44   18.00  56.38      0.24      0.37


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0405) |   Area    (ha)=  56.10   Curve Number    (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.64

     Unit Hyd Qpeak  (cms)=   1.307

     PEAK FLOW       (cms)=   1.878 (i)
     TIME TO PEAK    (hrs)=  13.667
     RUNOFF VOLUME    (mm)=  60.089
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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

--------------------
| ADD HYD   (0012) |
|   1 +  2 =   3   |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0405):    56.10   1.878    13.67     60.09
      + ID2= 2 (0412):  1135.70  16.443    18.00     56.38
```

```
        ==========================================
        ID = 3 (0012):  1191.80  16.880    17.87     56.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0413) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                 0.00         179.00        0.0450
                10.00         179.00    0.0450 /0.0300  Main Channel
                10.50         178.75        0.0300      Main Channel
                11.00         179.00    0.0300 /0.0450  Main Channel
                21.00         179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.01    178.76    .391E+00        0.0         0.05      443.64
       0.03    178.77    .156E+01        0.0         0.07      279.47
       0.04    178.79    .352E+01        0.0         0.10      213.28
       0.05    178.80    .625E+01        0.0         0.12      176.06
       0.06    178.81    .977E+01        0.0         0.14      151.72
       0.08    178.82    .141E+02        0.0         0.16      134.36
       0.09    178.84    .191E+02        0.0         0.17      121.23
       0.10    178.85    .250E+02        0.0         0.19      110.91
       0.11    178.86    .316E+02        0.0         0.20      102.53
       0.13    178.88    .391E+02        0.0         0.22       95.58
       0.14    178.89    .473E+02        0.0         0.23       89.69
       0.15    178.90    .563E+02        0.0         0.25       84.64
       0.16    178.91    .660E+02        0.0         0.26       80.24
       0.18    178.93    .766E+02        0.0         0.27       76.37
       0.19    178.94    .879E+02        0.0         0.29       72.94
       0.20    178.95    .100E+03        0.0         0.30       69.87
       0.21    178.96    .113E+03        0.0         0.31       67.10
       0.23    178.98    .127E+03        0.0         0.32       64.59
       0.24    178.99    .141E+03        0.0         0.33       62.30

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0012) 1191.80    16.88   17.87  56.55      0.24      0.33
     OUTFLOW: ID= 1 (0413) 1191.80    16.12   19.10  56.55      0.24      0.33


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0406) |   Area    (ha)=  65.30   Curve Number    (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.45

     Unit Hyd Qpeak  (cms)=   1.018

     PEAK FLOW       (cms)=   1.601 (i)
     TIME TO PEAK    (hrs)=  14.600
     RUNOFF VOLUME    (mm)=  60.060
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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

--------------------
| ADD HYD   (0013) |
|   1 +  2 =   3   |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0406):    65.30   1.601    14.60     60.06
      + ID2= 2 (0413):  1191.80  16.121    19.10     56.55
        ==========================================
        ID = 3 (0013):  1257.10  16.734    18.93     56.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0414) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
```

```
            <------ DATA FOR SECTION (   1.1) ------>
            Distance      Elevation        Manning
                0.00         179.00         0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75         0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00         0.0450

     <---------------------- TRAVEL TIME TABLE ----------------------->
      DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)       (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.01   178.76    .109E+00         0.0         0.04     143.43
       0.03   178.77    .438E+00         0.0         0.06      90.36
       0.04   178.79    .985E+00         0.0         0.08      68.96
       0.05   178.80    .175E+01         0.0         0.10      56.92
       0.06   178.81    .273E+01         0.0         0.12      49.05
       0.08   178.82    .394E+01         0.0         0.13      43.44
       0.09   178.84    .536E+01         0.0         0.15      39.20
       0.10   178.85    .700E+01         0.0         0.16      35.86
       0.11   178.86    .886E+01         0.0         0.18      33.15
       0.13   178.88    .109E+02         0.0         0.19      30.90
       0.14   178.89    .132E+02         0.0         0.20      29.00
       0.15   178.90    .158E+02         0.0         0.21      27.37
       0.16   178.91    .185E+02         0.0         0.22      25.94
       0.18   178.93    .214E+02         0.0         0.24      24.69
       0.19   178.94    .246E+02         0.0         0.25      23.58
       0.20   178.95    .280E+02         0.0         0.26      22.59
       0.21   178.96    .316E+02         0.0         0.27      21.69
       0.23   178.98    .354E+02         0.0         0.28      20.88
       0.24   178.99    .395E+02         0.0         0.29      20.14

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0013) 1257.10    16.73   18.93  56.73      0.24      0.29
     OUTFLOW: ID= 1 (0414) 1257.10    16.68   19.30  56.73      0.24      0.29


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0407) |   Area    (ha)=  16.70   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.27

     Unit Hyd Qpeak  (cms)=   0.502

     PEAK FLOW       (cms)=   0.680 (i)
     TIME TO PEAK    (hrs)=  13.267
     RUNOFF VOLUME    (mm)=  60.090
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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

--------------------
| ADD HYD    (0014) |
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0407):    16.70   0.680    13.27    60.09
      + ID2= 2 (0414):  1257.10  16.675    19.30    56.73
        ================================================
        ID = 3 (0014):  1273.80  16.750    19.27    56.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0415) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
            <------ DATA FOR SECTION (   1.1) ------>
            Distance      Elevation        Manning
                0.00         179.00         0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75         0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00         0.0450

     <---------------------- TRAVEL TIME TABLE ----------------------->
      DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)       (m)     (cu.m.)       (cms)        (m/s)      (min)
       0.01   178.76    .625E-01         0.0         0.02     141.96
       0.03   178.77    .250E+00         0.0         0.04      89.43
       0.04   178.79    .563E+00         0.0         0.05      68.25
       0.05   178.80    .100E+01         0.0         0.06      56.34
       0.06   178.81    .156E+01         0.0         0.07      48.55
       0.08   178.82    .225E+01         0.0         0.08      42.99
       0.09   178.84    .306E+01         0.0         0.09      38.79
       0.10   178.85    .400E+01         0.0         0.09      35.49
       0.11   178.86    .506E+01         0.0         0.10      32.81
       0.13   178.88    .625E+01         0.0         0.11      30.58
       0.14   178.89    .756E+01         0.0         0.12      28.70
       0.15   178.90    .900E+01         0.0         0.12      27.08
       0.16   178.91    .106E+02         0.0         0.13      25.68
       0.18   178.93    .123E+02         0.0         0.14      24.44
       0.19   178.94    .141E+02         0.0         0.14      23.34
       0.20   178.95    .160E+02         0.0         0.15      22.36
       0.21   178.96    .181E+02         0.0         0.16      21.47
       0.23   178.98    .203E+02         0.0         0.16      20.67
       0.24   178.99    .226E+02         0.0         0.17      19.94

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0014) 1273.80    16.75   19.27  56.78      0.24      0.17
     OUTFLOW: ID= 1 (0415) 1273.80    16.70   19.60  56.78      0.24      0.17


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

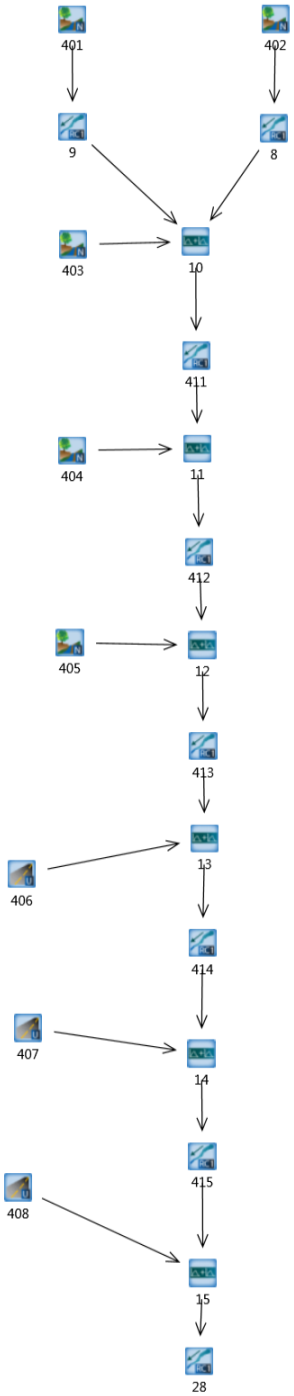
--------------------
| ADD HYD    (0015) |
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0408):     9.30   0.447    12.97    60.09
      + ID2= 2 (0415):  1273.80  16.702    19.60    56.78
        ================================================
        ID = 3 (0015):  1283.10  16.741    19.60    56.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

 FINISH
================================================================================================================
```

Scenario 4- Proposed Conditions without control



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

       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    Company
        OOO     T      T    H   H    Y    M   M   OOO               Serial

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


  Input   filename: C:\Program Files (x86)\Visual Otthymo 2.4\VO2\voin.dat
  Output  filename: C:\Users\dingm\AppData\Local\Temp\36d4a7b3-df33-4395-9a03-6d27d05a6c38\Scenario.out
  Summary filename: C:\Users\dingm\AppData\Local\Temp\36d4a7b3-df33-4395-9a03-6d27d05a6c38\Scenario.sum


DATE: 11/10/2016                          TIME: 09:38:10

USER:


COMMENTS: _____________________________________________


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

--------------------
| MASS STORM       |     Filename: C:\Users\dingm\AppD
|                  |               ata\Local\Temp\
|                  |               36d4a7b3-df33-4395-9a03-6d27d05a6c38\bd78fa12
| Ptotal= 98.50 mm |     Comments: 24 HOUR SCS TYPE II MASS CURVE: 15 MIN S
--------------------

                      Duration of storm    = 24.00 hrs
                      Mass curve time step = 15.00 min

      TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |   TIME    RAIN
       hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |    hrs   mm/hr
      0.25    1.18 |   6.25    1.97 |'  12.25   14.18 |  18.25    1.58
      0.50    1.18 |   6.50    1.58 |'  12.50   14.18 |  18.50    1.97
      0.75    0.79 |   6.75    1.97 |'  12.75    7.49 |  18.75    1.58
      1.00    1.18 |   7.00    1.58 |'  13.00    7.09 |  19.00    1.97
      1.25    1.18 |   7.25    2.36 |'  13.25    5.12 |  19.25    1.58
      1.50    1.18 |   7.50    1.97 |'  13.50    5.12 |  19.50    1.97
      1.75    0.79 |   7.75    2.36 |'  13.75    4.33 |  19.75    1.58
      2.00    1.18 |   8.00    1.97 |'  14.00    3.94 |  20.00    1.97
      2.25    1.18 |   8.25    2.76 |'  14.25    3.15 |  20.25    1.18
      2.50    1.58 |   8.50    2.36 |'  14.50    2.76 |  20.50    1.18
      2.75    1.18 |   8.75    2.76 |'  14.75    3.15 |  20.75    1.18
      3.00    1.18 |   9.00    2.76 |'  15.00    2.76 |  21.00    1.18
      3.25    1.18 |   9.25    3.15 |'  15.25    3.15 |  21.25    1.18
      3.50    1.58 |   9.50    3.15 |'  15.50    2.76 |  21.50    1.18
      3.75    1.18 |   9.75    3.55 |'  15.75    3.15 |  21.75    1.18
      4.00    1.18 |  10.00    3.55 |'  16.00    2.76 |  22.00    1.18
      4.25    1.58 |  10.25    4.73 |'  16.25    1.97 |  22.25    1.18
      4.50    1.58 |  10.50    4.33 |'  16.50    1.58 |  22.50    1.18
      4.75    1.58 |  10.75    6.30 |'  16.75    1.97 |  22.75    1.18
      5.00    1.58 |  11.00    5.91 |'  17.00    1.58 |  23.00    1.18
      5.25    1.58 |  11.25    9.46 |'  17.25    1.97 |  23.25    1.18
      5.50    1.58 |  11.50    9.46 |'  17.50    1.58 |  23.50    1.18
      5.75    1.58 |  11.75   29.16 |'  17.75    1.58 |  23.75    1.18
      6.00    1.58 |  12.00  120.56 |'  18.00    1.97 |  24.00    1.18

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| CALIB            |
| NASHYD    (0402) |   Area    (ha)= 500.20   Curve Number    (CN)= 78.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   4.08

        NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 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
      0.033   1.18 |  6.033    1.97 |' 12.033   14.18 | 18.033    1.58
      0.067   1.18 |  6.067    1.97 |' 12.067   14.18 | 18.07     1.58
      0.100   1.18 |  6.100    1.97 |' 12.100   14.18 | 18.10     1.58
      0.133   1.18 |  6.133    1.97 |' 12.133   14.18 | 18.13     1.58
      0.167   1.18 |  6.167    1.97 |' 12.167   14.18 | 18.17     1.58
      0.200   1.18 |  6.200    1.97 |' 12.200   14.18 | 18.20     1.58
      0.233   1.18 |  6.233    1.97 |' 12.233   14.18 | 18.23     1.58
      0.267   1.18 |  6.267    1.77 |' 12.267   14.18 | 18.27     1.77
      0.300   1.18 |  6.300    1.58 |' 12.300   14.18 | 18.30     1.97
      0.333   1.18 |  6.333    1.58 |' 12.333   14.18 | 18.33     1.97
      0.367   1.18 |  6.367    1.58 |' 12.367   14.18 | 18.37     1.97
      0.400   1.18 |  6.400    1.58 |' 12.400   14.18 | 18.40     1.97
      0.433   1.18 |  6.433    1.58 |' 12.433   14.18 | 18.43     1.97
      0.467   1.18 |  6.467    1.58 |' 12.467   14.18 | 18.47     1.97
      0.500   1.18 |  6.500    1.58 |' 12.500   14.17 | 18.50     1.97
      0.533   0.79 |  6.533    1.97 |' 12.533    7.49 | 18.53     1.58
      0.567   0.79 |  6.567    1.97 |' 12.567    7.49 | 18.57     1.58
      0.600   0.79 |  6.600    1.97 |' 12.600    7.49 | 18.60     1.58
      0.633   0.79 |  6.633    1.97 |' 12.633    7.49 | 18.63     1.58
      0.667   0.79 |  6.667    1.97 |' 12.667    7.49 | 18.67     1.58
      0.700   0.79 |  6.700    1.97 |' 12.700    7.49 | 18.70     1.58
      0.733   0.79 |  6.733    1.97 |' 12.733    7.49 | 18.73     1.58
      0.767   0.99 |  6.767    1.77 |' 12.767    7.29 | 18.77     1.77
      0.800   1.18 |  6.800    1.58 |' 12.800    7.09 | 18.80     1.97
      0.833   1.18 |  6.833    1.58 |' 12.833    7.09 | 18.83     1.97
      0.867   1.18 |  6.867    1.58 |' 12.867    7.09 | 18.87     1.97
      0.900   1.18 |  6.900    1.58 |' 12.900    7.09 | 18.90     1.97
      0.933   1.18 |  6.933    1.58 |' 12.933    7.09 | 18.93     1.97
      0.967   1.18 |  6.967    1.58 |' 12.967    7.09 | 18.97     1.97
      1.000   1.18 |  7.000    1.58 |' 13.000    7.09 | 19.00     1.97
      1.033   1.18 |  7.033    2.36 |' 13.033    5.52 | 19.03     1.58
      1.067   1.18 |  7.067    2.36 |' 13.067    5.52 | 19.07     1.58
      1.100   1.18 |  7.100    2.36 |' 13.100    5.52 | 19.10     1.58
      1.133   1.18 |  7.133    2.36 |' 13.133    5.52 | 19.13     1.58
      1.167   1.18 |  7.167    2.36 |' 13.167    5.52 | 19.17     1.58
      1.200   1.18 |  7.200    2.36 |' 13.200    5.52 | 19.20     1.58
      1.233   1.18 |  7.233    2.36 |' 13.233    5.52 | 19.23     1.58
      1.267   1.18 |  7.267    2.17 |' 13.267    5.32 | 19.27     1.77
      1.300   1.18 |  7.300    1.97 |' 13.300    5.12 | 19.30     1.97
      1.333   1.18 |  7.333    1.97 |' 13.333    5.12 | 19.33     1.97
      1.367   1.18 |  7.367    1.97 |' 13.367    5.12 | 19.37     1.97
      1.400   1.18 |  7.400    1.97 |' 13.400    5.12 | 19.40     1.97
      1.433   1.18 |  7.433    1.97 |' 13.433    5.12 | 19.43     1.97
      1.467   1.18 |  7.467    1.97 |' 13.467    5.12 | 19.47     1.97
      1.500   1.18 |  7.500    1.97 |' 13.500    5.12 | 19.50     1.97
      1.533   0.79 |  7.533    2.36 |' 13.533    4.33 | 19.53     1.58
      1.567   0.79 |  7.567    2.36 |' 13.567    4.33 | 19.57     1.58
      1.600   0.79 |  7.600    2.36 |' 13.600    4.33 | 19.60     1.58
      1.633   0.79 |  7.633    2.36 |' 13.633    4.33 | 19.63     1.58
      1.667   0.79 |  7.667    2.36 |' 13.667    4.33 | 19.67     1.58
      1.700   0.79 |  7.700    2.36 |' 13.700    4.33 | 19.70     1.58
      1.733   0.79 |  7.733    2.36 |' 13.733    4.33 | 19.73     1.58
      1.767   0.98 |  7.767    2.17 |' 13.767    4.14 | 19.77     1.77
      1.800   1.18 |  7.800    1.97 |' 13.800    3.94 | 19.80     1.97
      1.833   1.18 |  7.833    1.97 |' 13.833    3.94 | 19.83     1.97
      1.867   1.18 |  7.867    1.97 |' 13.867    3.94 | 19.87     1.97
      1.900   1.18 |  7.900    1.97 |' 13.900    3.94 | 19.90     1.97
      1.933   1.18 |  7.933    1.97 |' 13.933    3.94 | 19.93     1.97
      1.967   1.18 |  7.967    1.97 |' 13.967    3.94 | 19.97     1.97
      2.000   1.18 |  8.000    1.97 |' 14.000    3.94 | 20.00     1.97
      2.033   1.18 |  8.033    2.76 |' 14.033    3.15 | 20.03     1.18
      2.067   1.18 |  8.067    2.76 |' 14.067    3.15 | 20.07     1.18
      2.100   1.18 |  8.100    2.76 |' 14.100    3.15 | 20.10     1.18
      2.133   1.18 |  8.133    2.76 |' 14.133    3.15 | 20.13     1.18
      2.167   1.18 |  8.167    2.76 |' 14.167    3.15 | 20.17     1.18
      2.200   1.18 |  8.200    2.76 |' 14.200    3.15 | 20.20     1.18
      2.233   1.18 |  8.233    2.76 |' 14.233    3.15 | 20.23     1.18
      2.267   1.18 |  8.267    2.56 |' 14.267    2.95 | 20.27     1.18
      2.300   1.58 |  8.300    2.36 |' 14.300    2.76 | 20.30     1.18
      2.333   1.58 |  8.333    2.36 |' 14.333    2.76 | 20.33     1.18
      2.367   1.58 |  8.367    2.36 |' 14.367    2.76 | 20.37     1.18
      2.400   1.58 |  8.400    2.36 |' 14.400    2.76 | 20.40     1.18
      2.433   1.58 |  8.433    2.36 |' 14.433    2.76 | 20.43     1.18
      2.467   1.58 |  8.467    2.36 |' 14.467    2.76 | 20.47     1.18
      2.500   1.58 |  8.500    2.36 |' 14.500    2.76 | 20.50     1.18
      2.533   1.18 |  8.533    2.76 |' 14.533    3.15 | 20.53     1.18
      2.567   1.18 |  8.567    2.76 |' 14.567    3.15 | 20.57     1.18
      2.600   1.18 |  8.600    2.76 |' 14.600    3.15 | 20.60     1.18
      2.633   1.18 |  8.633    2.76 |' 14.633    3.15 | 20.63     1.18
      2.667   1.18 |  8.667    2.76 |' 14.667    3.15 | 20.67     1.18
      2.700   1.18 |  8.700    2.76 |' 14.700    3.15 | 20.70     1.18
      2.733   1.18 |  8.733    2.76 |' 14.733    3.15 | 20.73     1.18
      2.767   1.18 |  8.767    2.76 |' 14.767    2.95 | 20.77     1.18
      2.800   1.18 |  8.800    2.76 |' 14.800    2.76 | 20.80     1.18
      2.833   1.18 |  8.833    2.76 |' 14.833    2.76 | 20.83     1.18
      2.867   1.18 |  8.867    2.76 |' 14.867    2.76 | 20.87     1.18
      2.900   1.18 |  8.900    2.76 |' 14.900    2.76 | 20.90     1.18
      2.933   1.18 |  8.933    2.76 |' 14.933    2.76 | 20.93     1.18
      2.967   1.18 |  8.967    2.76 |' 14.967    2.76 | 20.97     1.18
      3.000   1.18 |  9.000    2.76 |' 15.000    2.76 | 21.00     1.18
      3.033   1.18 |  9.033    3.15 |' 15.033    3.15 | 21.03     1.18
      3.067   1.18 |  9.067    3.15 |' 15.067    3.15 | 21.07     1.18
      3.100   1.18 |  9.100    3.15 |' 15.100    3.15 | 21.10     1.18
      3.133   1.18 |  9.133    3.15 |' 15.133    3.15 | 21.13     1.18
      3.167   1.18 |  9.167    3.15 |' 15.167    3.15 | 21.17     1.18
      3.200   1.18 |  9.200    3.15 |' 15.200    3.15 | 21.20     1.18
      3.233   1.18 |  9.233    3.15 |' 15.233    3.15 | 21.23     1.18
      3.267   1.58 |  9.267    3.15 |' 15.267    2.95 | 21.27     1.18
      3.300   1.58 |  9.300    3.15 |' 15.300    2.76 | 21.30     1.18
      3.333   1.58 |  9.333    3.15 |' 15.333    2.76 | 21.33     1.18
      3.367   1.58 |  9.367    3.15 |' 15.367    2.76 | 21.37     1.18
      3.400   1.58 |  9.400    3.15 |' 15.400    2.76 | 21.40     1.18
      3.433   1.58 |  9.433    3.15 |' 15.433    2.76 | 21.43     1.18
      3.467   1.58 |  9.467    3.15 |' 15.467    2.76 | 21.47     1.18
      3.500   1.58 |  9.500    3.15 |' 15.500    2.76 | 21.50     1.18
      3.533   1.18 |  9.533    3.55 |' 15.533    3.15 | 21.53     1.18
      3.567   1.18 |  9.567    3.55 |' 15.567    3.15 | 21.57     1.18
      3.600   1.18 |  9.600    3.55 |' 15.600    3.15 | 21.60     1.18
      3.633   1.18 |  9.633    3.55 |' 15.633    3.15 | 21.63     1.18
      3.667   1.18 |  9.667    3.55 |' 15.667    3.15 | 21.67     1.18
      3.700   1.18 |  9.700    3.55 |' 15.700    3.15 | 21.70     1.18
      3.733   1.18 |  9.733    3.55 |' 15.733    3.15 | 21.73     1.18
      3.767   1.18 |  9.767    3.55 |' 15.767    2.95 | 21.77     1.18
      3.800   1.18 |  9.800    3.55 |' 15.800    2.76 | 21.80     1.18
      3.833   1.18 |  9.833    3.55 |' 15.833    2.76 | 21.83     1.18
      3.867   1.18 |  9.867    3.55 |' 15.867    2.76 | 21.87     1.18
      3.900   1.18 |  9.900    3.55 |' 15.900    2.76 | 21.90     1.18
      3.933   1.18 |  9.933    3.55 |' 15.933    2.76 | 21.93     1.18
      3.967   1.18 |  9.967    3.55 |' 15.967    2.76 | 21.97     1.18
      4.000   1.18 | 10.000    3.55 |' 16.000    2.76 | 22.00     1.18
      4.033   1.58 | 10.033    4.73 |' 16.033    1.97 | 22.03     1.18
      4.067   1.58 | 10.067    4.73 |' 16.067    1.97 | 22.07     1.18
      4.100   1.58 | 10.100    4.73 |' 16.100    1.97 | 22.10     1.18
      4.133   1.58 | 10.133    4.73 |' 16.133    1.97 | 22.13     1.18
      4.167   1.58 | 10.167    4.73 |' 16.167    1.97 | 22.17     1.18
      4.200   1.58 | 10.200    4.73 |' 16.200    1.97 | 22.20     1.18
      4.233   1.58 | 10.233    4.73 |' 16.233    1.97 | 22.23     1.18
      4.267   1.58 | 10.267    4.53 |' 16.267    1.77 | 22.27     1.18
      4.300   1.58 | 10.300    4.33 |' 16.300    1.58 | 22.30     1.18
      4.333   1.58 | 10.333    4.33 |' 16.333    1.58 | 22.33     1.18
      4.367   1.58 | 10.367    4.33 |' 16.367    1.58 | 22.37     1.18
      4.400   1.58 | 10.400    4.33 |' 16.400    1.58 | 22.40     1.18
      4.433   1.58 | 10.433    4.33 |' 16.433    1.58 | 22.43     1.18
      4.467   1.58 | 10.467    4.33 |' 16.467    1.58 | 22.47     1.18
      4.500   1.58 | 10.500    4.34 |' 16.500    1.58 | 22.50     1.18
      4.533   1.58 | 10.533    6.30 |' 16.533    1.97 | 22.53     1.18
      4.567   1.58 | 10.567    6.30 |' 16.567    1.97 | 22.57     1.18
      4.600   1.58 | 10.600    6.30 |' 16.600    1.97 | 22.60     1.18
      4.633   1.58 | 10.633    6.30 |' 16.633    1.97 | 22.63     1.18
      4.667   1.58 | 10.667    6.30 |' 16.667    1.97 | 22.67     1.18
      4.700   1.58 | 10.700    6.30 |' 16.700    1.97 | 22.70     1.18
      4.733   1.58 | 10.733    6.30 |' 16.733    1.97 | 22.73     1.18
      4.767   1.58 | 10.767    6.11 |' 16.767    1.77 | 22.77     1.18
      4.800   1.58 | 10.800    5.91 |' 16.800    1.58 | 22.80     1.18
      4.833   1.58 | 10.833    5.91 |' 16.833    1.58 | 22.83     1.18
      4.867   1.58 | 10.867    5.91 |' 16.867    1.58 | 22.87     1.18
      4.900   1.58 | 10.900    5.91 |' 16.900    1.58 | 22.90     1.18
      4.933   1.58 | 10.933    5.91 |' 16.933    1.58 | 22.93     1.18
      4.967   1.58 | 10.967    5.91 |' 16.967    1.58 | 22.97     1.18
      5.000   1.58 | 11.000    5.91 |' 17.000    1.58 | 23.00     1.18
      5.033   1.58 | 11.033    9.46 |' 17.033    1.97 | 23.03     1.18
      5.067   1.58 | 11.067    9.46 |' 17.067    1.97 | 23.07     1.18
      5.100   1.58 | 11.100    9.46 |' 17.100    1.97 | 23.10     1.18
      5.133   1.58 | 11.133    9.46 |' 17.133    1.97 | 23.13     1.18
      5.167   1.58 | 11.167    9.46 |' 17.167    1.97 | 23.17     1.18
      5.200   1.58 | 11.200    9.46 |' 17.200    1.97 | 23.20     1.18
      5.233   1.58 | 11.233    9.46 |' 17.233    1.97 | 23.23     1.18
      5.267   1.58 | 11.267    9.46 |' 17.267    1.77 | 23.27     1.18
      5.300   1.58 | 11.300    9.46 |' 17.300    1.58 | 23.30     1.18
      5.333   1.58 | 11.333    9.46 |' 17.333    1.58 | 23.33     1.18
      5.367   1.58 | 11.367    9.46 |' 17.367    1.58 | 23.37     1.18
      5.400   1.58 | 11.400    9.46 |' 17.400    1.58 | 23.40     1.18
      5.433   1.58 | 11.433    9.46 |' 17.433    1.58 | 23.43     1.18
      5.467   1.58 | 11.467    9.46 |' 17.467    1.58 | 23.47     1.18
      5.500   1.58 | 11.500    9.48 |' 17.500    1.58 | 23.50     1.18
      5.533   1.58 | 11.533   29.16 |' 17.533    1.58 | 23.53     1.18
      5.567   1.58 | 11.567   29.16 |' 17.567    1.58 | 23.57     1.18
      5.600   1.58 | 11.600   29.16 |' 17.600    1.58 | 23.60     1.18
      5.633   1.58 | 11.633   29.16 |' 17.633    1.58 | 23.63     1.18
      5.667   1.58 | 11.667   29.16 |' 17.667    1.58 | 23.67     1.18
      5.700   1.58 | 11.700   29.16 |' 17.700    1.58 | 23.70     1.18
      5.733   1.58 | 11.733   29.16 |' 17.733    1.58 | 23.73     1.18
      5.767   1.58 | 11.767   74.98 |' 17.767    1.77 | 23.77     1.18
      5.800   1.58 | 11.800  120.56 |' 17.800    1.97 | 23.80     1.18
      5.833   1.58 | 11.833  120.56 |' 17.833    1.97 | 23.83     1.18
      5.867   1.58 | 11.867  120.56 |' 17.867    1.97 | 23.87     1.18
      5.900   1.58 | 11.900  120.56 |' 17.900    1.97 | 23.90     1.18
      5.933   1.58 | 11.933  120.56 |' 17.933    1.97 | 23.93     1.18
      5.967   1.58 | 11.967  120.56 |' 17.967    1.97 | 23.97     1.18
      6.000   1.58 | 12.000  120.41 |' 18.000    1.97 | 24.00     1.18

     Unit Hyd Qpeak  (cms)=   4.683

     PEAK FLOW       (cms)=   7.582 (i)
     TIME TO PEAK    (hrs)=  16.533
     RUNOFF VOLUME    (mm)=  55.202
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.560

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

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| ROUTE CHN (0008) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
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                <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation        Manning
                  0.00         179.00          0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.50          0.0300     Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00          0.0450

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.03   178.52    .531E+00         0.0          0.07      194.95
        0.05   178.55    .213E+01         0.0          0.12      122.81
        0.08   178.58    .478E+01         0.0          0.15       93.72
        0.10   178.60    .850E+01         0.0          0.18       77.36
        0.13   178.63    .133E+02         0.0          0.21       66.67
        0.15   178.65    .191E+02         0.0          0.24       59.04
        0.18   178.68    .260E+02         0.0          0.27       53.27
        0.20   178.70    .340E+02         0.0          0.29       48.74
        0.23   178.73    .430E+02         0.0          0.31       45.06
        0.25   178.75    .531E+02         0.0          0.34       42.00
        0.28   178.78    .641E+02         0.0          0.36       39.41
        0.30   178.80    .765E+02         0.0          0.38       37.19
        0.33   178.83    .898E+02         0.0          0.40       35.26
        0.35   178.85    .104E+03         0.1          0.42       33.56
        0.38   178.88    .120E+03         0.1          0.44       32.05
        0.40   178.90    .136E+03         0.1          0.46       30.70
        0.43   178.93    .154E+03         0.1          0.48       29.49
        0.45   178.95    .172E+03         0.1          0.50       28.38
        0.48   178.98    .192E+03         0.1          0.52       27.38

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED

                                  <----- hydrograph ---->    <-pipe / channel->
                          AREA    QPEAK    TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)    (hrs)   (mm)       (m)       (m/s)
     INFLOW : ID= 2 (0402)  500.20     7.58   16.53  55.20      0.47      0.52
     OUTFLOW: ID= 1 (0008)  500.20     7.51   17.07  55.79      0.48      0.52

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0401) |   Area    (ha)= 288.80   Curve Number    (CN)= 77.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.23

     Unit Hyd Qpeak  (cms)=   4.947

     PEAK FLOW       (cms)=   6.857 (i)
     TIME TO PEAK    (hrs)=  14.367
     RUNOFF VOLUME    (mm)=  54.414
```

```
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT    =   0.552

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

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0009) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.50         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.03    178.52    .844E+00         0.0          0.05     437.87
       0.05    178.55    .338E+01         0.0          0.08     275.84
       0.08    178.58    .760E+01         0.0          0.11     210.51
       0.10    178.60    .135E+02         0.0          0.13     173.77
       0.13    178.63    .211E+02         0.0          0.15     149.75
       0.15    178.65    .304E+02         0.0          0.17     132.61
       0.18    178.68    .414E+02         0.0          0.19     119.66
       0.20    178.70    .540E+02         0.0          0.21     109.47
       0.23    178.73    .684E+02         0.0          0.22     101.20
       0.25    178.75    .844E+02         0.0          0.24      94.34
       0.28    178.78    .102E+03         0.0          0.25      88.53
       0.30    178.80    .122E+03         0.0          0.27      83.54
       0.33    178.83    .143E+03         0.0          0.28      79.20
       0.35    178.85    .165E+03         0.0          0.30      75.38
       0.38    178.88    .190E+03         0.0          0.31      71.99
       0.40    178.90    .216E+03         0.1          0.33      68.96
       0.43    178.93    .244E+03         0.1          0.34      66.23
       0.45    178.95    .273E+03         0.1          0.35      63.75
       0.48    178.98    .305E+03         0.1          0.37      61.49

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0401)  288.80    6.86   14.37  54.41      0.47      0.36
     OUTFLOW: ID= 1 (0009)  288.80    6.01   15.50  54.43      0.48      0.37


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0403) |   Area     (ha)= 149.40   Curve Number    (CN)= 79.0
|ID= 1 DT= 2.0 min |   Ia       (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.33

     Unit Hyd Qpeak  (cms)=   2.449

     PEAK FLOW       (cms)=   3.615 (i)
     TIME TO PEAK    (hrs)=  14.467
     RUNOFF VOLUME    (mm)=  57.170
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.580

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

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--------------------
| ADD HYD   (0010) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0008):   500.20    7.509    17.07    55.79
       + ID2= 2 (0009):   288.80    6.010    15.50    54.43
         ================================================
         ID = 3 (0010):   789.00   13.037    16.17    55.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0010) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0010):   789.00   13.037    16.17    55.29
       + ID2= 2 (0403):   149.40    3.615    14.47    57.17
         ================================================
         ID = 1 (0010):   938.40   16.000    15.77    55.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (0411) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .61OE+00         0.0          0.05     692.07
       0.03    178.77    .244E+01         0.0          0.07     435.98
       0.04    178.79    .549E+01         0.0          0.10     332.71
       0.05    178.80    .975E+01         0.0          0.12     274.65
       0.06    178.81    .152E+02         0.0          0.14     236.68
       0.08    178.82    .219E+02         0.0          0.16     209.59
       0.09    178.84    .299E+02         0.0          0.17     189.12
       0.10    178.85    .39OE+02         0.0          0.19     173.02
       0.11    178.86    .494E+02         0.0          0.20     159.95
       0.13    178.88    .61OE+02         0.0          0.22     149.10
       0.14    178.89    .737E+02         0.0          0.23     139.92
       0.15    178.90    .878E+02         0.0          0.25     132.04
       0.16    178.91    .103E+03         0.0          0.26     125.18
       0.18    178.93    .119E+03         0.0          0.27     119.14
       0.19    178.94    .137E+03         0.0          0.29     113.79
       0.20    178.95    .156E+03         0.0          0.30     108.99
       0.21    178.96    .176E+03         0.0          0.31     104.68
       0.23    178.98    .197E+03         0.0          0.32     100.76
       0.24    178.99    .220E+03         0.0          0.33      97.19

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0010)  938.40   16.00   15.77  55.59      0.24      0.33
     OUTFLOW: ID= 1 (0411)  938.40   13.55   17.77  55.59      0.24      0.33

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0404) |   Area     (ha)= 197.30   Curve Number    (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia       (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   3.10

     Unit Hyd Qpeak  (cms)=   2.431

     PEAK FLOW       (cms)=   4.018 (i)
     TIME TO PEAK    (hrs)=  15.333
     RUNOFF VOLUME    (mm)=  59.949
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.609

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

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--------------------
| ADD HYD   (0011) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0404):   197.30    4.018    15.33    59.95
       + ID2= 2 (0411):   938.40   13.550    17.77    55.59
         ================================================
         ID = 3 (0011):  1135.70   16.761    17.27    56.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (0412) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .266E+00         0.0          0.05     269.82
       0.03    178.77    .106E+01         0.0          0.08     169.98
       0.04    178.79    .239E+01         0.0          0.11     129.72
       0.05    178.80    .425E+01         0.0          0.13     107.08
       0.06    178.81    .664E+01         0.0          0.15      92.28
       0.08    178.82    .956E+01         0.0          0.17      81.72
       0.09    178.84    .130E+02         0.0          0.19      73.74
       0.10    178.85    .170E+02         0.0          0.21      67.46
       0.11    178.86    .215E+02         0.0          0.23      62.36
       0.13    178.88    .266E+02         0.0          0.24      58.13
       0.14    178.89    .321E+02         0.0          0.26      54.55
       0.15    178.90    .383E+02         0.0          0.28      51.48
       0.16    178.91    .449E+02         0.0          0.29      48.80
       0.18    178.93    .521E+02         0.0          0.30      46.45
       0.19    178.94    .598E+02         0.0          0.32      44.36
       0.20    178.95    .680E+02         0.0          0.33      42.49
       0.21    178.96    .768E+02         0.0          0.35      40.81
       0.23    178.98    .861E+02         0.0          0.36      39.29
       0.24    178.99    .959E+02         0.0          0.37      37.89

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0011) 1135.70   16.76   17.27  56.38      0.24      0.37
     OUTFLOW: ID= 1 (0412) 1135.70   16.44   18.00  56.38      0.24      0.37


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0405) |   Area     (ha)=  56.10   Curve Number    (CN)= 81.0
|ID= 1 DT= 2.0 min |   Ia       (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.64

     Unit Hyd Qpeak  (cms)=   1.307

     PEAK FLOW       (cms)=   1.878 (i)
     TIME TO PEAK    (hrs)=  13.667
     RUNOFF VOLUME    (mm)=  60.089
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0405):    56.10    1.878    13.67    60.09
       + ID2= 2 (0412):  1135.70   16.443    18.00    56.38
         ================================================
         ID = 3 (0012):  1191.80   16.880    17.87    56.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0413) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450
```

```
      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .391E+00         0.0          0.05     443.64
       0.03    178.77    .156E+01         0.0          0.07     279.47
       0.04    178.79    .352E+01         0.0          0.10     213.28
       0.05    178.80    .625E+01         0.0          0.12     176.06
       0.06    178.81    .977E+01         0.0          0.14     151.72
       0.08    178.82    .141E+02         0.0          0.16     134.36
       0.09    178.84    .191E+02         0.0          0.17     121.23
       0.10    178.85    .25OE+02         0.0          0.19     110.91
       0.11    178.86    .316E+02         0.0          0.20     102.53
       0.13    178.88    .391E+02         0.0          0.22      95.58
       0.14    178.89    .473E+02         0.0          0.23      89.69
       0.15    178.90    .563E+02         0.0          0.25      84.64
       0.16    178.91    .66OE+02         0.0          0.26      80.24
       0.18    178.93    .766E+02         0.0          0.27      76.37
       0.19    178.94    .879E+02         0.0          0.29      72.94
       0.20    178.95    .100E+03         0.0          0.30      69.87
       0.21    178.96    .113E+03         0.0          0.31      67.10
       0.23    178.98    .127E+03         0.0          0.32      64.59
       0.24    178.99    .141E+03         0.0          0.33      62.30

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0012) 1191.80   16.88   17.87  56.55      0.24      0.33
     OUTFLOW: ID= 1 (0413) 1191.80   16.12   19.10  56.55      0.24      0.33

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (0406) |   Area     (ha)=  65.30
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      45.71         19.59
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     659.80         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)          8.00         14.00
     Storage Coeff. (min)=       7.35 (ii)    12.49 (ii)
     Unit Hyd. Tpeak (min)=      8.00         14.00
     Unit Hyd. peak  (cms)=      0.15          0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=     10.00          5.02        14.620 (iii)
     TIME TO PEAK    (hrs)=     12.03         12.10         12.03
     RUNOFF VOLUME    (mm)=     97.49         69.27         84.80
     TOTAL RAINFALL   (mm)=     98.50         98.50         98.50
     RUNOFF COEFFICIENT   =      0.99          0.70          0.86


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*   =  81.0      Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0406):    65.30   14.620    12.03    84.80
       + ID2= 2 (0413):  1191.80   16.121    19.10    56.55
         ================================================
         ID = 3 (0013):  1257.10   16.443    19.07    58.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (0414) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
```

```
                 0.00        179.00        0.0450
                10.00        179.00    0.0450 /0.0300  Main Channel
                10.50        178.75        0.0300      Main Channel
                11.00        179.00    0.0300 /0.0450  Main Channel
                21.00        179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)      (min)
       0.01   178.76    .109E-00        0.0          0.04      143.43
       0.03   178.77    .438E+00        0.0          0.06       90.36
       0.04   178.79    .985E+00        0.0          0.08       68.96
       0.05   178.80    .175E+01        0.0          0.10       56.92
       0.06   178.81    .273E+01        0.0          0.12       49.05
       0.08   178.82    .394E+01        0.0          0.13       43.44
       0.09   178.84    .536E+01        0.0          0.15       39.20
       0.10   178.85    .700E+01        0.0          0.16       35.86
       0.11   178.86    .886E+01        0.0          0.18       33.15
       0.13   178.88    .109E+02        0.0          0.19       30.90
       0.14   178.89    .132E+02        0.0          0.20       29.00
       0.15   178.90    .158E+02        0.0          0.21       27.37
       0.16   178.91    .185E+02        0.0          0.22       25.94
       0.18   178.93    .214E+02        0.0          0.24       24.69
       0.19   178.94    .246E+02        0.0          0.25       23.58
       0.20   178.95    .280E+02        0.0          0.26       22.59
       0.21   178.96    .316E+02        0.0          0.27       21.69
       0.23   178.98    .354E+02        0.0          0.28       20.88
       0.24   178.99    .395E+02        0.0          0.29       20.14

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0013) 1257.10    16.44   19.07  58.02      0.24      0.29
     OUTFLOW: ID= 1 (0414) 1257.10    16.15   19.90  58.02      0.24      0.29


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--------------------
| CALIB            |
| STANDHYD  (0407) |   Area    (ha)=  16.70
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.69          5.01
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     333.67         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)          5.00         12.00
     Storage Coeff.  (min)=       4.88 (ii)   10.02 (ii)
     Unit Hyd. Tpeak (min)=       4.00         12.00
     Unit Hyd. peak  (cms)=       0.24          0.11
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.93          1.43          4.219 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.07         12.00
     RUNOFF VOLUME    (mm)=      97.49         69.27         84.80
     TOTAL RAINFALL   (mm)=      98.50         98.50         98.50
     RUNOFF COEFFICIENT   =       0.99          0.70          0.86


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (0014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0407):    16.70   4.219    12.00    84.80
      + ID2= 2 (0414):  1257.10  16.151    19.90    58.02
        ================================================
        ID = 3 (0014):  1273.80  16.233    19.93    58.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (0415) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
                <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                  0.00        179.00        0.0450
                 10.00        179.00    0.0450 /0.0300  Main Channel
                 10.50        178.75        0.0300      Main Channel
                 11.00        179.00    0.0300 /0.0450  Main Channel
                 21.00        179.00        0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)      (min)
       0.01   178.76    .625E-01        0.0          0.02      141.96
       0.03   178.77    .250E+00        0.0          0.04       89.43
       0.04   178.79    .563E+00        0.0          0.05       68.25
       0.05   178.80    .100E+01        0.0          0.06       56.34
       0.06   178.81    .156E+01        0.0          0.07       48.55
       0.08   178.82    .225E+01        0.0          0.08       42.99
       0.09   178.84    .306E+01        0.0          0.09       38.79
       0.10   178.85    .400E+01        0.0          0.09       35.49
       0.11   178.86    .506E+01        0.0          0.10       32.81
       0.13   178.88    .625E+01        0.0          0.11       30.58
       0.14   178.89    .756E+01        0.0          0.12       28.70
       0.15   178.90    .900E+01        0.0          0.12       27.08
       0.16   178.91    .106E+02        0.0          0.13       25.68
       0.18   178.93    .123E+02        0.0          0.14       24.44
       0.19   178.94    .141E+02        0.0          0.14       23.34
       0.20   178.95    .160E+02        0.0          0.15       22.36
       0.21   178.96    .181E+02        0.0          0.16       21.47
       0.23   178.98    .203E+02        0.0          0.16       20.67
       0.24   178.99    .226E+02        0.0          0.17       19.94

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0014) 1273.80    16.23   19.93  58.37      0.24      0.17
     OUTFLOW: ID= 1 (0415) 1273.80    16.12   20.30  58.37      0.24      0.17


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0408) |   Area    (ha)=   9.30
|ID= 1 DT= 2.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  85.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.91          1.39
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     249.00         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        86.96
               over (min)          5.00         8.00
     Storage Coeff.  (min)=       4.10 (ii)    7.37 (ii)
     Unit Hyd. Tpeak (min)=       4.00         8.00
     Unit Hyd. peak  (cms)=       0.27         0.15
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.57         0.27          2.839 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.03         12.00
     RUNOFF VOLUME    (mm)=      97.50        60.09         91.89
     TOTAL RAINFALL   (mm)=      98.50        98.50         98.50
     RUNOFF COEFFICIENT   =       0.99         0.61          0.93


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (0015) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0408):     9.30   2.839    12.00    91.89
      + ID2= 2 (0415):  1273.80  16.121    20.30    58.37
        ================================================
        ID = 3 (0015):  1283.10  16.152    20.30    58.61


     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0028) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
                <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                1143.00        176.00        0.0450
                1176.00        174.00        0.0450
                1209.00        173.00        0.0450
                1224.70        173.03    0.0450 /0.0300  Main Channel
                1230.30        172.05        0.0300      Main Channel
                1232.00        173.00    0.0300 /0.0450  Main Channel
                1256.00        175.00        0.0450
                1301.00        176.00        0.0450

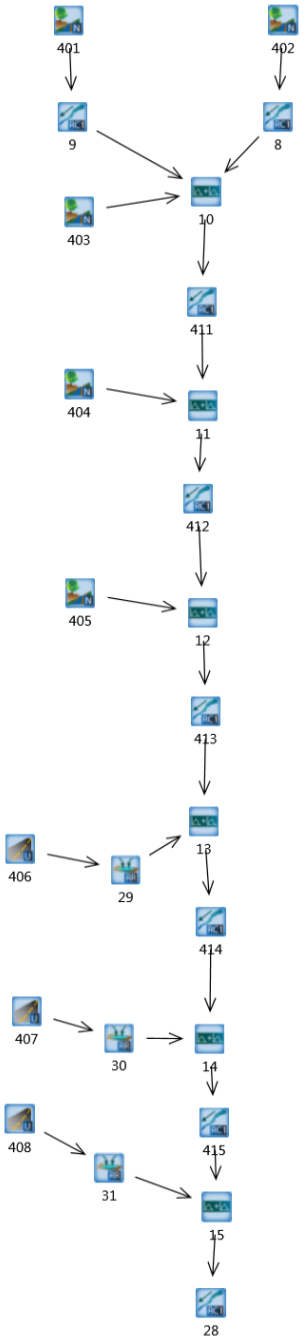
      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)      (min)
       0.19   172.24    .474E+02        0.0          0.26       22.37
       0.38   172.43    .190E+03        0.2          0.41       14.09
       0.57   172.62    .427E+03        0.7          0.54       10.75
       0.76   172.81    .758E+03        1.4          0.66        8.88
       0.95   173.00    .119E+04        2.6          0.76        7.65
       1.16   173.21    .319E+04        5.9          0.64        9.06
       1.38   173.43    .600E+04       11.7          0.68        8.52
       1.59   173.64    .953E+04       20.3          0.74        7.83
       1.81   173.86    .138E+05       31.8          0.81        7.23
       2.02   174.07    .188E+05       46.9          0.88        6.66
       2.24   174.29    .242E+05       66.1          0.96        6.11
       2.45   174.50    .302E+05       88.8          1.03        5.66
       2.66   174.71    .366E+05      115.0          1.10        5.30
       2.88   174.93    .434E+05      145.0          1.17        4.99
       3.09   175.14    .509E+05      176.5          1.21        4.80
       3.31   175.36    .592E+05      212.5          1.26        4.65
       3.52   175.57    .686E+05      254.0          1.30        4.50
       3.74   175.79    .790E+05      301.4          1.34        4.37
       3.95   176.00    .903E+05      354.8          1.37        4.24

                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0015) 1283.10    16.15   20.30  58.61      1.49      0.71
     OUTFLOW: ID= 1 (0028) 1283.10    16.14   20.40  58.61      1.49      0.71


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

 FINISH
================================================================================================
```

Scenario 3- Proposed Conditions with control



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

       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    Company
        OOO     T      T    H   H    Y    M   M   OOO               Serial

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


  Input   filename: C:\Program Files (x86)\Visual Otthymo 2.4\vO2\voin.dat
  Output  filename: C:\Users\dingm\AppData\Local\Temp\fd5f3f43-1d28-445d-8cc6-7a72697d6310\Scenario.out
  Summary filename: C:\Users\dingm\AppData\Local\Temp\fd5f3f43-1d28-445d-8cc6-7a72697d6310\Scenario.sum

DATE: 11/10/2016                          TIME: 09:39:28

USER:


COMMENTS: _____________________________________________________

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

--------------------
| MASS STORM       |     Filename: C:\Users\dingm\AppD
|                  |               ata\Local\Temp\
|                  |               fd5f3f43-1d28-445d-8cc6-7a72697d6310\bd78fa12
| Ptotal= 98.50 mm |     Comments: 24 HOUR SCS TYPE II MASS CURVE: 15 MIN S
--------------------
                      Duration of storm    = 24.00 hrs
                      Mass curve time step = 15.00 min

      TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |   TIME    RAIN
       hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |    hrs   mm/hr
      0.25    1.18 |   6.25    1.97 |'  12.25   14.18 |  18.25    1.58
      0.50    1.18 |   6.50    1.58 |'  12.50   14.18 |  18.50    1.97
      0.75    0.79 |   6.75    1.97 |'  12.75    7.49 |  18.75    1.58
      1.00    1.18 |   7.00    1.58 |'  13.00    7.09 |  19.00    1.97
      1.25    1.18 |   7.25    2.36 |'  13.25    5.12 |  19.25    1.58
      1.50    1.18 |   7.50    1.97 |'  13.50    5.12 |  19.50    1.97
      1.75    0.79 |   7.75    2.36 |'  13.75    4.33 |  19.75    1.58
      2.00    1.18 |   8.00    1.97 |'  14.00    3.94 |  20.00    1.97
      2.25    1.18 |   8.25    2.76 |'  14.25    3.15 |  20.25    1.18
      2.50    1.58 |   8.50    2.36 |'  14.50    2.76 |  20.50    1.18
      2.75    1.18 |   8.75    2.76 |'  14.75    3.15 |  20.75    1.18
      3.00    1.18 |   9.00    2.76 |'  15.00    2.76 |  21.00    1.18
      3.25    1.18 |   9.25    3.15 |'  15.25    3.15 |  21.25    1.18
      3.50    1.58 |   9.50    3.15 |'  15.50    2.76 |  21.50    1.18
      3.75    1.18 |   9.75    3.55 |'  15.75    3.15 |  21.75    1.18
      4.00    1.18 |  10.00    3.55 |'  16.00    2.76 |  22.00    1.18
      4.25    1.58 |  10.25    4.73 |'  16.25    1.97 |  22.25    1.18
      4.50    1.58 |  10.50    4.33 |'  16.50    1.58 |  22.50    1.18
      4.75    1.58 |  10.75    6.30 |'  16.75    1.97 |  22.75    1.18
      5.00    1.58 |  11.00    5.91 |'  17.00    1.58 |  23.00    1.18
      5.25    1.58 |  11.25    9.46 |'  17.25    1.97 |  23.25    1.18
      5.50    1.58 |  11.50    9.46 |'  17.50    1.58 |  23.50    1.18
      5.75    1.58 |  11.75   29.16 |'  17.75    1.58 |  23.75    1.18
      6.00    1.58 |  12.00  120.56 |'  18.00    1.97 |  24.00    1.18

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--------------------
| CALIB            |
| NASHYD    (0402) |   Area    (ha)= 500.20   Curve Number   (CN)= 78.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   4.08

        NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 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
      0.033   1.18 |  6.033    1.97 |' 12.033   14.18 | 18.033    1.58
      0.067   1.18 |  6.067    1.97 |' 12.067   14.18 | 18.07     1.58
      0.100   1.18 |  6.100    1.97 |' 12.100   14.18 | 18.10     1.58
      0.133   1.18 |  6.133    1.97 |' 12.133   14.18 | 18.13     1.58
      0.167   1.18 |  6.167    1.97 |' 12.167   14.18 | 18.17     1.58
      0.200   1.18 |  6.200    1.97 |' 12.200   14.18 | 18.20     1.58
      0.233   1.18 |  6.233    1.97 |' 12.233   14.18 | 18.23     1.58
      0.267   1.18 |  6.267    1.77 |' 12.267   14.18 | 18.27     1.77
      0.300   1.18 |  6.300    1.58 |' 12.300   14.18 | 18.30     1.97
      0.333   1.18 |  6.333    1.58 |' 12.333   14.18 | 18.33     1.97
      0.367   1.18 |  6.367    1.58 |' 12.367   14.18 | 18.37     1.97
      0.400   1.18 |  6.400    1.58 |' 12.400   14.18 | 18.40     1.97
      0.433   1.18 |  6.433    1.58 |' 12.433   14.18 | 18.43     1.97
      0.467   1.18 |  6.467    1.58 |' 12.467   14.18 | 18.47     1.97
      0.500   1.18 |  6.500    1.58 |' 12.500   14.17 | 18.50     1.97
      0.533   0.79 |  6.533    1.97 |' 12.533    7.49 | 18.53     1.58
      0.567   0.79 |  6.567    1.97 |' 12.567    7.49 | 18.57     1.58
      0.600   0.79 |  6.600    1.97 |' 12.600    7.49 | 18.60     1.58
      0.633   0.79 |  6.633    1.97 |' 12.633    7.49 | 18.63     1.58
      0.667   0.79 |  6.667    1.97 |' 12.667    7.49 | 18.67     1.58
      0.700   0.79 |  6.700    1.97 |' 12.700    7.49 | 18.70     1.58
      0.733   0.79 |  6.733    1.97 |' 12.733    7.49 | 18.73     1.58
      0.767   0.99 |  6.767    1.77 |' 12.767    7.29 | 18.77     1.77
      0.800   1.18 |  6.800    1.58 |' 12.800    7.09 | 18.80     1.97
      0.833   1.18 |  6.833    1.58 |' 12.833    7.09 | 18.83     1.97
      0.867   1.18 |  6.867    1.58 |' 12.867    7.09 | 18.87     1.97
      0.900   1.18 |  6.900    1.58 |' 12.900    7.09 | 18.90     1.97
      0.933   1.18 |  6.933    1.58 |' 12.933    7.09 | 18.93     1.97
      0.967   1.18 |  6.967    1.58 |' 12.967    7.09 | 18.97     1.97
      1.000   1.18 |  7.000    1.58 |' 13.000    7.09 | 19.00     1.97
      1.033   1.18 |  7.033    2.36 |' 13.033    5.52 | 19.03     1.58
      1.067   1.18 |  7.067    2.36 |' 13.067    5.52 | 19.07     1.58
      1.100   1.18 |  7.100    2.36 |' 13.100    5.52 | 19.10     1.58
      1.133   1.18 |  7.133    2.36 |' 13.133    5.52 | 19.13     1.58
      1.167   1.18 |  7.167    2.36 |' 13.167    5.52 | 19.17     1.58
      1.200   1.18 |  7.200    2.36 |' 13.200    5.52 | 19.20     1.58
      1.233   1.18 |  7.233    2.36 |' 13.233    5.52 | 19.23     1.58
      1.267   1.18 |  7.267    2.17 |' 13.267    5.32 | 19.27     1.77
      1.300   1.18 |  7.300    1.97 |' 13.300    5.12 | 19.30     1.97
      1.333   1.18 |  7.333    1.97 |' 13.333    5.12 | 19.33     1.97
      1.367   1.18 |  7.367    1.97 |' 13.367    5.12 | 19.37     1.97
      1.400   1.18 |  7.400    1.97 |' 13.400    5.12 | 19.40     1.97
      1.433   1.18 |  7.433    1.97 |' 13.433    5.12 | 19.43     1.97
      1.467   1.18 |  7.467    1.97 |' 13.467    5.12 | 19.47     1.97
      1.500   1.18 |  7.500    1.97 |' 13.500    5.12 | 19.50     1.97
      1.533   0.79 |  7.533    2.36 |' 13.533    4.33 | 19.53     1.58
      1.567   0.79 |  7.567    2.36 |' 13.567    4.33 | 19.57     1.58
      1.600   0.79 |  7.600    2.36 |' 13.600    4.33 | 19.60     1.58
      1.633   0.79 |  7.633    2.36 |' 13.633    4.33 | 19.63     1.58
      1.667   0.79 |  7.667    2.36 |' 13.667    4.33 | 19.67     1.58
      1.700   0.79 |  7.700    2.36 |' 13.700    4.33 | 19.70     1.58
      1.733   0.79 |  7.733    2.36 |' 13.733    4.33 | 19.73     1.58
      1.767   0.98 |  7.767    2.17 |' 13.767    4.14 | 19.77     1.77
      1.800   1.18 |  7.800    1.97 |' 13.800    3.94 | 19.80     1.97
      1.833   1.18 |  7.833    1.97 |' 13.833    3.94 | 19.83     1.97
      1.867   1.18 |  7.867    1.97 |' 13.867    3.94 | 19.87     1.97
      1.900   1.18 |  7.900    1.97 |' 13.900    3.94 | 19.90     1.97
      1.933   1.18 |  7.933    1.97 |' 13.933    3.94 | 19.93     1.97
      1.967   1.18 |  7.967    1.97 |' 13.967    3.94 | 19.97     1.97
      2.000   1.18 |  8.000    1.97 |' 14.000    3.94 | 20.00     1.97
      2.033   1.18 |  8.033    2.76 |' 14.033    3.15 | 20.03     1.18
      2.067   1.18 |  8.067    2.76 |' 14.067    3.15 | 20.07     1.18
      2.100   1.18 |  8.100    2.76 |' 14.100    3.15 | 20.10     1.18
      2.133   1.18 |  8.133    2.76 |' 14.133    3.15 | 20.13     1.18
      2.167   1.18 |  8.167    2.76 |' 14.167    3.15 | 20.17     1.18
      2.200   1.18 |  8.200    2.76 |' 14.200    3.15 | 20.20     1.18
      2.233   1.18 |  8.233    2.76 |' 14.233    3.15 | 20.23     1.18
      2.267   1.58 |  8.267    2.56 |' 14.267    2.95 | 20.27     1.18
      2.300   1.58 |  8.300    2.36 |' 14.300    2.76 | 20.30     1.18
      2.333   1.58 |  8.333    2.36 |' 14.333    2.76 | 20.33     1.18
      2.367   1.58 |  8.367    2.36 |' 14.367    2.76 | 20.37     1.18
      2.400   1.58 |  8.400    2.36 |' 14.400    2.76 | 20.40     1.18
      2.433   1.58 |  8.433    2.36 |' 14.433    2.76 | 20.43     1.18
      2.467   1.58 |  8.467    2.36 |' 14.467    2.76 | 20.47     1.18
      2.500   1.58 |  8.500    2.36 |' 14.500    2.76 | 20.50     1.18
      2.533   1.18 |  8.533    2.76 |' 14.533    3.15 | 20.53     1.18
      2.567   1.18 |  8.567    2.76 |' 14.567    3.15 | 20.57     1.18
      2.600   1.18 |  8.600    2.76 |' 14.600    3.15 | 20.60     1.18
      2.633   1.18 |  8.633    2.76 |' 14.633    3.15 | 20.63     1.18
      2.667   1.18 |  8.667    2.76 |' 14.667    3.15 | 20.67     1.18
      2.700   1.18 |  8.700    2.76 |' 14.700    3.15 | 20.70     1.18
      2.733   1.18 |  8.733    2.76 |' 14.733    3.15 | 20.73     1.18
      2.767   1.18 |  8.767    2.76 |' 14.767    2.95 | 20.77     1.18
      2.800   1.18 |  8.800    2.76 |' 14.800    2.76 | 20.80     1.18
      2.833   1.18 |  8.833    2.76 |' 14.833    2.76 | 20.83     1.18
      2.867   1.18 |  8.867    2.76 |' 14.867    2.76 | 20.87     1.18
      2.900   1.18 |  8.900    2.76 |' 14.900    2.76 | 20.90     1.18
      2.933   1.18 |  8.933    2.76 |' 14.933    2.76 | 20.93     1.18
      2.967   1.18 |  8.967    2.76 |' 14.967    2.76 | 20.97     1.18
      3.000   1.18 |  9.000    2.76 |' 15.000    2.76 | 21.00     1.18
      3.033   1.18 |  9.033    3.15 |' 15.033    3.15 | 21.03     1.18
      3.067   1.18 |  9.067    3.15 |' 15.067    3.15 | 21.07     1.18
      3.100   1.18 |  9.100    3.15 |' 15.100    3.15 | 21.10     1.18
      3.133   1.18 |  9.133    3.15 |' 15.133    3.15 | 21.13     1.18
      3.167   1.18 |  9.167    3.15 |' 15.167    3.15 | 21.17     1.18
      3.200   1.18 |  9.200    3.15 |' 15.200    3.15 | 21.20     1.18
      3.233   1.18 |  9.233    3.15 |' 15.233    3.15 | 21.23     1.18
      3.267   1.58 |  9.267    3.15 |' 15.267    2.95 | 21.27     1.18
      3.300   1.58 |  9.300    3.15 |' 15.300    2.76 | 21.30     1.18
      3.333   1.58 |  9.333    3.15 |' 15.333    2.76 | 21.33     1.18
      3.367   1.58 |  9.367    3.15 |' 15.367    2.76 | 21.37     1.18
      3.400   1.58 |  9.400    3.15 |' 15.400    2.76 | 21.40     1.18
      3.433   1.58 |  9.433    3.15 |' 15.433    2.76 | 21.43     1.18
      3.467   1.58 |  9.467    3.15 |' 15.467    2.76 | 21.47     1.18
      3.500   1.58 |  9.500    3.15 |' 15.500    2.76 | 21.50     1.18
      3.533   1.18 |  9.533    3.55 |' 15.533    3.15 | 21.53     1.18
      3.567   1.18 |  9.567    3.55 |' 15.567    3.15 | 21.57     1.18
      3.600   1.18 |  9.600    3.55 |' 15.600    3.15 | 21.60     1.18
      3.633   1.18 |  9.633    3.55 |' 15.633    3.15 | 21.63     1.18
      3.667   1.18 |  9.667    3.55 |' 15.667    3.15 | 21.67     1.18
      3.700   1.18 |  9.700    3.55 |' 15.700    3.15 | 21.70     1.18
      3.733   1.18 |  9.733    3.55 |' 15.733    3.15 | 21.73     1.18
      3.767   1.18 |  9.767    3.55 |' 15.767    2.95 | 21.77     1.18
      3.800   1.18 |  9.800    3.55 |' 15.800    2.76 | 21.80     1.18
      3.833   1.18 |  9.833    3.55 |' 15.833    2.76 | 21.83     1.18
      3.867   1.18 |  9.867    3.55 |' 15.867    2.76 | 21.87     1.18
      3.900   1.18 |  9.900    3.55 |' 15.900    2.76 | 21.90     1.18
      3.933   1.18 |  9.933    3.55 |' 15.933    2.76 | 21.93     1.18
      3.967   1.18 |  9.967    3.55 |' 15.967    2.76 | 21.97     1.18
      4.000   1.18 | 10.000    3.55 |' 16.000    2.76 | 22.00     1.18
      4.033   1.58 | 10.033    4.73 |' 16.033    1.97 | 22.03     1.18
      4.067   1.58 | 10.067    4.73 |' 16.067    1.97 | 22.07     1.18
      4.100   1.58 | 10.100    4.73 |' 16.100    1.97 | 22.10     1.18
      4.133   1.58 | 10.133    4.73 |' 16.133    1.97 | 22.13     1.18
      4.167   1.58 | 10.167    4.73 |' 16.167    1.97 | 22.17     1.18
      4.200   1.58 | 10.200    4.73 |' 16.200    1.97 | 22.20     1.18
      4.233   1.58 | 10.233    4.73 |' 16.233    1.97 | 22.23     1.18
      4.267   1.58 | 10.267    4.53 |' 16.267    1.77 | 22.27     1.18
      4.300   1.58 | 10.300    4.33 |' 16.300    1.58 | 22.30     1.18
      4.333   1.58 | 10.333    4.33 |' 16.333    1.58 | 22.33     1.18
      4.367   1.58 | 10.367    4.33 |' 16.367    1.58 | 22.37     1.18
      4.400   1.58 | 10.400    4.33 |' 16.400    1.58 | 22.40     1.18
      4.433   1.58 | 10.433    4.33 |' 16.433    1.58 | 22.43     1.18
      4.467   1.58 | 10.467    4.33 |' 16.467    1.58 | 22.47     1.18
      4.500   1.58 | 10.500    4.34 |' 16.500    1.58 | 22.50     1.18
      4.533   1.58 | 10.533    6.30 |' 16.533    1.97 | 22.53     1.18
      4.567   1.58 | 10.567    6.30 |' 16.567    1.97 | 22.57     1.18
      4.600   1.58 | 10.600    6.30 |' 16.600    1.97 | 22.60     1.18
      4.633   1.58 | 10.633    6.30 |' 16.633    1.97 | 22.63     1.18
      4.667   1.58 | 10.667    6.30 |' 16.667    1.97 | 22.67     1.18
      4.700   1.58 | 10.700    6.30 |' 16.700    1.97 | 22.70     1.18
      4.733   1.58 | 10.733    6.30 |' 16.733    1.97 | 22.73     1.18
      4.767   1.58 | 10.767    6.11 |' 16.767    1.77 | 22.77     1.18
      4.800   1.58 | 10.800    5.91 |' 16.800    1.58 | 22.80     1.18
      4.833   1.58 | 10.833    5.91 |' 16.833    1.58 | 22.83     1.18
      4.867   1.58 | 10.867    5.91 |' 16.867    1.58 | 22.87     1.18
      4.900   1.58 | 10.900    5.91 |' 16.900    1.58 | 22.90     1.18
      4.933   1.58 | 10.933    5.91 |' 16.933    1.58 | 22.93     1.18
      4.967   1.58 | 10.967    5.91 |' 16.967    1.58 | 22.97     1.18
      5.000   1.58 | 11.000    5.91 |' 17.000    1.58 | 23.00     1.18
      5.033   1.58 | 11.033    9.46 |' 17.033    1.97 | 23.03     1.18
      5.067   1.58 | 11.067    9.46 |' 17.067    1.97 | 23.07     1.18
      5.100   1.58 | 11.100    9.46 |' 17.100    1.97 | 23.10     1.18
      5.133   1.58 | 11.133    9.46 |' 17.133    1.97 | 23.13     1.18
      5.167   1.58 | 11.167    9.46 |' 17.167    1.97 | 23.17     1.18
      5.200   1.58 | 11.200    9.46 |' 17.200    1.97 | 23.20     1.18
      5.233   1.58 | 11.233    9.46 |' 17.233    1.97 | 23.23     1.18
      5.267   1.58 | 11.267    9.46 |' 17.267    1.77 | 23.27     1.18
      5.300   1.58 | 11.300    9.46 |' 17.300    1.58 | 23.30     1.18
      5.333   1.58 | 11.333    9.46 |' 17.333    1.58 | 23.33     1.18
      5.367   1.58 | 11.367    9.46 |' 17.367    1.58 | 23.37     1.18
      5.400   1.58 | 11.400    9.46 |' 17.400    1.58 | 23.40     1.18
      5.433   1.58 | 11.433    9.46 |' 17.433    1.58 | 23.43     1.18
      5.467   1.58 | 11.467    9.46 |' 17.467    1.58 | 23.47     1.18
      5.500   1.58 | 11.500    9.48 |' 17.500    1.58 | 23.50     1.18
      5.533   1.58 | 11.533   29.16 |' 17.533    1.58 | 23.53     1.18
      5.567   1.58 | 11.567   29.16 |' 17.567    1.58 | 23.57     1.18
      5.600   1.58 | 11.600   29.16 |' 17.600    1.58 | 23.60     1.18
      5.633   1.58 | 11.633   29.16 |' 17.633    1.58 | 23.63     1.18
      5.667   1.58 | 11.667   29.16 |' 17.667    1.58 | 23.67     1.18
      5.700   1.58 | 11.700   29.16 |' 17.700    1.58 | 23.70     1.18
      5.733   1.58 | 11.733   29.16 |' 17.733    1.58 | 23.73     1.18
      5.767   1.58 | 11.767   74.98 |' 17.767    1.77 | 23.77     1.18
      5.800   1.58 | 11.800  120.56 |' 17.800    1.97 | 23.80     1.18
      5.833   1.58 | 11.833  120.56 |' 17.833    1.97 | 23.83     1.18
      5.867   1.58 | 11.867  120.56 |' 17.867    1.97 | 23.87     1.18
      5.900   1.58 | 11.900  120.56 |' 17.900    1.97 | 23.90     1.18
      5.933   1.58 | 11.933  120.56 |' 17.933    1.97 | 23.93     1.18
      5.967   1.58 | 11.967  120.56 |' 17.967    1.97 | 23.97     1.18
      6.000   1.58 | 12.000  120.41 |' 18.000    1.97 | 24.00     1.18

     Unit Hyd Qpeak  (cms)=   4.683

     PEAK FLOW       (cms)=   7.582 (i)
     TIME TO PEAK    (hrs)=  16.533
     RUNOFF VOLUME    (mm)=  55.202
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.560

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

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| ROUTE CHN (0008) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
                  <------ DATA FOR SECTION (   1.1) ------>
                 Distance      Elevation        Manning
                    0.00         179.00          0.0450
                   10.00         179.00     0.0450 /0.0300  Main Channel
                   10.50         178.50          0.0300     Main Channel
                   11.00         179.00     0.0300 /0.0450  Main Channel
                   21.00         179.00          0.0450

       <---------------------- TRAVEL TIME TABLE ----------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)       (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.03    178.52    .531E+00         0.0          0.07      194.95
        0.05    178.55    .213E+01         0.0          0.12      122.81
        0.08    178.58    .478E+01         0.0          0.15       93.72
        0.10    178.60    .850E+01         0.0          0.18       77.36
        0.13    178.63    .133E+02         0.0          0.21       66.67
        0.15    178.65    .191E+02         0.0          0.24       59.04
        0.18    178.68    .260E+02         0.0          0.27       53.27
        0.20    178.70    .340E+02         0.0          0.29       48.74
        0.23    178.73    .430E+02         0.0          0.31       45.06
        0.25    178.75    .531E+02         0.0          0.34       42.00
        0.28    178.78    .641E+02         0.0          0.36       39.41
        0.30    178.80    .765E+02         0.0          0.38       37.19
        0.33    178.83    .898E+02         0.0          0.40       35.26
        0.35    178.85    .104E+03         0.1          0.42       33.56
        0.38    178.88    .120E+03         0.1          0.44       32.05
        0.40    178.90    .136E+03         0.1          0.46       30.70
        0.43    178.93    .154E+03         0.1          0.48       29.49
        0.45    178.95    .172E+03         0.1          0.50       28.38
        0.48    178.98    .192E+03         0.1          0.52       27.38

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED

                                    <----- hydrograph ---->    <-pipe / channel->
                           AREA     QPEAK    TPEAK   R.V.    MAX DEPTH   MAX VEL
                            (ha)     (cms)   (hrs)   (mm)       (m)        (m/s)
     INFLOW : ID= 2 (0402)  500.20     7.58   16.53  55.20      0.47       0.52
     OUTFLOW: ID= 1 (0008)  500.20     7.51   17.07  55.79      0.48       0.52

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--------------------
| CALIB            |
| NASHYD    (0401) |   Area    (ha)= 288.80   Curve Number   (CN)= 77.0
|ID= 1 DT= 2.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.23

     Unit Hyd Qpeak  (cms)=   4.947

     PEAK FLOW       (cms)=   6.857 (i)
     TIME TO PEAK    (hrs)=  14.367
     RUNOFF VOLUME    (mm)=  54.414
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     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT    =   0.552

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

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-------------------
| ROUTE CHN (0009) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.50         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.03    178.52    .844E+00         0.0          0.05     437.87
       0.05    178.55    .338E+01         0.0          0.08     275.84
       0.08    178.58    .760E+01         0.0          0.11     210.51
       0.10    178.60    .135E+02         0.0          0.13     173.77
       0.13    178.63    .211E+02         0.0          0.15     149.75
       0.15    178.65    .304E+02         0.0          0.17     132.61
       0.18    178.68    .414E+02         0.0          0.19     119.66
       0.20    178.70    .540E+02         0.0          0.21     109.47
       0.23    178.73    .684E+02         0.0          0.22     101.20
       0.25    178.75    .844E+02         0.0          0.24      94.34
       0.28    178.78    .102E+03         0.0          0.25      88.53
       0.30    178.80    .122E+03         0.0          0.27      83.54
       0.33    178.83    .143E+03         0.0          0.28      79.20
       0.35    178.85    .165E+03         0.0          0.30      75.38
       0.38    178.88    .190E+03         0.0          0.31      71.99
       0.40    178.90    .216E+03         0.1          0.33      68.96
       0.43    178.93    .244E+03         0.1          0.34      66.23
       0.45    178.95    .273E+03         0.1          0.35      63.75
       0.48    178.98    .305E+03         0.1          0.37      61.49

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0401)  288.80    6.86   14.37  54.41      0.47      0.36
     OUTFLOW: ID= 1 (0009)  288.80    6.01   15.50  54.43      0.48      0.37


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-------------------
| CALIB             |
| NASHYD    (0403)  |   Area    (ha)= 149.40   Curve Number   (CN)= 79.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.33

     Unit Hyd Qpeak  (cms)=   2.449

     PEAK FLOW       (cms)=   3.615 (i)
     TIME TO PEAK    (hrs)=  14.467
     RUNOFF VOLUME    (mm)=  57.170
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.580

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

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-------------------
| ADD HYD   (0010) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0008):   500.20   7.509    17.07    55.79
      + ID2= 2 (0009):   288.80   6.010    15.50    54.43
        ================================================
        ID = 3 (0010):   789.00  13.037    16.17    55.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| ADD HYD   (0010) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
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-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (0010):   789.00  13.037    16.17    55.29
      + ID2= 2 (0403):   149.40   3.615    14.47    57.17
        ================================================
        ID = 1 (0010):   938.40  16.000    15.77    55.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| ROUTE CHN (0411) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .61OE+00         0.0          0.05     692.07
       0.03    178.77    .244E+01         0.0          0.07     435.98
       0.04    178.79    .549E+01         0.0          0.10     332.71
       0.05    178.80    .975E+01         0.0          0.12     274.65
       0.06    178.81    .152E+02         0.0          0.14     236.68
       0.08    178.82    .219E+02         0.0          0.16     209.59
       0.09    178.84    .299E+02         0.0          0.17     189.12
       0.10    178.85    .39OE+02         0.0          0.19     173.02
       0.11    178.86    .494E+02         0.0          0.20     159.95
       0.13    178.88    .61OE+02         0.0          0.22     149.10
       0.14    178.89    .737E+02         0.0          0.23     139.92
       0.15    178.90    .878E+02         0.0          0.25     132.04
       0.16    178.91    .103E+03         0.0          0.26     125.18
       0.18    178.93    .119E+03         0.0          0.27     119.14
       0.19    178.94    .137E+03         0.0          0.29     113.79
       0.20    178.95    .156E+03         0.0          0.30     108.99
       0.21    178.96    .176E+03         0.0          0.31     104.68
       0.23    178.98    .197E+03         0.0          0.32     100.76
       0.24    178.99    .220E+03         0.0          0.33      97.19

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0010)  938.40   16.00   15.77  55.59      0.24      0.33
     OUTFLOW: ID= 1 (0411)  938.40   13.55   17.77  55.59      0.24      0.33


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| CALIB             |
| NASHYD    (0404)  |   Area    (ha)= 197.30   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   3.10

     Unit Hyd Qpeak  (cms)=   2.431

     PEAK FLOW       (cms)=   4.018 (i)
     TIME TO PEAK    (hrs)=  15.333
     RUNOFF VOLUME    (mm)=  59.949
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.609

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

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-------------------
| ADD HYD   (0011) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0404):   197.30   4.018    15.33    59.95
      + ID2= 2 (0411):   938.40  13.550    17.77    55.59
        ================================================
        ID = 3 (0011):  1135.70  16.761    17.27    56.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (0412) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .266E+00         0.0          0.05     269.82
       0.03    178.77    .106E+01         0.0          0.08     169.98
       0.04    178.79    .239E+01         0.0          0.11     129.72
       0.05    178.80    .425E+01         0.0          0.13     107.08
       0.06    178.81    .664E+01         0.0          0.15      92.28
       0.08    178.82    .956E+01         0.0          0.17      81.72
       0.09    178.84    .130E+02         0.0          0.19      73.74
       0.10    178.85    .170E+02         0.0          0.21      67.46
       0.11    178.86    .215E+02         0.0          0.23      62.36
       0.13    178.88    .266E+02         0.0          0.24      58.13
       0.14    178.89    .321E+02         0.0          0.26      54.55
       0.15    178.90    .383E+02         0.0          0.28      51.48
       0.16    178.91    .449E+02         0.0          0.29      48.80
       0.18    178.93    .521E+02         0.0          0.30      46.45
       0.19    178.94    .598E+02         0.0          0.32      44.36
       0.20    178.95    .680E+02         0.0          0.33      42.49
       0.21    178.96    .768E+02         0.0          0.35      40.81
       0.23    178.98    .861E+02         0.0          0.36      39.29
       0.24    178.99    .959E+02         0.0          0.37      37.89

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0011) 1135.70   16.76   17.27  56.38      0.24      0.37
     OUTFLOW: ID= 1 (0412) 1135.70   16.44   18.00  56.38      0.24      0.37


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-------------------
| CALIB             |
| NASHYD    (0405)  |   Area    (ha)=  56.10   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   1.64

     Unit Hyd Qpeak  (cms)=   1.307

     PEAK FLOW       (cms)=   1.878 (i)
     TIME TO PEAK    (hrs)=  13.667
     RUNOFF VOLUME    (mm)=  60.089
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

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-------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0405):    56.10   1.878    13.67    60.09
      + ID2= 2 (0412):  1135.70  16.443    18.00    56.38
        ================================================
        ID = 3 (0012):  1191.80  16.880    17.87    56.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (0413) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450
```

```
      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
         (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
       0.01    178.76    .391E+00         0.0          0.05     443.64
       0.03    178.77    .156E+01         0.0          0.07     279.47
       0.04    178.79    .352E+01         0.0          0.10     213.28
       0.05    178.80    .625E+01         0.0          0.12     176.06
       0.06    178.81    .977E+01         0.0          0.14     151.72
       0.08    178.82    .141E+02         0.0          0.16     134.36
       0.09    178.84    .191E+02         0.0          0.17     121.23
       0.10    178.85    .25OE+02         0.0          0.19     110.91
       0.11    178.86    .316E+02         0.0          0.20     102.53
       0.13    178.88    .391E+02         0.0          0.22      95.58
       0.14    178.89    .473E+02         0.0          0.23      89.69
       0.15    178.90    .563E+02         0.0          0.25      84.64
       0.16    178.91    .66OE+02         0.0          0.26      80.24
       0.18    178.93    .766E+02         0.0          0.27      76.37
       0.19    178.94    .879E+02         0.0          0.29      72.94
       0.20    178.95    .10OE+03         0.0          0.30      69.87
       0.21    178.96    .113E+03         0.0          0.31      67.10
       0.23    178.98    .127E+03         0.0          0.32      64.59
       0.24    178.99    .141E+03         0.0          0.33      62.30

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0012) 1191.80   16.88   17.87  56.55      0.24      0.33
     OUTFLOW: ID= 1 (0413) 1191.80   16.12   19.10  56.55      0.24      0.33


-------------------------------------------------------------------------------
-------------------
| CALIB             |
| STANDHYD  (0406)  |   Area    (ha)=  65.30
|ID= 1 DT= 2.0 min  |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
-------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      45.71         19.59
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     659.80         40.00
     Mannings n             =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)          8.00         14.00
     Storage Coeff. (min)=       7.35 (ii)    12.49 (ii)
     Unit Hyd. Tpeak (min)=      8.00         14.00
     Unit Hyd. peak  (cms)=      0.15          0.09
                                                      *TOTALS*
     PEAK FLOW       (cms)=     10.00          5.02      14.620 (iii)
     TIME TO PEAK    (hrs)=     12.03         12.10       12.03
     RUNOFF VOLUME    (mm)=     97.49         69.27       84.80
     TOTAL RAINFALL   (mm)=     98.50         98.50       98.50
     RUNOFF COEFFICIENT   =      0.99          0.70        0.86


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*   =  81.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| RESERVOIR (0029) |
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.9550     2.2000
                         0.0200     0.2000   |   1.6000     3.1800
                         0.5590     1.5200   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0406)    65.300    14.620     12.03      84.80
     OUTFLOW: ID= 1 (0029)    65.300     1.590     12.87      83.39

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.88
               TIME SHIFT OF PEAK FLOW          (min)= 50.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  3.1657

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

```
--------------------
| ADD HYD   (0013) |
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0029):    65.30   1.590    12.87    83.39
      + ID2= 2 (0413):  1191.80  16.121    19.10    56.55
        ================================================
        ID = 3 (0013):  1257.10  16.843    19.03    57.94

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0414) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation        Manning
                0.00         179.00         0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75         0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.01   178.76    .109E+00         0.0          0.04      143.43
        0.03   178.77    .438E+00         0.0          0.06       90.36
        0.04   178.79    .985E+00         0.0          0.08       68.96
        0.05   178.80    .175E+01         0.0          0.10       56.92
        0.06   178.81    .273E+01         0.0          0.12       49.05
        0.08   178.82    .394E+01         0.0          0.13       43.44
        0.09   178.84    .536E+01         0.0          0.15       39.20
        0.10   178.85    .700E+01         0.0          0.16       35.86
        0.11   178.86    .886E+01         0.0          0.18       33.15
        0.13   178.88    .109E+02         0.0          0.19       30.90
        0.14   178.89    .132E+02         0.0          0.20       29.00
        0.15   178.90    .158E+02         0.0          0.21       27.37
        0.16   178.91    .185E+02         0.0          0.22       25.94
        0.18   178.93    .214E+02         0.0          0.24       24.69
        0.19   178.94    .246E+02         0.0          0.25       23.58
        0.20   178.95    .280E+02         0.0          0.26       22.59
        0.21   178.96    .316E+02         0.0          0.27       21.69
        0.23   178.98    .354E+02         0.0          0.28       20.88
        0.24   178.99    .395E+02         0.0          0.29       20.14

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <----- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK    TPEAK   R.V.    MAX DEPTH   MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
    INFLOW : ID= 2 (0013) 1257.10    16.84   19.03  57.94      0.24       0.29
    OUTFLOW: ID= 1 (0414) 1257.10    16.78   19.37  57.94      0.24       0.29


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0407) |   Area    (ha)=  16.70
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.69          5.01
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     333.67         40.00
     Mannings n            =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)        5.00         12.00
     Storage Coeff.  (min)=       4.88 (ii)    10.02 (ii)
     Unit Hyd. Tpeak (min)=       4.00         12.00
     Unit Hyd. peak  (cms)=       0.24          0.11
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.93          1.43          4.219 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.07         12.00
     RUNOFF VOLUME    (mm)=      97.49         69.27         84.80
     TOTAL RAINFALL   (mm)=      98.50         98.50         98.50
     RUNOFF COEFFICIENT   =       0.99          0.70          0.86

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

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0030) |
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4220     0.5300
                          0.0200     0.1000   |   0.6800     0.7250
                          0.2370     0.3600   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0407)     16.700     4.219     12.00      84.80
     OUTFLOW: ID= 1 (0030)     16.700     0.677     12.53      84.41

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.05
                   TIME SHIFT OF PEAK FLOW         (min)= 32.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.7231

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

--------------------
| ADD HYD   (0014) |
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0030):    16.70   0.677    12.53    84.41
      + ID2= 2 (0414):  1257.10  16.784    19.37    57.94
        ================================================
        ID = 3 (0014):  1273.80  16.933    19.33    58.29

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0415) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation        Manning
                0.00         179.00         0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75         0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00         0.0450

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.01   178.76    .625E-01         0.0          0.02      141.96
        0.03   178.77    .250E+00         0.0          0.04       89.43
        0.04   178.79    .563E+00         0.0          0.05       68.25
        0.05   178.80    .100E+01         0.0          0.06       56.34
        0.06   178.81    .156E+01         0.0          0.07       48.55
        0.08   178.82    .225E+01         0.0          0.08       42.99
        0.09   178.84    .306E+01         0.0          0.09       38.79
        0.10   178.85    .400E+01         0.0          0.09       35.49
        0.11   178.86    .506E+01         0.0          0.10       32.81
        0.13   178.88    .625E+01         0.0          0.11       30.58
        0.14   178.89    .756E+01         0.0          0.12       28.70
        0.15   178.90    .900E+01         0.0          0.12       27.08
        0.16   178.91    .106E+02         0.0          0.13       25.68
        0.18   178.93    .123E+02         0.0          0.14       24.44
        0.19   178.94    .141E+02         0.0          0.14       23.34
        0.20   178.95    .160E+02         0.0          0.15       22.36
        0.21   178.96    .181E+02         0.0          0.16       21.47
        0.23   178.98    .203E+02         0.0          0.16       20.67
        0.24   178.99    .226E+02         0.0          0.17       19.94

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <----- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK    TPEAK   R.V.    MAX DEPTH   MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
    INFLOW : ID= 2 (0014) 1273.80    16.93   19.33  58.29      0.24       0.17
    OUTFLOW: ID= 1 (0415) 1273.80    16.88   19.67  58.29      0.24       0.17


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0408) |   Area    (ha)=   9.30
```

```
|ID= 1 DT= 2.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  85.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.91          1.39
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     249.00         40.00
     Mannings n            =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56         86.96
               over (min)        5.00          8.00
     Storage Coeff.  (min)=       4.10 (ii)     7.37 (ii)
     Unit Hyd. Tpeak (min)=       4.00          8.00
     Unit Hyd. peak  (cms)=       0.27          0.15
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.57          0.27          2.839 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.03         12.00
     RUNOFF VOLUME    (mm)=      97.50         60.09         91.89
     TOTAL RAINFALL   (mm)=      98.50         98.50         98.50
     RUNOFF COEFFICIENT   =       0.99          0.61          0.93


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0031) |
| IN= 2---> OUT= 1 |
| DT= 2.0 min      |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2780     0.3150
                          0.0200     0.0500   |   0.4470     0.4220
                          0.1560     0.2250   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0408)      9.300     2.839     12.00      91.89
     OUTFLOW: ID= 1 (0031)      9.300     0.446     12.30      91.82

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.70
                   TIME SHIFT OF PEAK FLOW         (min)= 18.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.4212

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

--------------------
| ADD HYD   (0015) |
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0031):     9.30   0.446    12.30    91.82
      + ID2= 2 (0415):  1273.80  16.882    19.67    58.29
        ================================================
        ID = 3 (0015):  1283.10  16.965    19.67    58.53

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0028) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation        Manning
               1143.00         176.00         0.0450
               1176.00         174.00         0.0450
               1209.00         173.00         0.0450
               1224.70         173.03    0.0450 /0.0300  Main Channel
               1230.30         172.05         0.0300      Main Channel
               1232.00         173.00    0.0300 /0.0450  Main Channel
               1256.00         175.00         0.0450
               1301.00         176.00         0.0450

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.19   172.24    .474E+02         0.0          0.26       22.37
        0.38   172.43    .190E+03         0.2          0.41       14.09
        0.57   172.62    .427E+03         0.7          0.54       10.75
        0.76   172.81    .758E+03         1.4          0.66        8.88
        0.95   173.00    .119E+04         2.6          0.76        7.65
```

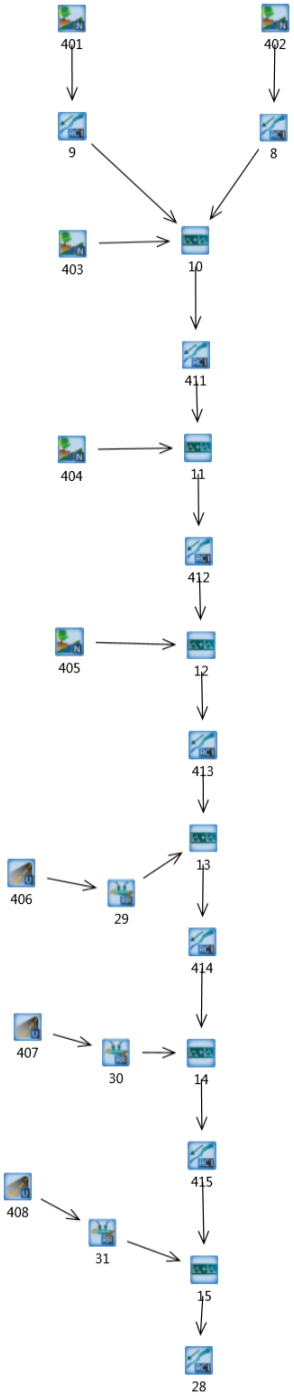
```
        1.16   173.21    .319E+04         5.9          0.64        9.06
        1.38   173.43    .600E+04        11.7          0.68        8.52
        1.59   173.64    .953E+04        20.3          0.74        7.83
        1.81   173.86    .138E+05        31.8          0.81        7.23
        2.02   174.07    .188E+05        46.9          0.88        6.66
        2.24   174.29    .242E+05        66.1          0.96        6.11
        2.45   174.50    .302E+05        88.8          1.03        5.66
        2.66   174.71    .366E+05       115.0          1.10        5.30
        2.88   174.93    .434E+05       145.0          1.17        4.99
        3.09   175.14    .509E+05       176.5          1.21        4.80
        3.31   175.36    .592E+05       212.5          1.26        4.65
        3.52   175.57    .686E+05       254.0          1.30        4.50
        3.74   175.79    .790E+05       301.4          1.34        4.37
        3.95   176.00    .903E+05       354.8          1.37        4.24

                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK    TPEAK   R.V.    MAX DEPTH   MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
    INFLOW : ID= 2 (0015) 1283.10    16.96   19.67  58.53      1.51       0.72
    OUTFLOW: ID= 1 (0028) 1283.10    16.96   19.77  58.53      1.51       0.72


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

 FINISH
================================================================================
```

Scenario 5- Proposed Conditions with control-25mm ONLY



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

       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    Company
        OOO     T      T    H   H    Y    M   M   OOO               Serial

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


  Input   filename: C:\Program Files (x86)\Visual Otthymo 2.4\VO2\voin.dat
  Output  filename: C:\Users\dingm\AppData\Local\Temp\4a0cb172-3a23-45a2-b2be-bb0c83ce55be\Scenario.out
  Summary filename: C:\Users\dingm\AppData\Local\Temp\4a0cb172-3a23-45a2-b2be-bb0c83ce55be\Scenario.sum


DATE: 11/10/2016                          TIME: 09:41:50

USER:


COMMENTS: _____________________________________________

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

-------------------
| MASS STORM      |     Filename: C:\Users\dingm\AppD
|                 |               ata\Local\Temp\
|                 |               4a0cb172-3a23-45a2-b2be-bb0c83ce55be\bd78fa12
| Ptotal= 98.50 mm |    Comments: 24 HOUR SCS TYPE II MASS CURVE: 15 MIN S
-------------------

                     Duration of storm    = 24.00 hrs
                     Mass curve time step = 15.00 min

      TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |   TIME    RAIN
       hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |    hrs   mm/hr
      0.25    1.18 |   6.25    1.97 |'  12.25   14.18 |  18.25    1.58
      0.50    1.18 |   6.50    1.58 |'  12.50   14.18 |  18.50    1.97
      0.75    0.79 |   6.75    1.97 |'  12.75    7.49 |  18.75    1.58
      1.00    1.18 |   7.00    1.58 |'  13.00    7.09 |  19.00    1.97
      1.25    1.18 |   7.25    2.36 |'  13.25    5.12 |  19.25    1.58
      1.50    1.18 |   7.50    1.97 |'  13.50    5.12 |  19.50    1.97
      1.75    0.79 |   7.75    2.36 |'  13.75    4.33 |  19.75    1.58
      2.00    1.18 |   8.00    1.97 |'  14.00    3.94 |  20.00    1.97
      2.25    1.18 |   8.25    2.76 |'  14.25    3.15 |  20.25    1.18
      2.50    1.58 |   8.50    2.36 |'  14.50    2.76 |  20.50    1.18
      2.75    1.18 |   8.75    2.76 |'  14.75    3.15 |  20.75    1.18
      3.00    1.18 |   9.00    2.76 |'  15.00    2.76 |  21.00    1.18
      3.25    1.18 |   9.25    3.15 |'  15.25    3.15 |  21.25    1.18
      3.50    1.58 |   9.50    3.15 |'  15.50    2.76 |  21.50    1.18
      3.75    1.18 |   9.75    3.55 |'  15.75    3.15 |  21.75    1.18
      4.00    1.18 |  10.00    3.55 |'  16.00    2.76 |  22.00    1.18
      4.25    1.58 |  10.25    4.73 |'  16.25    1.97 |  22.25    1.18
      4.50    1.58 |  10.50    4.33 |'  16.50    1.58 |  22.50    1.18
      4.75    1.58 |  10.75    6.30 |'  16.75    1.97 |  22.75    1.18
      5.00    1.58 |  11.00    5.91 |'  17.00    1.58 |  23.00    1.18
      5.25    1.58 |  11.25    9.46 |'  17.25    1.97 |  23.25    1.18
      5.50    1.58 |  11.50    9.46 |'  17.50    1.58 |  23.50    1.18
      5.75    1.58 |  11.75   29.16 |'  17.75    1.58 |  23.75    1.18
      6.00    1.58 |  12.00  120.56 |'  18.00    1.97 |  24.00    1.18

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| CALIB           |
| NASHYD   (0402) |    Area    (ha)= 500.20   Curve Number   (CN)= 78.0
|ID= 1 DT= 2.0 min |    Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=   4.08

        NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.
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```
                    ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |   TIME    RAIN |'  TIME    RAIN |   TIME    RAIN
       hrs   mm/hr |    hrs   mm/hr |'   hrs   mm/hr |    hrs   mm/hr
      0.033   1.18 |  6.033    1.97 |' 12.033   14.18 | 18.033    1.58
      0.067   1.18 |  6.067    1.97 |' 12.067   14.18 | 18.07     1.58
      0.100   1.18 |  6.100    1.97 |' 12.100   14.18 | 18.10     1.58
      0.133   1.18 |  6.133    1.97 |' 12.133   14.18 | 18.13     1.58
      0.167   1.18 |  6.167    1.97 |' 12.167   14.18 | 18.17     1.58
      0.200   1.18 |  6.200    1.97 |' 12.200   14.18 | 18.20     1.58
      0.233   1.18 |  6.233    1.97 |' 12.233   14.18 | 18.23     1.58
      0.267   1.18 |  6.267    1.77 |' 12.267   14.18 | 18.27     1.77
      0.300   1.18 |  6.300    1.58 |' 12.300   14.18 | 18.30     1.97
      0.333   1.18 |  6.333    1.58 |' 12.333   14.18 | 18.33     1.97
      0.367   1.18 |  6.367    1.58 |' 12.367   14.18 | 18.37     1.97
      0.400   1.18 |  6.400    1.58 |' 12.400   14.18 | 18.40     1.97
      0.433   1.18 |  6.433    1.58 |' 12.433   14.18 | 18.43     1.97
      0.467   1.18 |  6.467    1.58 |' 12.467   14.18 | 18.47     1.97
      0.500   1.18 |  6.500    1.58 |' 12.500   14.17 | 18.50     1.97
      0.533   0.79 |  6.533    1.97 |' 12.533    7.49 | 18.53     1.58
      0.567   0.79 |  6.567    1.97 |' 12.567    7.49 | 18.57     1.58
      0.600   0.79 |  6.600    1.97 |' 12.600    7.49 | 18.60     1.58
      0.633   0.79 |  6.633    1.97 |' 12.633    7.49 | 18.63     1.58
      0.667   0.79 |  6.667    1.97 |' 12.667    7.49 | 18.67     1.58
      0.700   0.79 |  6.700    1.97 |' 12.700    7.49 | 18.70     1.58
      0.733   0.79 |  6.733    1.97 |' 12.733    7.49 | 18.73     1.58
      0.767   0.99 |  6.767    1.77 |' 12.767    7.29 | 18.77     1.77
      0.800   1.18 |  6.800    1.58 |' 12.800    7.09 | 18.80     1.97
      0.833   1.18 |  6.833    1.58 |' 12.833    7.09 | 18.83     1.97
      0.867   1.18 |  6.867    1.58 |' 12.867    7.09 | 18.87     1.97
      0.900   1.18 |  6.900    1.58 |' 12.900    7.09 | 18.90     1.97
      0.933   1.18 |  6.933    1.58 |' 12.933    7.09 | 18.93     1.97
      0.967   1.18 |  6.967    1.58 |' 12.967    7.09 | 18.97     1.97
      1.000   1.18 |  7.000    1.58 |' 13.000    7.09 | 19.00     1.97
      1.033   1.18 |  7.033    2.36 |' 13.033    5.52 | 19.03     1.58
      1.067   1.18 |  7.067    2.36 |' 13.067    5.52 | 19.07     1.58
      1.100   1.18 |  7.100    2.36 |' 13.100    5.52 | 19.10     1.58
      1.133   1.18 |  7.133    2.36 |' 13.133    5.52 | 19.13     1.58
      1.167   1.18 |  7.167    2.36 |' 13.167    5.52 | 19.17     1.58
      1.200   1.18 |  7.200    2.36 |' 13.200    5.52 | 19.20     1.58
      1.233   1.18 |  7.233    2.36 |' 13.233    5.52 | 19.23     1.58
      1.267   1.18 |  7.267    2.17 |' 13.267    5.32 | 19.27     1.77
      1.300   1.18 |  7.300    1.97 |' 13.300    5.12 | 19.30     1.97
      1.333   1.18 |  7.333    1.97 |' 13.333    5.12 | 19.33     1.97
      1.367   1.18 |  7.367    1.97 |' 13.367    5.12 | 19.37     1.97
      1.400   1.18 |  7.400    1.97 |' 13.400    5.12 | 19.40     1.97
      1.433   1.18 |  7.433    1.97 |' 13.433    5.12 | 19.43     1.97
      1.467   1.18 |  7.467    1.97 |' 13.467    5.12 | 19.47     1.97
      1.500   1.18 |  7.500    1.97 |' 13.500    5.12 | 19.50     1.97
      1.533   0.79 |  7.533    2.36 |' 13.533    4.33 | 19.53     1.58
      1.567   0.79 |  7.567    2.36 |' 13.567    4.33 | 19.57     1.58
      1.600   0.79 |  7.600    2.36 |' 13.600    4.33 | 19.60     1.58
      1.633   0.79 |  7.633    2.36 |' 13.633    4.33 | 19.63     1.58
      1.667   0.79 |  7.667    2.36 |' 13.667    4.33 | 19.67     1.58
      1.700   0.79 |  7.700    2.36 |' 13.700    4.33 | 19.70     1.58
      1.733   0.79 |  7.733    2.36 |' 13.733    4.33 | 19.73     1.58
      1.767   0.98 |  7.767    2.17 |' 13.767    4.14 | 19.77     1.77
      1.800   1.18 |  7.800    1.97 |' 13.800    3.94 | 19.80     1.97
      1.833   1.18 |  7.833    1.97 |' 13.833    3.94 | 19.83     1.97
      1.867   1.18 |  7.867    1.97 |' 13.867    3.94 | 19.87     1.97
      1.900   1.18 |  7.900    1.97 |' 13.900    3.94 | 19.90     1.97
      1.933   1.18 |  7.933    1.97 |' 13.933    3.94 | 19.93     1.97
      1.967   1.18 |  7.967    1.97 |' 13.967    3.94 | 19.97     1.97
      2.000   1.18 |  8.000    1.97 |' 14.000    3.94 | 20.00     1.97
      2.033   1.18 |  8.033    2.76 |' 14.033    3.15 | 20.03     1.18
      2.067   1.18 |  8.067    2.76 |' 14.067    3.15 | 20.07     1.18
      2.100   1.18 |  8.100    2.76 |' 14.100    3.15 | 20.10     1.18
      2.133   1.18 |  8.133    2.76 |' 14.133    3.15 | 20.13     1.18
      2.167   1.18 |  8.167    2.76 |' 14.167    3.15 | 20.17     1.18
      2.200   1.18 |  8.200    2.76 |' 14.200    3.15 | 20.20     1.18
      2.233   1.18 |  8.233    2.76 |' 14.233    3.15 | 20.23     1.18
      2.267   1.18 |  8.267    2.56 |' 14.267    2.95 | 20.27     1.18
      2.300   1.58 |  8.300    2.36 |' 14.300    2.76 | 20.30     1.18
      2.333   1.58 |  8.333    2.36 |' 14.333    2.76 | 20.33     1.18
      2.367   1.58 |  8.367    2.36 |' 14.367    2.76 | 20.37     1.18
      2.400   1.58 |  8.400    2.36 |' 14.400    2.76 | 20.40     1.18
      2.433   1.58 |  8.433    2.36 |' 14.433    2.76 | 20.43     1.18
      2.467   1.58 |  8.467    2.36 |' 14.467    2.76 | 20.47     1.18
      2.500   1.58 |  8.500    2.36 |' 14.500    2.76 | 20.50     1.18
      2.533   1.18 |  8.533    2.76 |' 14.533    3.15 | 20.53     1.18
      2.567   1.18 |  8.567    2.76 |' 14.567    3.15 | 20.57     1.18
      2.600   1.18 |  8.600    2.76 |' 14.600    3.15 | 20.60     1.18
      2.633   1.18 |  8.633    2.76 |' 14.633    3.15 | 20.63     1.18
      2.667   1.18 |  8.667    2.76 |' 14.667    3.15 | 20.67     1.18
      2.700   1.18 |  8.700    2.76 |' 14.700    3.15 | 20.70     1.18
      2.733   1.18 |  8.733    2.76 |' 14.733    3.15 | 20.73     1.18
      2.767   1.18 |  8.767    2.76 |' 14.767    2.95 | 20.77     1.18
      2.800   1.18 |  8.800    2.76 |' 14.800    2.76 | 20.80     1.18
      2.833   1.18 |  8.833    2.76 |' 14.833    2.76 | 20.83     1.18
      2.867   1.18 |  8.867    2.76 |' 14.867    2.76 | 20.87     1.18
      2.900   1.18 |  8.900    2.76 |' 14.900    2.76 | 20.90     1.18
      2.933   1.18 |  8.933    2.76 |' 14.933    2.76 | 20.93     1.18
      2.967   1.18 |  8.967    2.76 |' 14.967    2.76 | 20.97     1.18
      3.000   1.18 |  9.000    2.76 |' 15.000    2.76 | 21.00     1.18
      3.033   1.18 |  9.033    3.15 |' 15.033    3.15 | 21.03     1.18
      3.067   1.18 |  9.067    3.15 |' 15.067    3.15 | 21.07     1.18
      3.100   1.18 |  9.100    3.15 |' 15.100    3.15 | 21.10     1.18
      3.133   1.18 |  9.133    3.15 |' 15.133    3.15 | 21.13     1.18
      3.167   1.18 |  9.167    3.15 |' 15.167    3.15 | 21.17     1.18
      3.200   1.18 |  9.200    3.15 |' 15.200    3.15 | 21.20     1.18
      3.233   1.18 |  9.233    3.15 |' 15.233    3.15 | 21.23     1.18
      3.267   1.58 |  9.267    3.15 |' 15.267    2.95 | 21.27     1.18
      3.300   1.58 |  9.300    3.15 |' 15.300    2.76 | 21.30     1.18
      3.333   1.58 |  9.333    3.15 |' 15.333    2.76 | 21.33     1.18
      3.367   1.58 |  9.367    3.15 |' 15.367    2.76 | 21.37     1.18
      3.400   1.58 |  9.400    3.15 |' 15.400    2.76 | 21.40     1.18
      3.433   1.58 |  9.433    3.15 |' 15.433    2.76 | 21.43     1.18
      3.467   1.58 |  9.467    3.15 |' 15.467    2.76 | 21.47     1.18
      3.500   1.58 |  9.500    3.15 |' 15.500    2.76 | 21.50     1.18
      3.533   1.18 |  9.533    3.55 |' 15.533    3.15 | 21.53     1.18
      3.567   1.18 |  9.567    3.55 |' 15.567    3.15 | 21.57     1.18
      3.600   1.18 |  9.600    3.55 |' 15.600    3.15 | 21.60     1.18
      3.633   1.18 |  9.633    3.55 |' 15.633    3.15 | 21.63     1.18
      3.667   1.18 |  9.667    3.55 |' 15.667    3.15 | 21.67     1.18
      3.700   1.18 |  9.700    3.55 |' 15.700    3.15 | 21.70     1.18
      3.733   1.18 |  9.733    3.55 |' 15.733    3.15 | 21.73     1.18
      3.767   1.18 |  9.767    3.55 |' 15.767    2.95 | 21.77     1.18
      3.800   1.18 |  9.800    3.55 |' 15.800    2.76 | 21.80     1.18
      3.833   1.18 |  9.833    3.55 |' 15.833    2.76 | 21.83     1.18
      3.867   1.18 |  9.867    3.55 |' 15.867    2.76 | 21.87     1.18
      3.900   1.18 |  9.900    3.55 |' 15.900    2.76 | 21.90     1.18
      3.933   1.18 |  9.933    3.55 |' 15.933    2.76 | 21.93     1.18
      3.967   1.18 |  9.967    3.55 |' 15.967    2.76 | 21.97     1.18
      4.000   1.18 | 10.000    3.55 |' 16.000    2.76 | 22.00     1.18
      4.033   1.58 | 10.033    4.73 |' 16.033    1.97 | 22.03     1.18
      4.067   1.58 | 10.067    4.73 |' 16.067    1.97 | 22.07     1.18
      4.100   1.58 | 10.100    4.73 |' 16.100    1.97 | 22.10     1.18
      4.133   1.58 | 10.133    4.73 |' 16.133    1.97 | 22.13     1.18
      4.167   1.58 | 10.167    4.73 |' 16.167    1.97 | 22.17     1.18
      4.200   1.58 | 10.200    4.73 |' 16.200    1.97 | 22.20     1.18
      4.233   1.58 | 10.233    4.73 |' 16.233    1.97 | 22.23     1.18
      4.267   1.58 | 10.267    4.53 |' 16.267    1.77 | 22.27     1.18
      4.300   1.58 | 10.300    4.33 |' 16.300    1.58 | 22.30     1.18
      4.333   1.58 | 10.333    4.33 |' 16.333    1.58 | 22.33     1.18
      4.367   1.58 | 10.367    4.33 |' 16.367    1.58 | 22.37     1.18
      4.400   1.58 | 10.400    4.33 |' 16.400    1.58 | 22.40     1.18
      4.433   1.58 | 10.433    4.33 |' 16.433    1.58 | 22.43     1.18
      4.467   1.58 | 10.467    4.33 |' 16.467    1.58 | 22.47     1.18
      4.500   1.58 | 10.500    4.34 |' 16.500    1.58 | 22.50     1.18
      4.533   1.58 | 10.533    6.30 |' 16.533    1.97 | 22.53     1.18
      4.567   1.58 | 10.567    6.30 |' 16.567    1.97 | 22.57     1.18
      4.600   1.58 | 10.600    6.30 |' 16.600    1.97 | 22.60     1.18
      4.633   1.58 | 10.633    6.30 |' 16.633    1.97 | 22.63     1.18
      4.667   1.58 | 10.667    6.30 |' 16.667    1.97 | 22.67     1.18
      4.700   1.58 | 10.700    6.30 |' 16.700    1.97 | 22.70     1.18
      4.733   1.58 | 10.733    6.30 |' 16.733    1.97 | 22.73     1.18
      4.767   1.58 | 10.767    6.11 |' 16.767    1.77 | 22.77     1.18
      4.800   1.58 | 10.800    5.91 |' 16.800    1.58 | 22.80     1.18
      4.833   1.58 | 10.833    5.91 |' 16.833    1.58 | 22.83     1.18
      4.867   1.58 | 10.867    5.91 |' 16.867    1.58 | 22.87     1.18
      4.900   1.58 | 10.900    5.91 |' 16.900    1.58 | 22.90     1.18
      4.933   1.58 | 10.933    5.91 |' 16.933    1.58 | 22.93     1.18
      4.967   1.58 | 10.967    5.91 |' 16.967    1.58 | 22.97     1.18
      5.000   1.58 | 11.000    5.91 |' 17.000    1.58 | 23.00     1.18
      5.033   1.58 | 11.033    9.46 |' 17.033    1.97 | 23.03     1.18
      5.067   1.58 | 11.067    9.46 |' 17.067    1.97 | 23.07     1.18
      5.100   1.58 | 11.100    9.46 |' 17.100    1.97 | 23.10     1.18
      5.133   1.58 | 11.133    9.46 |' 17.133    1.97 | 23.13     1.18
      5.167   1.58 | 11.167    9.46 |' 17.167    1.97 | 23.17     1.18
      5.200   1.58 | 11.200    9.46 |' 17.200    1.97 | 23.20     1.18
      5.233   1.58 | 11.233    9.46 |' 17.233    1.97 | 23.23     1.18
      5.267   1.58 | 11.267    9.46 |' 17.267    1.77 | 23.27     1.18
      5.300   1.58 | 11.300    9.46 |' 17.300    1.58 | 23.30     1.18
      5.333   1.58 | 11.333    9.46 |' 17.333    1.58 | 23.33     1.18
      5.367   1.58 | 11.367    9.46 |' 17.367    1.58 | 23.37     1.18
      5.400   1.58 | 11.400    9.46 |' 17.400    1.58 | 23.40     1.18
      5.433   1.58 | 11.433    9.46 |' 17.433    1.58 | 23.43     1.18
      5.467   1.58 | 11.467    9.46 |' 17.467    1.58 | 23.47     1.18
      5.500   1.58 | 11.500    9.48 |' 17.500    1.58 | 23.50     1.18
      5.533   1.58 | 11.533   29.16 |' 17.533    1.58 | 23.53     1.18
      5.567   1.58 | 11.567   29.16 |' 17.567    1.58 | 23.57     1.18
      5.600   1.58 | 11.600   29.16 |' 17.600    1.58 | 23.60     1.18
      5.633   1.58 | 11.633   29.16 |' 17.633    1.58 | 23.63     1.18
      5.667   1.58 | 11.667   29.16 |' 17.667    1.58 | 23.67     1.18
      5.700   1.58 | 11.700   29.16 |' 17.700    1.58 | 23.70     1.18
      5.733   1.58 | 11.733   29.16 |' 17.733    1.58 | 23.73     1.18
      5.767   1.58 | 11.767   74.98 |' 17.767    1.77 | 23.77     1.18
      5.800   1.58 | 11.800  120.56 |' 17.800    1.97 | 23.80     1.18
      5.833   1.58 | 11.833  120.56 |' 17.833    1.97 | 23.83     1.18
      5.867   1.58 | 11.867  120.56 |' 17.867    1.97 | 23.87     1.18
      5.900   1.58 | 11.900  120.56 |' 17.900    1.97 | 23.90     1.18
      5.933   1.58 | 11.933  120.56 |' 17.933    1.97 | 23.93     1.18
      5.967   1.58 | 11.967  120.56 |' 17.967    1.97 | 23.97     1.18
      6.000   1.58 | 12.000  120.41 |' 18.000    1.97 | 24.00     1.18

     Unit Hyd Qpeak  (cms)=   4.683

     PEAK FLOW       (cms)=   7.582 (i)
     TIME TO PEAK    (hrs)=  16.533
     RUNOFF VOLUME    (mm)=  55.202
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.560

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

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| ROUTE CHN (0008) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
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                <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation        Manning
                  0.00         179.00          0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.50          0.0300     Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00          0.0450

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)       (m/s)       (min)
        0.03   178.52    .531E+00         0.0        0.07      194.95
        0.05   178.55    .213E+01         0.0        0.12      122.81
        0.08   178.58    .478E+01         0.0        0.15       93.72
        0.10   178.60    .850E+01         0.0        0.18       77.36
        0.13   178.63    .133E+02         0.0        0.21       66.67
        0.15   178.65    .191E+02         0.0        0.24       59.04
        0.18   178.68    .260E+02         0.0        0.27       53.27
        0.20   178.70    .340E+02         0.0        0.29       48.74
        0.23   178.73    .430E+02         0.0        0.31       45.06
        0.25   178.75    .531E+02         0.0        0.34       42.00
        0.28   178.78    .641E+02         0.0        0.36       39.41
        0.30   178.80    .765E+02         0.0        0.38       37.19
        0.33   178.83    .898E+02         0.0        0.40       35.26
        0.35   178.85    .104E+03         0.1        0.42       33.56
        0.38   178.88    .120E+03         0.1        0.44       32.05
        0.40   178.90    .136E+03         0.1        0.46       30.70
        0.43   178.93    .154E+03         0.1        0.48       29.49
        0.45   178.95    .172E+03         0.1        0.50       28.38
        0.48   178.98    .192E+03         0.1        0.52       27.38

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED

                                  <----- hydrograph ---->    <-pipe / channel->
                          AREA    QPEAK    TPEAK   R.V.    MAX DEPTH  MAX VEL
                          (ha)    (cms)    (hrs)   (mm)       (m)       (m/s)
     INFLOW : ID= 2 (0402)  500.20     7.58   16.53  55.20      0.47      0.52
     OUTFLOW: ID= 1 (0008)  500.20     7.51   17.07  55.79      0.48      0.52

--------------------------------------------------------------------------------------------------------
-------------------
| CALIB           |
| NASHYD   (0401) |    Area    (ha)= 288.80   Curve Number   (CN)= 77.0
|ID= 1 DT= 2.0 min |    Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=   2.23

     Unit Hyd Qpeak  (cms)=   4.947

     PEAK FLOW       (cms)=   6.857 (i)
     TIME TO PEAK    (hrs)=  14.367
     RUNOFF VOLUME    (mm)=  54.414
```

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     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT    =   0.552

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

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-------------------
| ROUTE CHN (0009) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.50         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

       <---------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
          (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
        0.03    178.52    .844E+00         0.0          0.05     437.87
        0.05    178.55    .338E+01         0.0          0.08     275.84
        0.08    178.58    .760E+01         0.0          0.11     210.51
        0.10    178.60    .135E+02         0.0          0.13     173.77
        0.13    178.63    .211E+02         0.0          0.15     149.75
        0.15    178.65    .304E+02         0.0          0.17     132.61
        0.18    178.68    .414E+02         0.0          0.19     119.66
        0.20    178.70    .540E+02         0.0          0.21     109.47
        0.23    178.73    .684E+02         0.0          0.22     101.20
        0.25    178.75    .844E+02         0.0          0.24      94.34
        0.28    178.78    .102E+03         0.0          0.25      88.53
        0.30    178.80    .122E+03         0.0          0.27      83.54
        0.33    178.83    .143E+03         0.0          0.28      79.20
        0.35    178.85    .165E+03         0.0          0.30      75.38
        0.38    178.88    .190E+03         0.0          0.31      71.99
        0.40    178.90    .216E+03         0.1          0.33      68.96
        0.43    178.93    .244E+03         0.1          0.34      66.23
        0.45    178.95    .273E+03         0.1          0.35      63.75
        0.48    178.98    .305E+03         0.1          0.37      61.49

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0401)  288.80    6.86   14.37  54.41      0.47      0.36
     OUTFLOW: ID= 1 (0009)  288.80    6.01   15.50  54.43      0.48      0.37


-------------------------------------------------------------------------------
-------------------
| CALIB             |
| NASHYD    (0403)  |   Area    (ha)= 149.40   Curve Number   (CN)= 79.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.33

     Unit Hyd Qpeak  (cms)=   2.449

     PEAK FLOW       (cms)=   3.615 (i)
     TIME TO PEAK    (hrs)=  14.467
     RUNOFF VOLUME    (mm)=  57.170
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.580

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

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (0010) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------             (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0008):   500.20   7.509    17.07    55.79
      + ID2= 2 (0009):   288.80   6.010    15.50    54.43
        ================================================
        ID = 3 (0010):   789.00  13.037    16.17    55.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (0010) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
-------------------             (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (0010):   789.00  13.037    16.17    55.29
      + ID2= 2 (0403):   149.40   3.615    14.47    57.17
        ================================================
        ID = 1 (0010):   938.40  16.000    15.77    55.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (0411) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

       <---------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
          (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
        0.01    178.76    .61OE+00         0.0          0.05     692.07
        0.03    178.77    .244E+01         0.0          0.07     435.98
        0.04    178.79    .549E+01         0.0          0.10     332.71
        0.05    178.80    .975E+01         0.0          0.12     274.65
        0.06    178.81    .152E+02         0.0          0.14     236.68
        0.08    178.82    .219E+02         0.0          0.16     209.59
        0.09    178.84    .299E+02         0.0          0.17     189.12
        0.10    178.85    .39OE+02         0.0          0.19     173.02
        0.11    178.86    .494E+02         0.0          0.20     159.95
        0.13    178.88    .61OE+02         0.0          0.22     149.10
        0.14    178.89    .737E+02         0.0          0.23     139.92
        0.15    178.90    .878E+02         0.0          0.25     132.04
        0.16    178.91    .103E+03         0.0          0.26     125.18
        0.18    178.93    .119E+03         0.0          0.27     119.14
        0.19    178.94    .137E+03         0.0          0.29     113.79
        0.20    178.95    .156E+03         0.0          0.30     108.99
        0.21    178.96    .176E+03         0.0          0.31     104.68
        0.23    178.98    .197E+03         0.0          0.32     100.76
        0.24    178.99    .220E+03         0.0          0.33      97.19

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0010)  938.40   16.00   15.77  55.59      0.24      0.33
     OUTFLOW: ID= 1 (0411)  938.40   13.55   17.77  55.59      0.24      0.33


-------------------------------------------------------------------------------
-------------------
| CALIB             |
| NASHYD    (0404)  |   Area    (ha)= 197.30   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   3.10

     Unit Hyd Qpeak  (cms)=   2.431

     PEAK FLOW       (cms)=   4.018 (i)
     TIME TO PEAK    (hrs)=  15.333
     RUNOFF VOLUME    (mm)=  59.949
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.609

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

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (0011) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------             (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0404):   197.30   4.018    15.33    59.95
      + ID2= 2 (0411):   938.40  13.550    17.77    55.59
        ================================================
        ID = 3 (0011):  1135.70  16.761    17.27    56.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (0412) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450

       <---------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
          (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
        0.01    178.76    .266E+00         0.0          0.05     269.82
        0.03    178.77    .106E+01         0.0          0.08     169.98
        0.04    178.79    .239E+01         0.0          0.11     129.72
        0.05    178.80    .425E+01         0.0          0.13     107.08
        0.06    178.81    .664E+01         0.0          0.15      92.28
        0.08    178.82    .956E+01         0.0          0.17      81.72
        0.09    178.84    .130E+02         0.0          0.19      73.74
        0.10    178.85    .170E+02         0.0          0.21      67.46
        0.11    178.86    .215E+02         0.0          0.23      62.36
        0.13    178.88    .266E+02         0.0          0.24      58.13
        0.14    178.89    .321E+02         0.0          0.26      54.55
        0.15    178.90    .383E+02         0.0          0.28      51.48
        0.16    178.91    .449E+02         0.0          0.29      48.80
        0.18    178.93    .521E+02         0.0          0.30      46.45
        0.19    178.94    .598E+02         0.0          0.32      44.36
        0.20    178.95    .680E+02         0.0          0.33      42.49
        0.21    178.96    .76BE+02         0.0          0.35      40.81
        0.23    178.98    .861E+02         0.0          0.36      39.29
        0.24    178.99    .959E+02         0.0          0.37      37.89

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0011) 1135.70   16.76   17.27  56.38      0.24      0.37
     OUTFLOW: ID= 1 (0412) 1135.70   16.44   18.00  56.38      0.24      0.37


-------------------------------------------------------------------------------
-------------------
| CALIB             |
| NASHYD    (0405)  |   Area    (ha)=  56.10   Curve Number   (CN)= 81.0
|ID= 1 DT= 2.0 min  |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   1.64

     Unit Hyd Qpeak  (cms)=   1.307

     PEAK FLOW       (cms)=   1.878 (i)
     TIME TO PEAK    (hrs)=  13.667
     RUNOFF VOLUME    (mm)=  60.089
     TOTAL RAINFALL   (mm)=  98.499
     RUNOFF COEFFICIENT   =   0.610

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

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------             (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0405):    56.10   1.878    13.67    60.09
      + ID2= 2 (0412):  1135.70  16.443    18.00    56.38
        ================================================
        ID = 3 (0012):  1191.80  16.880    17.87    56.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (0413) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
               <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation        Manning
                  0.00         179.00         0.0450
                 10.00         179.00     0.0450 /0.0300  Main Channel
                 10.50         178.75         0.0300      Main Channel
                 11.00         179.00     0.0300 /0.0450  Main Channel
                 21.00         179.00         0.0450
```

```
       <---------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
          (m)       (m)    (cu.m.)       (cms)         (m/s)      (min)
        0.01    178.76    .391E+00         0.0          0.05     443.64
        0.03    178.77    .156E+01         0.0          0.07     279.47
        0.04    178.79    .352E+01         0.0          0.10     213.28
        0.05    178.80    .625E+01         0.0          0.12     176.06
        0.06    178.81    .977E+01         0.0          0.14     151.72
        0.08    178.82    .141E+02         0.0          0.16     134.36
        0.09    178.84    .191E+02         0.0          0.17     121.23
        0.10    178.85    .25OE+02         0.0          0.19     110.91
        0.11    178.86    .316E+02         0.0          0.20     102.53
        0.13    178.88    .391E+02         0.0          0.22      95.58
        0.14    178.89    .473E+02         0.0          0.23      89.69
        0.15    178.90    .563E+02         0.0          0.25      84.64
        0.16    178.91    .66OE+02         0.0          0.26      80.24
        0.18    178.93    .766E+02         0.0          0.27      76.37
        0.19    178.94    .879E+02         0.0          0.29      72.94
        0.20    178.95    .100E+03         0.0          0.30      69.87
        0.21    178.96    .113E+03         0.0          0.31      67.10
        0.23    178.98    .127E+03         0.0          0.32      64.59
        0.24    178.99    .141E+03         0.0          0.33      62.30

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (0012) 1191.80   16.88   17.87  56.55      0.24      0.33
     OUTFLOW: ID= 1 (0413) 1191.80   16.12   19.10  56.55      0.24      0.33


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-------------------
| CALIB             |
| STANDHYD  (0406)  |   Area    (ha)=  65.30
|ID= 1 DT= 2.0 min  |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
-------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      45.71         19.59
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     659.80         40.00
     Mannings n             =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)         8.00         14.00
     Storage Coeff. (min)=        7.35 (ii)    12.49 (ii)
     Unit Hyd. Tpeak (min)=       8.00         14.00
     Unit Hyd. peak  (cms)=       0.15          0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=      10.00          5.02         14.620 (iii)
     TIME TO PEAK    (hrs)=      12.03         12.10          12.03
     RUNOFF VOLUME    (mm)=      97.49         69.27          84.80
     TOTAL RAINFALL   (mm)=      98.50         98.50          98.50
     RUNOFF COEFFICIENT   =       0.99          0.70           0.86


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*   =  81.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| RESERVOIR (0029) |
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0910      1.1400
                         0.0300     0.2280   |  16.0000      1.3680

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0406)     65.300    14.620     12.03      84.80
     OUTFLOW: ID= 1 (0029)     65.300    14.123     12.07      80.64

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.60
                    TIME SHIFT OF PEAK FLOW         (min)=  2.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=  1.3424

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-------------------
| ADD HYD   (0013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0029):    65.30  14.123    12.07    80.64
      + ID2= 2 (0413):  1191.80  16.121    19.10    56.55
        ================================================
        ID = 3 (0013):  1257.10  16.442    19.07    57.80

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (0414) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                0.00         179.00        0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75        0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00        0.0450

     <---------------------- TRAVEL TIME TABLE ----------------------->
      DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
      0.01   178.76    .109E+00        0.0         0.04     143.43
      0.03   178.77    .438E+00        0.0         0.06      90.36
      0.04   178.79    .985E+00        0.0         0.08      68.96
      0.05   178.80    .175E+01        0.0         0.10      56.92
      0.06   178.81    .273E+01        0.0         0.12      49.05
      0.08   178.82    .394E+01        0.0         0.13      43.44
      0.09   178.84    .536E+01        0.0         0.15      39.20
      0.10   178.85    .700E+01        0.0         0.16      35.86
      0.11   178.86    .886E+01        0.0         0.18      33.15
      0.13   178.88    .109E+02        0.0         0.19      30.90
      0.14   178.89    .132E+02        0.0         0.20      29.00
      0.15   178.90    .158E+02        0.0         0.21      27.37
      0.16   178.91    .185E+02        0.0         0.22      25.94
      0.18   178.93    .214E+02        0.0         0.24      24.69
      0.19   178.94    .246E+02        0.0         0.25      23.58
      0.20   178.95    .280E+02        0.0         0.26      22.59
      0.21   178.96    .316E+02        0.0         0.27      21.69
      0.23   178.98    .354E+02        0.0         0.28      20.88
      0.24   178.99    .395E+02        0.0         0.29      20.14

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0013) 1257.10    16.44   19.07  57.80      0.24      0.29
     OUTFLOW: ID= 1 (0414) 1257.10    16.37   19.50  57.80      0.22      0.28


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-------------------
| CALIB             |
| STANDHYD  (0407) |   Area    (ha)=  16.70
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  55.00
-------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.69          5.01
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     333.67         40.00
     Mannings n            =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56        148.13
               over (min)         5.00         12.00
     Storage Coeff.  (min)=       4.88 (ii)    10.02 (ii)
     Unit Hyd. Tpeak (min)=       4.00         12.00
     Unit Hyd. peak  (cms)=       0.24          0.11
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.93          1.43          4.219 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.07          12.00
     RUNOFF VOLUME    (mm)=      97.49         69.27          84.80
     TOTAL RAINFALL   (mm)=      98.50         98.50          98.50
     RUNOFF COEFFICIENT   =       0.99          0.70           0.86

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| RESERVOIR (0030) |
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0230     0.2940
                         0.0100     0.0590   |   4.5000     0.3530

                            AREA     QPEAK     TPEAK       R.V.
                            (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0407)     16.700     4.219     12.00      84.80
     OUTFLOW: ID= 1 (0030)     16.700     4.032     12.03      81.38

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.57
                   TIME SHIFT OF PEAK FLOW          (min)=  2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.3472

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-------------------
| ADD HYD   (0014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0030):    16.70   4.032    12.03    81.38
      + ID2= 2 (0414):  1257.10  16.367    19.50    57.80
        ================================================
        ID = 3 (0014):  1273.80  16.450    19.50    58.11

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| ROUTE CHN (0415) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                0.00         179.00        0.0450
               10.00         179.00    0.0450 /0.0300  Main Channel
               10.50         178.75        0.0300      Main Channel
               11.00         179.00    0.0300 /0.0450  Main Channel
               21.00         179.00        0.0450

     <---------------------- TRAVEL TIME TABLE ----------------------->
      DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
      0.01   178.76    .625E-01        0.0         0.02     141.96
      0.03   178.77    .250E+00        0.0         0.04      89.43
      0.04   178.79    .563E+00        0.0         0.05      68.25
      0.05   178.80    .100E+01        0.0         0.06      56.34
      0.06   178.81    .156E+01        0.0         0.07      48.55
      0.08   178.82    .225E+01        0.0         0.08      42.99
      0.09   178.84    .306E+01        0.0         0.09      38.79
      0.10   178.85    .400E+01        0.0         0.09      35.49
      0.11   178.86    .506E+01        0.0         0.10      32.81
      0.13   178.88    .625E+01        0.0         0.11      30.58
      0.14   178.89    .756E+01        0.0         0.12      28.70
      0.15   178.90    .900E+01        0.0         0.12      27.08
      0.16   178.91    .106E+02        0.0         0.13      25.68
      0.18   178.93    .123E+02        0.0         0.14      24.44
      0.19   178.94    .141E+02        0.0         0.14      23.34
      0.20   178.95    .160E+02        0.0         0.15      22.36
      0.21   178.96    .181E+02        0.0         0.16      21.47
      0.23   178.98    .203E+02        0.0         0.16      20.67
      0.24   178.99    .226E+02        0.0         0.17      19.94

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0014) 1273.80    16.45   19.50  58.11      0.24      0.17
     OUTFLOW: ID= 1 (0415) 1273.80    16.40   19.80  58.10      0.22      0.16


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-------------------
| CALIB             |
| STANDHYD  (0408) |   Area    (ha)=   9.30
|ID= 1 DT= 2.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  85.00
-------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.91          1.39
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     249.00         40.00
     Mannings n            =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     120.56         86.96
               over (min)         5.00          8.00
     Storage Coeff.  (min)=       4.10 (ii)     7.37 (ii)
     Unit Hyd. Tpeak (min)=       4.00          8.00
     Unit Hyd. peak  (cms)=       0.27          0.15
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.57          0.27          2.839 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.03          12.00
     RUNOFF VOLUME    (mm)=      97.50         60.09          91.89
     TOTAL RAINFALL   (mm)=      98.50         98.50          98.50
     RUNOFF COEFFICIENT   =       0.99          0.61           0.93

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (0031) |
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0180     0.2124
                         0.0080     0.0425   |   3.0000     0.2550

                            AREA     QPEAK     TPEAK       R.V.
                            (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0408)      9.300     2.839     12.00      91.89
     OUTFLOW: ID= 1 (0031)      9.300     2.718     12.00      88.46

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.74
                   TIME SHIFT OF PEAK FLOW          (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2517

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-------------------
| ADD HYD   (0015) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------            (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0031):     9.30   2.718    12.00    88.46
      + ID2= 2 (0415):  1273.80  16.396    19.80    58.10
        ================================================
        ID = 3 (0015):  1283.10  16.438    19.83    58.32

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (0028) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  2.00
-------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
               1143.00         176.00        0.0450
               1176.00         174.00        0.0450
               1209.00         173.00        0.0450
               1224.70         173.03    0.0450 /0.0300  Main Channel
               1230.30         172.05        0.0300      Main Channel
               1232.00         173.00    0.0300 /0.0450  Main Channel
               1256.00         175.00        0.0450
               1301.00         176.00        0.0450

     <---------------------- TRAVEL TIME TABLE ----------------------->
      DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
      0.19   172.24    .474E+02        0.0         0.26      22.37
      0.38   172.43    .190E+03        0.2         0.41      14.09
      0.57   172.62    .427E+03        0.7         0.54      10.75
      0.76   172.81    .758E+03        1.4         0.66       8.88
      0.95   173.00    .119E+04        2.6         0.76       7.65
      1.16   173.21    .319E+04        5.9         0.64       9.06
      1.38   173.43    .600E+04       11.7         0.68       8.52
      1.59   173.64    .953E+04       20.3         0.74       7.83
      1.81   173.86    .138E+05       31.8         0.81       7.23
      2.02   174.07    .188E+05       46.9         0.88       6.66
      2.24   174.29    .242E+05       66.1         0.96       6.11
      2.45   174.50    .302E+05       88.8         1.03       5.66
      2.66   174.71    .366E+05      115.0         1.10       5.30
      2.88   174.93    .434E+05      145.0         1.17       4.99
      3.09   175.14    .509E+05      176.5         1.21       4.80
      3.31   175.36    .592E+05      212.5         1.26       4.65
      3.52   175.57    .686E+05      254.0         1.30       4.50
      3.74   175.79    .790E+05      301.4         1.34       4.37
      3.95   176.00    .903E+05      354.8         1.37       4.24

                                <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0015) 1283.10    16.44   19.83  58.32      1.50      0.72
     OUTFLOW: ID= 1 (0028) 1283.10    16.43   19.93  58.32      1.50      0.72


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 FINISH
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