New East-West Road Class EA
Hwy 6 to Brant Street

Drainage and Hydrology
Final Report
May 2010

City of Hamilton

Project No. 08-9020

Submitted by

Dillon Consulting Limited

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1.0 INTRODUCTION

A detailed drainage study was completed to provide input to Phase 3 & 4 of the Municipal Class Environmental Assessment planning and design process that was triggered by the Waterdown/Aldershot Transportation Master Plan (WATMP). The WATMP involves the Waterdown Road Improvement and the New East-West Corridor within the study area bounded by Concession 5 East in the north, Highway 407 in the east, Plains Road in the south, and Highway No. 6 in the west, as illustrated in Figure 1. This report only addresses drainage components of the New East-West Corridor.

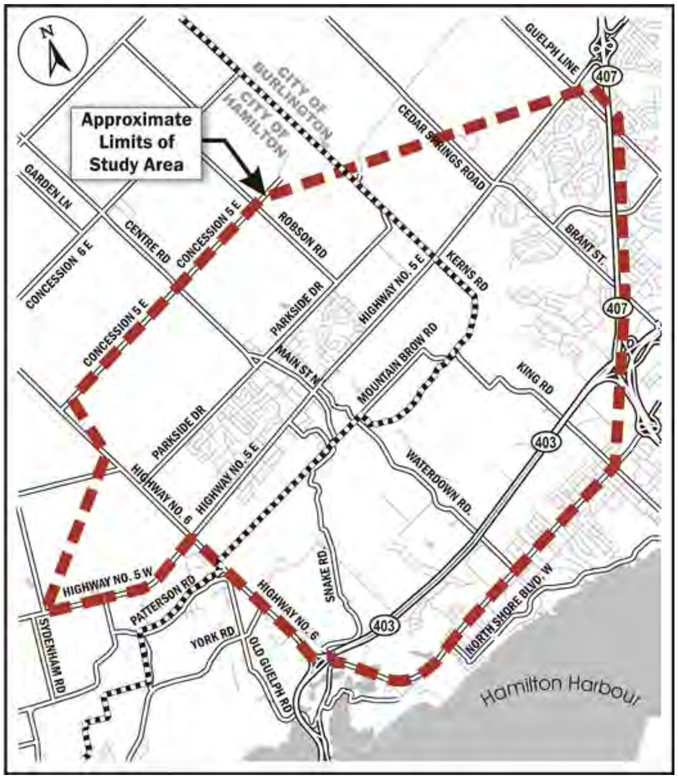


Figure 1 Study Area

1.1 Study Objectives

The objectives of this drainage study is to evaluate the impacts of the proposed roadway improvements on the surface water systems, to assess potential impacts of roadway runoff on receiving watercourses, and to assist in the selection of appropriate management measures. These management measures will be taken to a preliminary level of design. The drainage study results will provide input and guidance to the detailed design process with the objective of achieving protection, preservation, and enhancement of the local subwatershed environments. Specifically, the purpose of this study is to undertake the following activities within the context of the East-West corridor areas:

- establish existing hydraulic conditions of the watercourses at existing and proposed crossing locations within the East-West corridor;
- establish design criteria;
- evaluate proposed road crossing structures to meet design criteria;
- identify the potential impacts on natural water systems and hydrologic processes resulting from proposed changes in land use, such as increased flooding and erosion potential and water quality impairment;
- identify specific opportunities for protection, enhancement and rehabilitation of local watercourses, including SWM measures that meet design criteria;
- prepare preliminary design details for watercourse crossing and SWM measures; and,
- identify criteria for the detailed design.

Specific drainage management goals include the following:

- to convey upstream run-off through the roadway without adverse impacts on the road, upstream and downstream lands;
- to convey runoff from the road right-of-way to downstream watercourses; and
- to ensure that runoff from the right-of-way does not adversely impact the natural environment of receiving water bodies.

1.2 Data Collection

Background studies and information were collected and reviewed, and conditions associated with the road development were considered in the drainage analysis. Below is the list of documents reviewed:

Waterdown North Master Drainage Plan (Waterdown North MDP), Philips Engineering Ltd., February 2007
This study provides hydrologic and hydraulic analysis results of the Borer's Creek watershed and recommended strategy for managing storm runoff from the proposed Waterdown North development. Steam flows derived from the continuous simulation by the hydrologic model QUALHYMO were used in the HEC-RAS model to evaluate existing and future hydraulic

condition of the creek. The recommended stormwater management plan for the Waterdwon North includes on-site detention ponds, stream realignment, and crossing structures along the proposed new East-West corridor. The preferred stormwater management plan was incorporated into the road drainage stormwater management strategy.

Upcountry Estates Environmental Implementation Report, Paragon Engineering Ltd., May 1996
This Environmental Implementation Report was prepared in support of the Upcountry Estates development which is located within the New East-West corridor study area. A preferred management strategy was proposed to maintain and enhance the natural environment features within the Grindstone Creek subwatershed. A conceptual landscape restoration and rehabilitation plan was proposed for the reach of a Grindstone tributary along the east boundary of the Upcountry development site but no consideration of the proposed roadway by that time. This conceptual stream corridor rehabilitation plan was considered into the East-West Road drainage analysis.

Grindstone Creek Watershed Study, Conservation Halton, June 1998
In this study, the entire Grindstone Creek watershed was divided into four subwatersheds. Regeneration plans for each area were prepared to promote the integrity and legacy of the creek. The areas identified in the regeneration plans are located within the EA study area and therefore have been considered in the drainage analysis.

Grindstone Creek Subwatershed Study, Cosburn Patterson Wardman Ltd., January 1995
The Grindstone Creek Subwatershed Study area extends from Hwy 403 in the south to Waterdown Road in the north and from the main Grindstone Creek Valley in the west to the east of Waterdown Road, covering a 560 ha area. A Subwatershed Management Plan was recommended for future development and was considered in the drainage analysis.

2.0 HYDRAULIC ASSESSMENT

The evaluation of hydraulic conditions for the existing and proposed road crossing structures is based on the study objectives and is summarized in the sections below. Detailed HEC-RAS model outputs are provided in Appendix A; CulverMaster outputs are provided in Appendix B; and VO2 hydrological model outputs are provided in Appendix C. All the model digital files are provided on the CD attached to this report.

2.1 Road Drainage Area Characteristics

The New East-West corridor crosses two watersheds, the Borer's Creek and Grindestone Creek watersheds which are within the jurisdictions of Hamilton Conservation Authority (HCA) and Conservation Halton (CH), respectively. The drainage features and road crossing structures (existing and proposed) are presented in Figure 2.

A total of 12 crossing structures associated with the New East-West corridor road improvements have been evaluated. Some are proposed new structures, while others are existing structures which are proposed to be extended or replaced due to road improvement works.

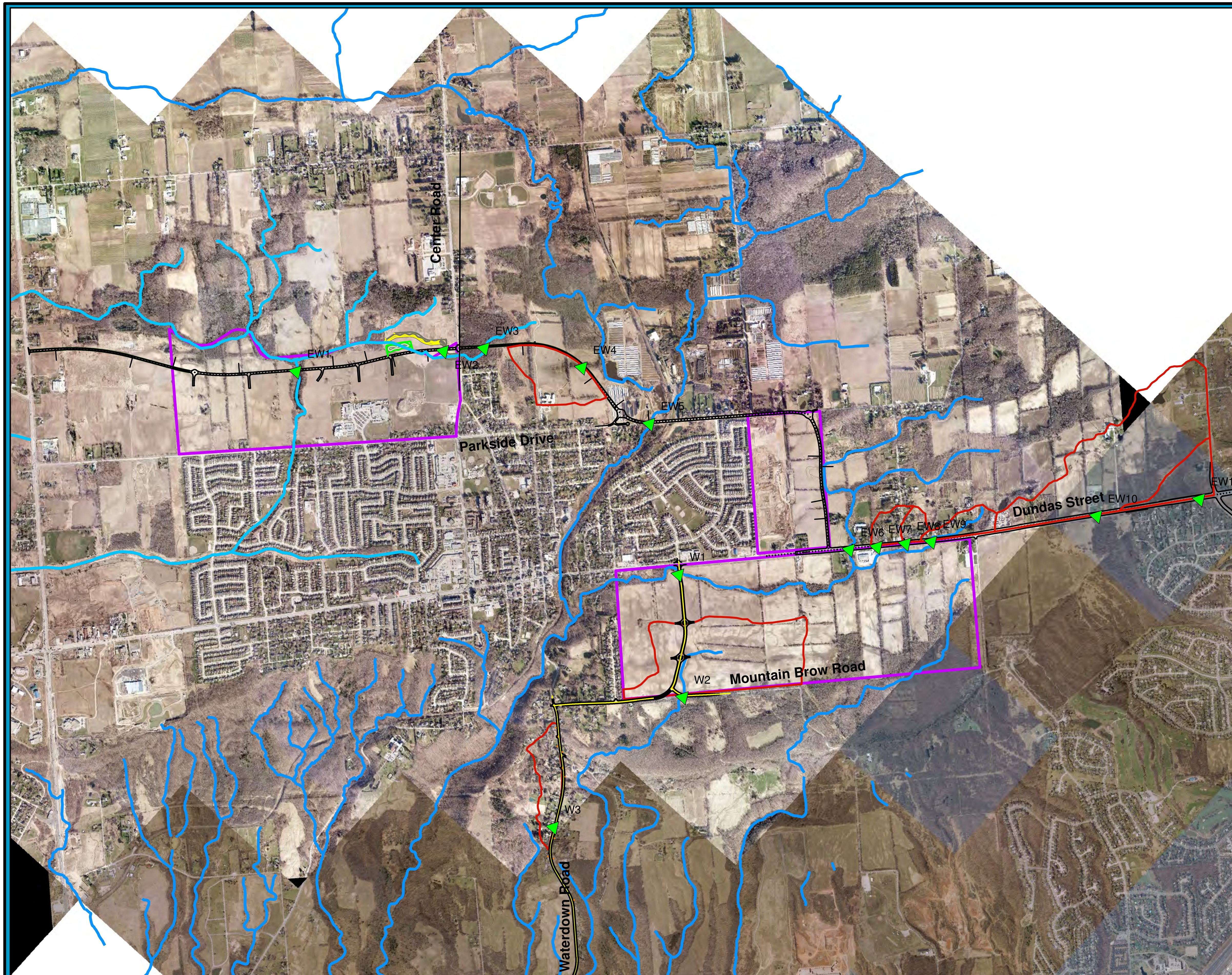
2.2 Design Criteria

Consultation with the City of Hamilton and both HCA and CH was conducted at the beginning of the study. Comments on the preliminary road alignment were provided by CH in a letter dated September 17, 2008. The comments related to road drainage components in the letter have been fully addressed in this drainage report. Based on City of Hamilton Design Guidelines and comments from HCA and CH, the road crossing structures have been designed to meet the following design criteria:

- Based on the road classification and the span of the proposed structure, the appropriate design event should be determined according to the design flood criteria indicated in the MTO Directive B-100 (and as per the City of Hamilton Design Guidelines);
- Required freeboard (culverts) or clearance (bridges) of the structure is also determined for the design flood criteria;
- At existing watercourse crossings, upstream flood levels for the Regulatory event (i.e., Hurricane Hazel) have to be maintained or improved, if possible;
- At new watercourse crossings, the existing flood levels for the Regulatory event (i.e., Hurricane Hazel) are established so that it can be demonstrated that there are no adverse impacts on the flood hazard; and,
- Safe access and egress should be provided for both pedestrian and vehicular traffic during the flood event. Per MNR guidelines, safe access and egress is defined by a depth velocity product of less than 0.4 m^2/s, with a maximum flooding depth over the road of less than 0.3 m, and a maximum velocity over the road of less than 1.7 m/s.

Proposed New East-West Roadway

Figure 2
Road Crossing Structures



Legend

- Road Crossing Structure
- Catchment to Structure
- UrbanExpansionBoundary
- Borer's Creek System
- Grindstone Creek System

W N S E

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425 212.5 0 425 850

Notes:
Base mapping provided by the City of Hamilton, the City of Burlington and the Region of Halton. Additional mapping provided by Halton Region Conservation Authority and the Ministry of Natural Resources.

Please note that the land uses depicted on this map reflect the land uses derived from the City of Hamilton and City of Burlington OPs and airphotos in order to derive the nature of the land use. Areas along Waterdown Road were classified as residential.

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2.3 Hydraulic Evaluation of Road Crossing Structures

This section presents the evaluation of each of the existing and proposed structures along the corridor starting from the west and moving eastward. The design event and check flow for each structure are determined based on MTO Highway Drainage Design Standards January 2008 as shown in Table 1. The freeboard/clearance at culver/bridge crossings shall be greater than or equal to 1.0 m for freeways, arterials and collectors. The freeboard at water crossings shall be greater than or equal to 0.3 m for local roads. The minimum freeboard is measured vertically from the high water level for the design flow to the edge of the travelled lane. The clearance is measured vertically from the high water level for the design flow to the lowest point on the soffit.

Table 1 Design Flow Return Period for Bridges and Culverts

Functional Road Classification	Return Period of Design Flows (Years)		Check Flow for Scour
	Total Span less than or equal to 6.0 m	Total Span greater than 6.0 m	
Freeway, Urban Arterial	50	100	130% of 100 year
Rural Arterial, Collector Road	25	50	115% of 100 year
Local Road	10	25	100% of 100 year

EW1, EW2, and EW3

The proposed E-W corridor crosses the Borer's Creek system at three locations, EW1, EW2 and EW3 as shown in Figure 2. EW1 is located on the main branch of Borer's Creek, while EW 2 and EW3 are located along the east tributary.

HEC-RAS models were established to evaluate these three new structures. Existing creek conditions were first established. The geometry file was created with HEC-GeoRAS based on the DEM created from 0.5 m contours of the study area. Cross sections of the existing condition model were generated with consideration of the proposed road alignment to establish a point of comparison under the future condition. See Figure 3 for existing conditions HEC-RAS cross-sections. For proposed conditions, some existing sections were revised and others added to account for the road alignment and crossing locations. Also, cross-sections in the future scenario have been developed based on the proposed creek realignment for a section of the east tributary.

This creek realignment is proposed in the Waterdown North MDP to accommodate the proposed development. See Figure 4 for the proposed conditions HEC-RAS cross-sections.

Flow files were obtained from the Waterdown North MDP in which QUALHYMO hydrologic modelling was completed for the Borer's Creek watershed to identify design flows at selected flow points. The design flows for the entire east tributary with a total drainage area about 200 ha were determined in the MDP study. Flow transposition was conducted to identify flows to EW3 and EW2 based on their drainage areas. Design flows to these two crossing structures are listed in Table 1 and assigned at associated cross sections in the model.

Table 2 - Design Flow Transposition for Crossings EW2 and EW3

Catchment	Drainage Area (ha)	Design Event Flows (m^3/s)						
		2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	Regional Event
East Tributary	195	1.47	2.5	3.21	3.87	4.69	5.26	17.74
Crossing E/W2	81	0.76	1.30	1.66	2.00	2.43	2.73	9.19
Crossing E/W3	22	0.29	0.49	0.62	0.75	0.91	1.02	3.44

EW1 is located on the main branch of Borer's creek where a deep, wide valley exists. In addition to meet the flood design criteria, the design of the proposed structure should minimize the disturbance to the existing valley features. The cross section associated with the proposed structure in the existing condition model is RS 561.655.

EW2 is located within the realigned section of the creek. A new existing conditions was first established based on the proposed creek realignment prior to evaluating the impacts of EW2. At this stage, no detailed design and hydraulic analysis have been completed for the creek realignment. Only a preliminary plan was provided by the consultant (Metropolitan Consulting Inc) for the Parkside Hills Subdivision development. The plan shows a low flow channel setting within the bank full channel which is proposed to convey the Regional event. Since the creek realignment design is not within the scope of the road drainage study, cross sections of the proposed creek work were assumed based on the provided preliminary plan and existing topography. Detailed survey and hydraulic analysis should be conducted during the detailed design to verify the creek conveyance capacity and structure hydraulic conditions. The detailed design team must ensure that the proposed EW2 crossing, in combination with the creek realignment works, will not cause any adverse impacts on the existing flood levels. The cross section associated with the proposed structure in the existing condition model is RS 1687.198.

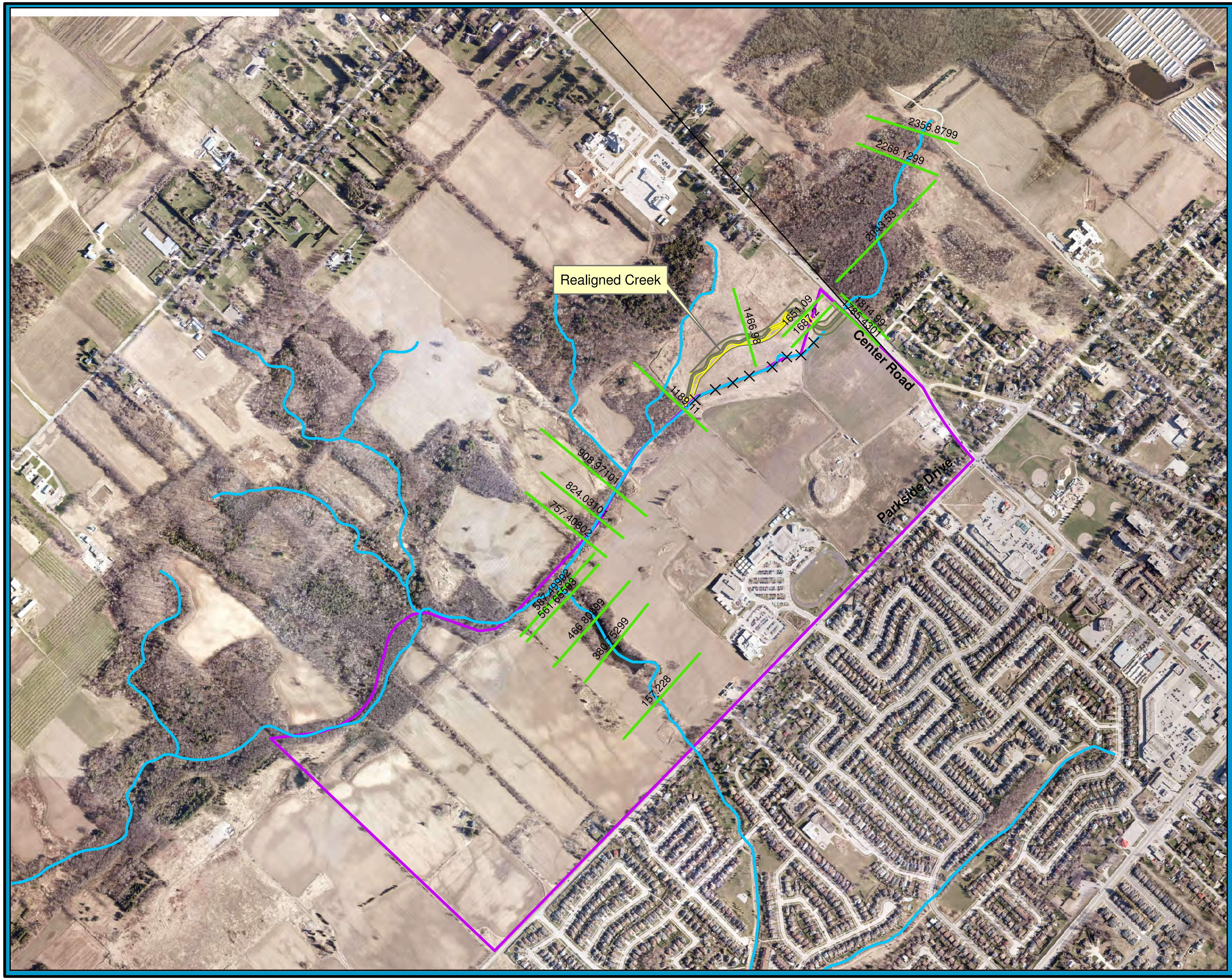
EW3 is located where the East-West corridor intersects the Centre Road Woodlot north of Parkside Drive and east of Centre Road. A wetland community covers greater than 90% of the woodlot area. This Centre Road Woodlot wetland feature has been recently included into the Logies Creek - Parkside Drive Provincially Significant Wetland (PSW) Complex (Art Timmerman, OMNR, personal communication, September 2008) due to its demonstrated wetland function, proximity (within 750 metres) to existing PSW units and hydrologic connectivity to the PSW via a tributary of Borer's Creek. The proposed road bisects the woodlot wetland; therefore, the design of a road crossing here is not only to convey the flow downstream but also to provide a function to connect the wetland and maintain the existing hydrologic pattern of the woodlot wetland to the extent possible. The cross section associated with the proposed structure in the existing condition model is RS 2043.53.

Proposed dimensions of these three structures are as follows:

EW1: Three-cell concrete box culverts are proposed at this water crossing. One cell with the dimension of 6.0 m (span) x 3.0 m (rise) x 36 m (length) is located at a lower elevation with 0.5 m embedded into the channel to allow the low flow channel to be constructed through the structure. The other two cells are set at a higher elevation with the dimensions of 6.0 m (span) x 2.0 m (rise) x 36 m (length) to convey high flows. Given the total span of the structure of 18 m and the urban section of the road, the 100 year event is the design event.

EW2: A concrete box culvert with the dimension of 6.0 m (span) x 1.7 m (rise) x 36 m (length) is proposed at this crossing location. The structure bottom is embedded into the channel with 0.5 m to allow the construction of the low flow channel. Given the span of the proposed structure with 6.0 m and the urban section of the road, the design event for the structure is the 50 year.

EW3: A series of culverts along the road section within the Center Road woodlot wetland are proposed here to convey flows downstream and at the same time to connect the wetland separated by the proposed roadway. A total of 6 arch shaped open bottom CSP pipes are designed with the dimension of 1.2 m (span) x 1.0 m (rise). Figure 5 illustrates the proposed configuration of this series of structures at Crossing EW3. This series of culverts makes the total span of the crossing of 7.2 m. With the rural section of the road, the design event for the structure is the 50 year event.



Proposed New East-West Roadway

Figure 3
Borer's Creek Existing Condition HEC-RAS Cross Sections

Legend

- ✕ Creek Removed
- Borer's Existing HEC-RAS XS
- Borer's Creek System
- Waterdown North Development

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Notes:
Base mapping provided by the City of Hamilton, the City of Burlington and the Region of Halton. Additional mapping provided by Halton Region Conservation Authority and the Ministry of Natural Resources.

Please note that the land uses depicted on this map reflect the land uses derived from the City of Hamilton and City of Burlington OPs and airphotos in order to derive the nature of the land use. Areas along Waterdown Road were classified as residential.

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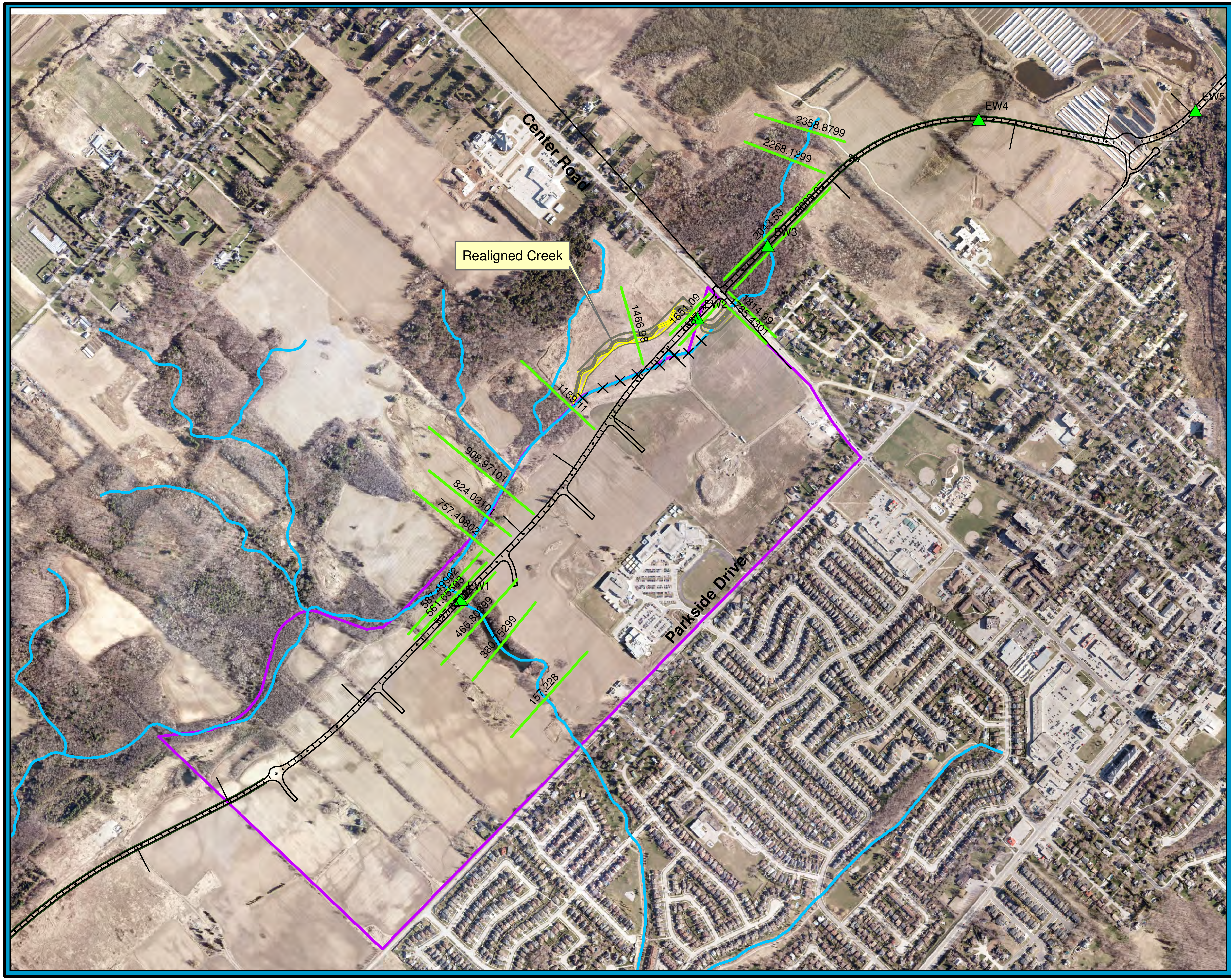

Proposed New East-West Roadway

Figure 4
Borer's Creek Future Condition HEC-RAS Cross Sections

Legend

- Road Crossing Structure
- Creek Removed
- Borer's Future HEC-RAS XS
- Borer's Creek System
- Waterdown North Development

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Notes:
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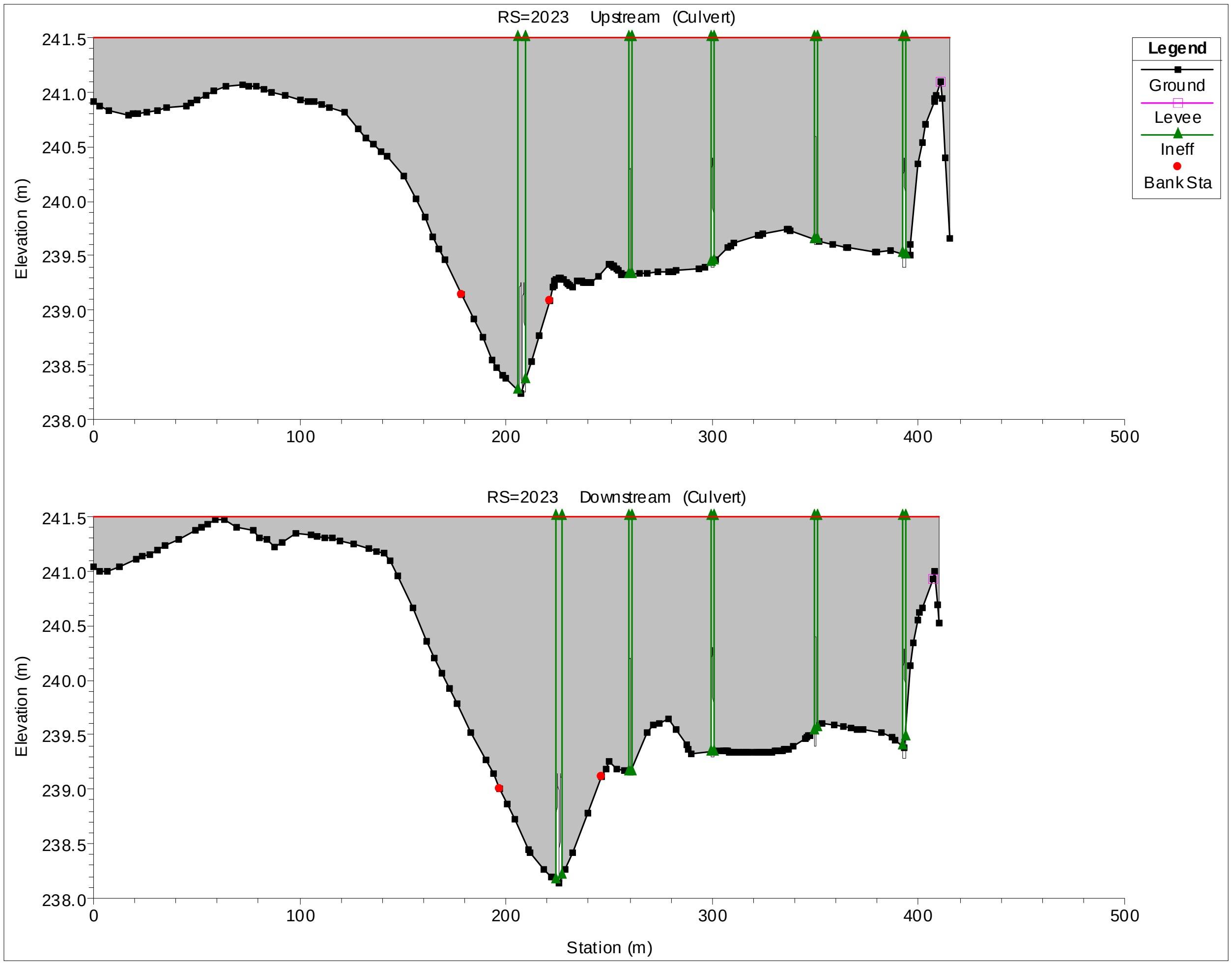

Figure 5 Series of Culverts Connecting the Center Road Woodlot at Crossing EW3

Hydraulic conditions at the proposed structures are summarized in Table 3. Detailed HEC-RAS outputs for each cross section are provided in Appendix A.

Table 3 - EW1/EW2/EW3 Proposed Hydraulic Conditions

Structure	Design Event	Flow (m3/s)	Water Level at Inlet (m)	Water Level at Outlet (m)	Velocity (m/s)	Performance
EW1 (RS 538)	2 year	2.82	234.50	234.50	0.42	
	5 year	5.1	234.61	234.60	0.60	
	10 year	6.67	234.65	234.65	0.72	
	25 year	8.08	234.69	234.69	0.81	
	50 year	9.71	234.73	234.73	0.90	
	100 year	10.8	234.76	234.76	0.96	Design Event, 4.0 m freeboard
	Regional	40.64	235.18	235.19	2.11	Road not overtopped
EW2 (RS 1669)	2 year	0.76	238.67	238.67	0.26	
	5 year	1.3	238.81	238.81	0.35	
	10 year	1.66	238.89	238.88	0.39	
	25 year	2	238.95	238.95	0.43	
	50 year	2.43	239.02	239.01	0.48	Design Event, 1.9 m freeboard
	100 year	2.73	239.06	239.05	0.52	
	Regional	9.19	239.69	239.64	1.08	Road not overtopped
EW3 (RS 2023)	2 year	0.29	239.61	239.61	0.09	
	5 year	0.49	239.77	239.77	0.12	
	10 year	0.62	239.90	239.90	0.15	
	25 year	0.75	240.16	240.16	0.15	
	50 year	0.91	240.44	240.44	0.16	1.0 m
	100 year	1.02	240.47	240.47	0.18	
	Regional	3.44	240.64	240.60	0.6	Road not overtopped

Based on the span of the structure and road classification, the design event for EW 1 is the 100 year event and for EW2 and EW 3 is the 50 year event. As detailed HEC-RAS outputs shown in Appendix A, there are no any adverse impacts on the existing Regional flood levels caused by Crossing EW2 and EW3. Two cross sections upstream of EW1, RS 561.6553 and RS 587.4989, have some increases of the Regional water level at 0.11m and 0.25 m, respectively. This about 50 m long of the reach is confined within the deep, wide valley of Borer's main branch. These minor increases of the Regional water level would not cause any negative impacts to the adjacent properties and therefore are viewed as acceptable.

Crossing EW4

At this location, the proposed road crosses a regulated watercourse within the Grindstone Creek Watershed. It is not a permanent watercourse but a natural depression area associated with wetland features. The contours show a very flat topography around the wetland (see Figure 6). During the frequent events, the rainfall runoff is mostly contained in the wetland and infiltrates into the ground. When less frequent events occur (e.g., 100 year or Regional storm), water levels build up and drive the flow towards Grindstone Creek. Since the proposed road disconnects the wetland and the downstream creek, a new crossing structure is required here.

Hydrologic modeling with Visual OTTHYMO 2.0 (VO2) was conducted to determine design flows to the proposed structure. Given the rural land use, the NASHYD command was used. The model input parameters are presented in Table 4. Peak flows are reported in Table 5.

Proposed New East-West Roadway

Figure 6
Borer's Creek Future Condition HEC-RAS Cross Sections

Legend

- Road Crossing Structure
- Creek Removed
- Borer's Creek System
- Catchment to Structure
- Grindstone Creek System

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Notes:
Base mapping provided by the City of Hamilton, the City of Burlington and the Region of Halton. Additional mapping provided by Halton Region Conservation Authority and the Ministry of Natural Resources.

Please note that the land uses depicted on this map reflect the land uses derived from the City of Hamilton and City of Burlington OPs and airphotos in order to derive the nature of the land use. Areas along Waterdown Road were classified as residential.

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Table 4 - VO2 Inputs for EW4 Hydrologic Modelling

Area (ha)	CN (AMC II)	CN (AMC III)	Tp (hr)	IA (mm)	N
15.7	82	92	0.73	5	3

Table 5 - Design Flows to Crossing EW4

	2year	5year	10year	25year	50year	100year	Regional Event
Design flow (m^3/s)	0.27	0.48	0.64	0.85	1.0	1.2	1.8

Since it is a new structure, the existing hydraulic conditions of the watercourse were established first. Assuming uniform flow conditions, Bentley's FlowMaster program was used to model the watercourse and determine the design water levels at the proposed road crossing location. The results are shown in Table 6.

Table 6 - Existing Water Levels within the Watercourse at Crossing EW4

	2year	5year	10year	25year	50year	100year	Regional
Existing Water Level (m)	241.22	241.31	241.31	241.35	241.37	241.39	241.45

Bentley's Culvert Master program was used to assess the proposed structure. A box culver with the dimensions of 4.0 m (span) x 1.5 m (rise) x 30 m (length) is proposed here to meet the design criteria. Given the span of the proposed structure and the road classification as rural arterial, the design event for the structure is the 25 year storm. Water levels at the design event and Regional event are presented in Table 7.

Table 7 - Future Water Levels at Crossing EW4

	25yr	Regional
Water Level (m)	241.34	241.50

<u>*Crossing EW5*</u>

Crossing EW5 crosses the main branch of the Grindstone Creek at Parkside Drive. Currently, there is a bridge structure with dimensions of 6.0 m (span) x 2.4 m (rise). HEC-RAS models for the Grindstone Creek system were provided by Conservation Halton and used here to evaluate the existing and proposed hydraulic conditions of the structure. Flow files were derived from the Grindstone Creek Flood Damage Reduction Study 1985.

Figure 7 Existing Bridge at Parkside Dr (Left: upstream face; Right: downstream face)

Figure 7 shows the existing structure conditions. The existing hydraulic performance of the structure is summarized in Table 8. The cross section of the structure in the existing and proposed condition HEC-RAS model is RS 1335.743. Detailed HEC-RAS outputs for cross sections upstream and downstream of this structure are provided in Appendix A to present existing and proposed hydraulic conditions within the reach near the structure.

Table 8 - Summary of Existing Hydraulic Conditions at EW5

Design Event	Flow (m3/s)	Water Level (m)	Velocity (m/s)	Performance
5 year	21.7	231.76	2.84	
10 year	24.9	231.89	2.96	
25 year	28.2	232.02	3.07	0.66 m clearance to the structure soffit
50 year	30.4	232.10	3.14	0.58 m clearance to the structure soffit
100 year	32.0	232.16	3.2	0.52 m clearance to the structure soffit
Regional Event	128.8	234.35	2.18	Road overtopped by 1.54 m, flow velocity 1.25 m/s

As shown in Table 7, with the existing structure, the road is overtopped with a significant depth during the Regional Event. When the road upgrades to be proceeded, it is the opportunity to resolve this flooding hazard. In order to accommodate a larger structure and meet associated structural design criteria, the existing relatively narrow creek valley upstream of the structure needs to be widened.

A reconnaissance-level site visit was conducted by Dillon geomorphologist to identify any channel improvement opportunities. It is likely that potential for floodplain cut (and reduction in velocity and shear) is possible, primarily on the west bank, upstream of Parkside Drive. The east bank upstream of Parkside Drive is considerably higher and more densely vegetated. A disturbance to this east bank is not recommended and may encounter opposition at the approvals stage. It is recommended that any proposed cut on the west bank be initiated (for EA level planning purposes) at approximately the 5-year water level. This approach will maintain the integrity of the low flow channel and, most importantly, will maintain sediment transport continuity through this reach. Failure to address the low flow section may lead to increased instability due to the deposition of coarser sediment (due to a wider section) and subsequent formation of secondary channels.

The five year event water level is 231.12 m within the channel without a structure in place. The channel widening at the west bank starts at this elevation with a 6.0 m bench cut to the west and 3:1 bank slope up to meet the existing ground. The new geometry of the upstream section in the HEC-RAS model (RS 134.187) was created accordingly. Further detailed channel work should be conducted during the detailed design. Approval agencies should be consulted regarding the approvability of the channel works. Detailed morphological assessment should be conducted to accurately define the low flow channel's discharge.

The proposed road geometry and profile were input into the future condition HEC-RAS model to evaluate the proposed structure. A 14 m span bridge is required here to meet design requirements. Hydraulic results are summarized in Table 8. Given the span of the proposed structure (i.e., greater than 6 m) and the road classification as urban arterial at this section, the design event for the structure is the 100 year storm.

Table 9 - Summary of Future Hydraulic Conditions at EW5

Design Event	Flow (m3/s)	Water Level Inside Bridge US (m)	Water Level Inside Bridge DS (m)	Velocity (m/s)	Performance
5 year	21.7	231.42	230.93	3.34	
10 year	24.9	231.50	230.98	3.50	
25 year	28.2	231.58	231.03	3.67	
50 year	30.4	231.64	231.07	3.74	
100 year	32	231.67	231.09	3.83	1.22 m clearance to the structure soffit
Regional Event	128.8	234.27	234.27	3.63	Road overtopped with a depth of 0.18 m, flow velocity through the roadway is 0.85 m/s

Crossing EW6

Crossing EW6 is located where a tributary of Grindstone Creek crosses Dundas Street. Currently there is a concrete culvert with dimensions of 3.05 m (span) x 1.52 m (rise) x 26 m (Length). HEC-RAS models for the Grindstone Creek system were provided by Conservation Halton and used here to evaluate the existing and proposed hydraulic conditions of the structure. Design flows from the 5 year to 100 year and the Regional Events were obtained from the Grindstone Creek Flood Damage Reduction Study.

Existing hydraulic conditions at the structure are summarized in
Table 9, indicating that the existing structure does not meet the flood design criteria, i.e., not provide a sufficient freeboard under the design event (50 year) and safe access under the Regional Event. HEC-RAS outputs for cross sections upstream and downstream of the structure are provided in Appendix A. The lowest road surface elevation is 246.0 m. The cross section of the structure in the existing and proposed condition model is RS 2525.37.

Table 10 - Summary of Existing Hydraulic Conditions at Crossing EW6

Design Event	Flow (m3/s)	Water Level at Inlet (m)	Water Level at Outlet (m)	Velocity (m/s)	Performance
5 yr Event	9.5	244.65	243.55	4.17	
10 yr Event	10.8	244.73	243.63	4.29	
25 yr Event	12	244.81	243.69	4.40	
50 yr Event	12.9	244.87	243.74	4.47	0.64 m freeboard to the road surface
100 yr Event	13.4	244.9	243.77	4.51	
Regional Event	42.2	246.58	246.5	1.18	Road overtopped with a depth of 0.62 m, flow velocity at 0.68 m/s

A new structure is required to accommodate the road widening and improve the existing hydraulic conditions. A concrete box culvert with the dimensions of 6.0 m (span) x 1.8 m (rise) x 54 m (length) is proposed. The proposed structure hydraulic conditions are summarized in Table 10, meeting the design criteria. The structure is embedded into the creek channel with 0.4 m to construct a low flow channel inside the structure. Some channel realignment works upstream of the structure are required to lower the structure inlet and provide the structure slope at 1.3%. Given the high velocity under the regional event, appropriate rip-rap protection should be designed during the detail stage to ensure the structure safety.

Table 11 - Summary of Future Hydraulic Conditions at Crossing EW6

Design Event	Flow (m3/s)	Water Level at Inlet (m)	Water Level at Outlet (m)	Velocity (m/s)	Performance
5 yr Event	9.5	244.03	243.66	2.5	
10 yr Event	10.8	244.09	243.72	2.6	
25 yr Event	12	244.14	243.76	2.7	
50 yr Event	12.9	244.18	243.8	2.76	The design event with 1.82 m freeboard
100 yr Event	13.4	244.2	243.82	2.8	
Regional Event	42.2	244.8	244.1	4.3	Road overtopped with a depth of 0.16 m, flow velocity at 0.54 m/s

Crossing EW7, WE8, EW9, EW10, and EW11

These existing five structures are located along Dundas Street and convey the upstream overland flows collected by side ditches to the downstream surface water systems of the Grindstone Creek Watershed. To minimize the impact to the existing drainage system, these five structures are maintained at the existing locations with appropriate upgrades to accommodate the proposed road improvements.

Design flows to each structure were determined by VO2 hydrologic modeling as summarized in Table 12. Detailed VO2 output is provided in Appendix C. Digital model files are included on the CD enclosed with this report.

Table 12 - Design Flows to Each Crossing EW7 to EW11

Crossing Structures	Drainage Area (ha)	2year	5year	10year	25year	50year	100year	Regional
EW7	4.39	0.11	0.202	0.27	0.363	0.43	0.498	0.575
EW8	3.02	0.075	0.139	0.185	0.25	0.296	0.343	0.395
EW9	5.90	0.121	0.221	0.294	0.396	0.468	0.542	0.703
EW10	62.20	0.685	1.258	1.684	2.278	2.709	3.152	5.937
EW11	10.10	0.194	0.374	0.513	0.711	0.857	1.009	1.337

Information describing the existing structures (i.e., opening size, invert elevations, etc.,) was obtained from road contract drawings and field survey provided by the City of Hamilton and Halton Region as summarized in Table 13. Bentley CulvertMaster was used to conduct hydraulic analyses of the structures. Existing hydraulic conditions were first determined to establish the design targets for the future condition. The results are summarized in Table 13.

The function of these five structures is mainly for drainage conveyance not associated with any permanent watercourses or environmental features. Therefore, CSP pipes and a concrete box culvert are proposed without embedment. The proposed structure dimensions and hydraulic conditions are summarized in Table 14.

Under the proposed condition, crossings EW7 and EW8 do not meet the freeboard requirement but maintain or improve the existing hydraulic conditions. The proposed road work along Dundas Street is try to maintain the existing road profile. Raising the road profile to meet the freeboard requirement may not be cost-effective. Proposed hydraulic conditions at Crossing EW9, WE10, and EW11 meet the design criteria.

Table 13 - Existing Hydraulic Conditions of Crossings EW7 to EW 11

Crossing No.	Diameter (mm)	Length (m)	Upstream Invert (m)	Downstream Invert (m)	Design Water Level 50yr Event (m)	Regional Water Level (m)	Freeboard at 50yr Event (m)	Road Overtopped at Regional Event
EW7	750	32.8	247.552	247.247	248.22	248.35	0.78	No
EW8	750	32.9	252.064	251.854	252.62	252.62	Road overtopped	Yes
EW9	750	33.3	252.679	252.059	253.39	253.59	0.61	No
EW10	1400	32.1	250.556	250.481	251.89	251.92	Road overtopped	Yes
EW11	1000	54	220.324	215.667	221.21	221.49	1.79	No

Table 14 - Proposed Hydraulic Conditions of Crossings EW7 to EW 11

Crossing No.	Diameter (mm)	Length (m)	Upstream Invert (m)	Downstream Invert (m)	Design Water Level 50yr Event (m)	Regional Water Level (m)	Freeboard at 50yr Event (m)	Road Overtopped at Regional Event
EW7	750	50	247.552	247.10	248.22	248.35	0.78	No
EW8	750	44	251.46	250.9	252.00	252.09	0.90	No
EW9	750	48	252.14	251.62	252.85	253.05	1.68	No
EW10	3000mm x 1000mm	44	250.9	250.4	251.60	252.08	1.07	No
EW11	1000	56	220.324	215.667	221.21	221.49	1.79	No

2.4 Floodplain Storage Analysis

The section of the proposed East-West corridor between Parkside Drive and Dundas Street traverses the Regulated floodplain of the Grindstone Trib1 West Branch (named in the HEC-RAS model provided by CH). The existing floodplain is encroached upon the proposed roadway as indicated in Figure 8. The total storage affected is about 4,200 m^3 shown as the shaded area in Figure 7. This is natural floodplain storage and should be preserved.

The HEC-RAS model for the Grindstone Trib1 West Brach provided by CH was used to model the roadway impacts on the existing floodlines. The roadway encroachment was modeled at three cross sections, RS 406.1851, RS 305.5756, and RS 204.9612. There is a 14 cm increase to the existing flood level at RS 406.1851, 4 cm increase at RS 305.5756, and no any increases at any upstream and downstream cross sections. The 4 cm increase at RS 305.5756 is viewed negligible. The 14 cm increase at RS 406.1851 results in the proposed Regional water level at 248.52 m. Based on the existing topography near RS 406.1851 as the contour information shown in Figure 8, the affected farm land at the eastside of the roadway is minimal.

Based on the hydraulic analysis results and with consideration of the stream rehabilitation plan proposed in the Upcountry Estates Environmental Implementation Report, May 1996, two flow equalization culverts are proposed to connect the floodplain and maintain the storage at the west side of the roadway. These two culverts will be located above the low flow level and allow for flow attenuation to the downstream water system during the extreme events by maintaining the natural floodplain storage.

Preliminary sizing of the flow equalization culverts was conducted, assuming that during the Regional event (Hurricane Hazel), water levels build up upstream of the road and trigger the flow through the proposed culverts. Given the nature of the Regional event (i.e., high flow volume but low intensity and a flow rate at 0.4 m^3/s) the time required to fill the total storage (4,200 m^3) west of the roadway is estimated at 3 hours. To maintain the existing floodplain storage, two 1000 mm circular culvert are proposed. Detailed sizing should be conducted by dynamic modeling during the detailed design stage based on the tributary design flow hydrograph and with consideration for associated channel realignment works, and creek rehabilitation works by others. There are also opportunities to mitigate the 14 cm flood level increase at RS 406.1851 by appropriate sizing of the two flow equalization culverts through the dynamic modeling in the detailed design stage.

Proposed New East-West Roadway

Figure 8
Floodplain Encroachment on Grindstone Tributary

Legend

- Flow Equalization Culvert1
- Affected Floodplain Storage
- GrindTrib1West_XSCutlines
- Upcountry Development Boundary
- Existing Floodplain by CH

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Meters
90 45 0 90 180

Notes:
Base mapping provided by the City of Hamilton, the City of Burlington and the Region of Halton. Additional mapping provided by Halton Region Conservation Authority and the Ministry of Natural Resources.

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3.0 STORMWATER MANAGEMENT

The effects of urbanization and intensification are well documented and can dramatically alter the natural hydrologic cycle. As roads are built and corridors expanded, the amount of impervious area within a watershed increases. Increases in impervious areas increase the volume and peak rate of runoff, while decreasing groundwater recharge. Urbanization can also increase the type and amount of pollutants in surface water runoff. Older approaches to stormwater management have focused on efficiently collecting and conveying stormwater offsite. Newer approaches to stormwater management seek to retain natural features of drainage systems and provide onsite management to address water quality and water quantity goals. This approach views stormwater as a resource to be used to recharge groundwater and to supply fresh water to surface water features. Properly managing stormwater can avoid problems with erosion, flooding, and adverse impacts on natural drainage features.

As roadway improvement activities alter the watershed landscape, adverse impacts to receiving waters may result from changes in the quality and quantity of stormwater runoff. In addition to causing runoff volume impacts, stormwater can also be a major source of non point source pollution within the urban environment. The type and quantity of pollutants carried by stormwater runoff, commonly resulting in non-point source pollution of receiving waters are highly variable. The pollutant characteristics of stormwater runoff are largely based on land use characteristics and vary with the duration and intensity of rainfall events.

3.1 Stormwater Management Targets

Review of background studies within the Grindstone and Borer’s Creek watersheds, City of Hamilton Stormwater master Plan-Class Environmental Assessment Report (City-Wide), May 2007 by Aquafor Beech Ltd, City of Hamilton Criteria and Guidelines for Stormwater Infrastructure Design, September 2007, and consultation with staff from the City of Hamilton, HCA and CH were conducted to identify the stormwater management targets related to proposed road improvements within the EA study area. The criteria are defined as follows:

Borer's Creek Watershed – Based on Waterdown North MDP

- Water quality control is Enhanced Level (80% TSS Removal)
- Erosion control is based on maintaining existing erosion potential (continuous simulation modeling)
- Quantity control is generally not required

Grindstone Creek Watershed

- Water quality control is Enhanced Level (80% TSS Removal)
- Erosion control is based on 25 mm event
- Quantity control is post- to pre-development peak flow control

It is noted that given the small scale of the road improvements relative to the size of watersheds, and given constraints associated with road development, erosion and quantity control targets may not be met at some locations. Details at specific outlet locations are provided in later sections of this report.

3.2 Roadway Stormwater Management Alternatives

The MOE Stormwater Management Planning and Design Manual provides extensive lists of stormwater Best Management Practices (BMPs) in three categories: source, conveyance and end-of-pipe controls. City of Hamilton also developed City of Hamilton Stormwater Master Plan-Class Environmental Assessment Report (City-Wide) in May 2007 to identify appropriate stromwater management strategies within the City. However, measures which are generally applicable to the road runoff control are limited by the nature of the project, i.e., linear corridor with limited adjacent properties and multiple water crossing locations and outlets.

Sources control measures usually refer to the measures implemented at the lot level such as surface storage and reduced grading to allow greater ponding. Generally source control measures are not applicable to road runoff control.

Conveyance control measures refer to BMPs that are used to transport stormwater from drainage areas to receiving waters. These measures may include grassed swales/ditches, pervious pipe systems, vegetated buffer strips and oversized pipes (i.e., super pipe storage).

End-of-pipe stormwater management measures are located at the outlet of the drainage system. Measures may include wet ponds, dry ponds, wetlands, infiltration basins, and oil/grit separators (OGS).

Stormwater management practices were screened with the consideration of the practicality, feasibility, and limitations of each management option based on site specific conditions. The following site specific conditions were considered:

- Classification of receiving watercourses, sensitivity of aquatic resources;
- The proposed roadway classification and cross-sections (i.e., urban sections with sewer/ditch system and rural sections with ditches);
- The limited physical space within the highway right-of-way to implement large-scale regional stormwater management facilities;
- The limited property available adjacent to the urban sections of the East-West corridor along Parkside Drive and Dundas Street, precluding the use of wet/dry ponds for quantity and erosion control of stormwater runoff;
- Local soils (clay/silt clay) having low percolation rates, limiting the use of infiltration type stormwater management practices;
- The high sediment loading caused by construction activities and winter sanding practices, which significantly reduce the life-expectancy of infiltration type stormwater management facilities; and,
- Location of proposed development SWM facilities (i.e., within Waterdown North) that could accept ROW and adjacent area drainage.

A variety of stormwater best management practices have been considered for use within the East-West corridor. The ‘do nothing’ alternative is generally eliminated on the basis that any modification to the lands contained within the right-of-way will result in some degree of environmental degradation whether it be on a temporary basis during construction or a permanent basis over the life expectancy of the reconstructed infrastructure. The proposed increase in imperviousness and construction activities within the right-of-way may result in negative effects such as reduced water quality, increased water quantity, degradation of in-stream aquatic resources, and erosion and sediment loading. These impacts result in the need for appropriate mitigation measures.

Extended detention stormwater management facilities can effectively provide quality/quantity and erosion control for surface runoff. In general, storage-type stormwater management facilities are not feasible for linear transportation facilities such as roads and highways. The general configuration and size of the drainage areas associated with a roadway make it difficult to meet design requirements such as minimum contributing drainage area and levels of imperviousness. Quality enhancement and erosion control is based on the premise of extended detention with a controlled outlet. Small contributing drainage area results in impractical outlet sizes which are prone to clogging with debris during normal and winter operation. Space limitations within the existing right-of-way often result in undesirable pond geometry. Ponds having seriously compromised layout geometry generally under-perform and result in short-circuiting, significantly reducing long-term total suspended solids removal rates. Because of this, City of Hamilton has the intention to coordinate with developers of adjacent properties when the road corridor traverses proposed development lands and utilize their on-site stormwater detention facilities to centrally manage the road runoff.

Generally, infiltration facilities are not recommended to treat road runoff for either quantity or quality control because of the high TSS load from the road surface which reduces the facility life expectancy and limited performance during winter months when the ground is frozen. Also, road runoff may contain a high concentration of dissolved solids (i.e., chlorides) which could contaminant baseflow/groundwater through the use of infiltration type measures.

Grassed ditches have historically been associated with rural drainage and have been constructed primarily for stormwater conveyance. Stormwater management objectives have changed and grassed ditches are also being promoted to filter and detain stormwater runoff. Routing flow through wide, flat bottom ditches has a number of benefits with respect to stormwater quantity and quality control. Grassed swales and ditches can be effective for pollutant removal if designed properly. The water quality benefits associated with grassed ditches depend on the contact area between the water and the swale, and the swale slope. Grassed swales are most effective for stormwater treatment when a minimum channel slope is maintained (e.g., <1%) and a wide bottom width (> 0.75m) is provided. Grassed swales with a slope of up to 2% can be used for water quality purposes, but effectiveness diminishes as velocities increase. Wide, flat bottom ditches provide a degree of peak flow attenuation that normally would not be achieved. Treatment of runoff is provided in a grassed swale by four processes: sedimentation, filtration, infiltration, and vegetative uptake. In swales with flat gradients, suspended particles within slow moving surface runoff has time to settle out or get captured by the vegetation. Soil conditions may also allow for some infiltration into the local topsoil within the swale or subsequently into the lower soil masses. Long residence times will allow for some minor vegetative uptake.

Special purpose stormwater management devices such as oil/grit separators having limited application is becoming more common for linear facilities such as roadways and highways. The drainage area characteristics and the point source outlet locations from local storm sewer systems servicing the roadway makes the use of an oil/grit separator a feasible alternative to providing quality treatment within the Study Area. An oil/grit separator requires a maintenance schedule similar to that of a standard roadside catch basin and has proven efficiency in removing trash, grit, suspended solids, and a range of oil and oil by-products from stormwater runoff. High volume commercial truck traffic with the potential for spills and limited space make an oil/grit separator a feasible alternative for addressing stormwater runoff quality from the corridor.

3.3 Recommended Stormwater Management Strategy

The proposed New East-West corridor crosses the Borer's and Grindstone Creek systems at a several locations (see Figure 9). In general, right-of-way (ROW) runoff is directed to the receiving watercourse at these locations. This section outlines the different catchment characteristics, stormwater management targets, and specific road design requirements as well as the proposed stormwater management strategy for each outlet.

The construction of new roadways and improvements to the existing roads (i.e., changes in horizontal and vertical alignments) result in changes to existing drainage boundaries. A drainage scheme has been developed for the entire East-West corridor based on the recommended preliminary road design. The proposed road drainage pattern is shown in Figure 9.

Visual OTTHYMO (VO2) hydrologic modeling was conducted for each outlet under existing (no road improvement) and proposed (after road improvement) conditions to identify the road improvement impacts on receiving watercourses and to assist in selecting appropriate stormwater management measures.

Intensity – Duration-Frequency data from the Mount Hope rain gauge station were used to create input storm files. The 12 hour SCS Type II design distribution for the 25 mm, 2 year, 5 year, 10 year, 25 year, 50 year and 100 year storm events, and Regional event were simulated. The NASHYD command was applied given the rural land use along the corridor. Model input parameters in terms of catchment drainage areas, time to peak (Tp), and curve numbers (CN) are determined based on specific catchment characteristics. Typical values for other input parameters required in NASHYD include the number of linear reservoir (N = 3) and pervious area depression storage (IA = 5 mm).

The hydrologic modeling conducted focused on the changes within the road drainage boundary. The purpose of this modeling is to demonstrate the local hydrologic changes caused by the roadway works and to guide the selection of appropriate stormwater management measures to mitigate the impacts to the extent possible.

As mentioned previously, due to property limitations and relatively small drainage areas, detention facilities are not practical means to achieve erosion and peak flow control. Also, the increases of peak flows within the road drainage boundary caused by the road improvement do not necessarily mean increased peak flows at the watershed scale. Therefore, at some outlet locations, there are only locally increased peak flows from the road drainage area.

VO2 model output is included in Appendix C and digital model files are on the CD enclosed with this report.

Outlet EW1

Outlet EW1 is located on the main branch of Borer's Creek. The proposed roadway intercepts overland flows from a large rural area south of the road which flow towards the west tributary of Borer's Creek under existing conditions. The total drainage area to Outlet 1 is 38 ha. Table 15 summarizes the catchment hydrologic parameters under existing and future conditions. The significant change of the Tp is due to the change of flow route. Under existing conditions, runoff flows overland to the Borer's Creek West Tributary and through creek routing to the Outlet EW1 location. However, after the new road built, this overland flow is intercepted by the road side ditch and the storm sewer system and is conveyed more directly to the watercourse and this increases the local discharge rate at Outlet EW1.

Table 15 - Outlet EW1 Catchment Hydrologic Parameters

Outlet Location	**Area (ha)**	**Existing**			**Future**		
		T_p (hr)	CN(AMCII)	CN(AMCIII)	T_p (hr)	CN(AMCII)	CN(AMCIII)
EW1	38	2.04	87.0	94	0.56	88.2	94.8

Without any stormwater management measures, the peak flow rate for local ROW and adjacent area drainage would increase under future conditions, as indicated by VO2 modeling results in Table 16. These increases are due to the reduced flow travel time after the road and drainage system are built. Table 17 shows the in-stream design flows at the Outlet EW1 location which are generated from about 600 ha subwatershed. Although the future condition peak flows from the road drainage area can represent up to 40% of the total in-stream flows for some design events, but the peaking time from the entire subwatershed is much longer than the peaking time from the road drainage; therefore the total peaks may not be affected.

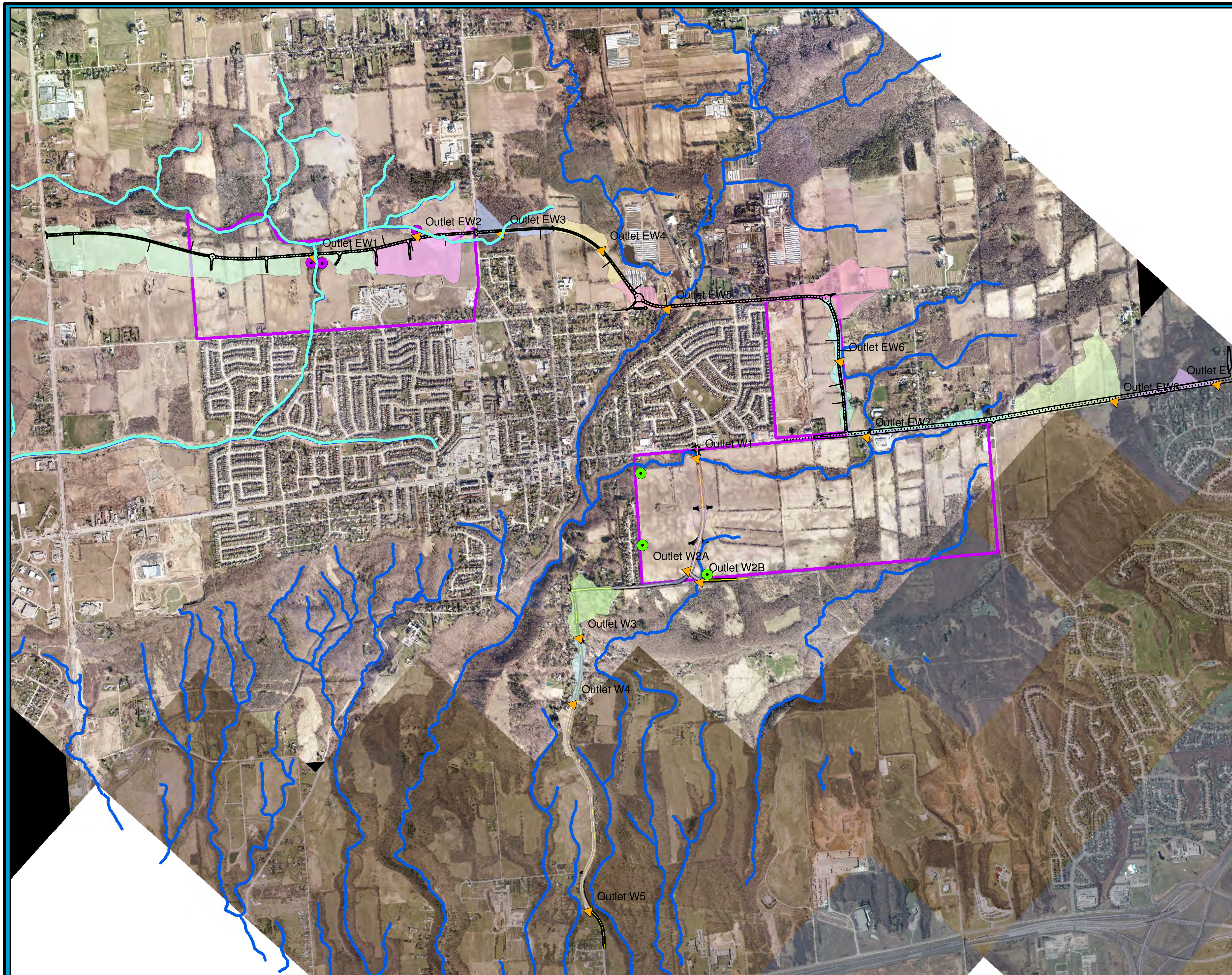
Table 16 - Outlet EW1 Existing and Future Hydrologic Conditions

	Existing		Future	
Storm Event	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.135	7	0.369	7
2 yr	0.411	20	1.128	21
5 yr	0.718	34	1.947	36
10 yr	0.936	45	2.521	46
25 yr	1.230	59	3.284	60
50 yr	1.438	68	3.819	70
100 yr	1.649	78	4.357	80
Regional	3.059	192	4.738	193

Table 17- Peak Flows of Outlet 1 at Borer's Creek (m^3/s) (Developed by Waterdown North MDP)

2 year	**5year**	**10 year**	**25 year**	**50 year**	**100 year**	**Regional Event**
2.82	5.1	6.67	8.08	9.71	10.8	40.64

As shown in Figure 9, a part of the ROW and local drainage contributing to Outlet EW1 (i.e., approximately 16 ha) is within the Waterdown North development area. Runoff from this section of the road will be managed by the development stormwater management plan. Two stormwater management facilities are proposed on either side of the main branch of the Borer's Creek which provide runoff quality and erosion control. Therefore, the proposed impacts on Borer's Creek would be mitigated by these two stormwater ponds. ROW and adjacent land runoff from Hwy 6 to the western boundary of the Waterdown North development also flows towards the main branch of Borer's Creek given the existing topography and road design. The drainage area is about 22 ha with a percent imperviousness of less than 10% which requires approximately 840 m^3 permanent pool storage for quality control. Any additional erosion control requirements beyond what is provided in the proposed SWM to the west of Borer's Creek must be determined through continuous simulation modeling. The City proposed to update the North Waterdown MDP to accommodate the proposed roadway and other changers to the North Waterdown development land. The City and consulting team for the development will work together to accommodate this additional runoff volume to the site stormwater management facilities. Analysis will be required during the detail design phase of the SWM pond proposed on the west side of the Borer's Creek.



Proposed New East-West Roadway

Figure 9
Road Drainage Area and Outlet

Legend

- Road Drainage Outlet
- Grindstone Creek
- Borer's Creek
- UrbanExpansionBoundary

SWM Facility

- Quality/Erosion Control
- Quality/Quantity/Erosion Control

SWM_catchment

- OutletEW1
- OutletEW2
- OutletEW3
- OutletEW4
- OutletEW5
- OutletEW6
- OutletEW7
- OutletEW8
- OutletEW9
- OutletW1
- OutletW2A
- OutletW2B
- OutletW3
- OutletW4
- OutletW5

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Meters

340 170 0 340 680

Notes:
Base mapping provided by the City of Hamilton, the City of Burlington and the Region of Halton. Additional mapping provided by Halton Region Conservation Authority and the Ministry of Natural Resources.

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Outlet EW2

The entire drainage area to Outlet EW2 is located within the Waterdown North development area. The catchment hydrologic parameters listed in Table 18 only demonstrate the changes caused by the new road corridor but do not include the proposed land development. As such, the VO2 hydrologic modeling results presented in Table 19 demonstrate the impacts on the existing hydrologic regime associated with proposed road improvement works. These impacts include marginal increases to runoff peaks flows and volumes, however based on the watershed study recommendations, peak flow control is not required. A stormwater quality and erosion control pond is proposed in the Waterdown North development on the north side of the proposed road. ROW runoff will be managed by this SWM facility.

Table 18 - Outlet EW2 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		t_p (hr)	CN(AMCII)	CN(AMCIII)	t_p (hr)	CN(AMCII)	CN(AMCIII)
EW2	15	0.45	88.0	94.8	0.46	89.1	95.0

Table 19 - Outlet EW2 Existing and Future Hydrologic Conditions

Storm Event	Existing		Future	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.160	7	0.173	8
2 yr	0.483	21	0.505	22
5 yr	0.846	35	0.874	37
10 yr	1.102	46	1.132	47
25 yr	1.444	60	1.475	62
50 yr	1.684	70	1.715	72
100 yr	1.926	80	1.956	82
Regional	1.948	193	1.939	193

Outlet EW3

Outlet EW3 is located at the woodlot/wetland east of Center Road. Due to the proposed new roadway, the existing overland flow pattern and drainage area characteristics are modified (i.e., time to peak (Tp) and CN values). Under proposed (future) conditions, the Tp value is marginally higher due to the modified overland flow route. The CN value has a relatively large increase due to the large proportion of road area with a height percent imperviousness compare to the relatively small total drainage area (i.e., 4.2 ha). Existing and proposed catchment parameters are presented in Table 20.

Table 20 -Outlet EW3 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		T_p (hr)	CN(AMCII)	CN(AMCIII)	T_p (hr)	CN(AMCII)	CN(AMCIII)
EW3	4.2	0.56	78.7	90.0	0.58	84.9	93.5

Table 21 summarizes hydrologic modeling outputs under existing and future conditions. Under future conditions, results show moderate increases to both runoff peak flows and event volumes due to the increased CN values. Outlet EW3 discharges to the woodlot/wetland, where flow velocities are relatively slow. As modeled in HEC-RAS, the flow velocity near Outlet EW 3 within the woodlot/forest is approximately 0.01 m/s for storms up to and including the Regional event. The wetland with a large storage volume provides significant flow attenuation. Therefore, any increases in peak runoff rates or volumes at the outlet would not increase erosion potential downstream of the wetland given the attenuation provided. It is also anticipated that flow attenuation will mitigate any peak flows from all the return period events. This section of the road is designed as a rural section with side ditches collecting the ROW and external area runoff. Wide bottom grass swales are proposed to treat stormwater runoff and provide 80% TSS removal. The treated runoff can be directed to the wetland to help maintain this feature.

Table 21 -Outlet EW3 Existing and Future Hydrologic Conditions

	Existing (Outlet EW3)		Future (Outlet EW3)	
Storm Event	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.023	4	0.032	6
2 yr	0.081	14	0.104	18
5 yr	0.151	26	0.186	32
10 yr	0.203	35	0.244	42
25 yr	0.276	47	0.324	55
50 yr	0.328	55	0.380	65
100 yr	0.382	64	0.438	74
Regional	0.513	182	0.516	190

Outlet EW4

Outlet EW4 discharges to a regulated wetland watercourse within the Grindstone Creek Watershed. Due to the proposed roadway, the existing overland flow pattern and drainage area characteristics are modified (i.e., Tp and CN values). Existing and proposed catchment parameters are presented in Table 22.

Table 22 - Outlet EW4 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		T_p (hr)	CN(AMCII)	CN(AMCIII)	T_p (hr)	CN(AMCII)	CN(AMCIII)
EW4	5.0	0.35	86.5	94.0	0.24	88.3	94.8

Table 23 summarizes hydrologic modeling outputs under existing and future conditions. Minor increases to both runoff peak flows and volumes result. As per the hydraulic analysis presented for Outlet EW3, the wetland at Outlet EW4 has a very flat terrain and behaves like a natural depression area with flow attenuation potential. Therefore, these minor increase peak flows would not increase downstream erosion potential or design event peak flow rates. Also, this section of the road is designed as a rural section with side ditches collecting ROW and external area runoff. Wide bottom grass swales are proposed to treat stormwater runoff and provide 80% TSS removal. Similar to Outlet EW2, the treated runoff can be directed to the wetland and maintain this feature.

Table 23 - Outlet EW4 Existing and Future Hydrologic Conditions

Storm Event	Existing		Future	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.054	7	0.075	7
2 yr	0.183	19	0.217	20
5 yr	0.320	33	0.366	34
10 yr	0.417	43	0.468	44
25 yr	0.548	57	0.612	57
50 yr	0.639	67	0.715	67
100 yr	0.732	76	0.819	76
Regional	0.697	189	0.691	183

<u>Outlet EW5</u>

Outlet EW5 is located on the main branch of Grindstone at Parkside Drive. East of the outlet a new roadway is proposed while west of the outlet, the existing 4 lane road (Parkside Drive) is proposed to be widened to a 6 lane road. Table 24 shows the existing and proposed catchment hydrologic parameters. Due to the new roadway, there is a decrease in the drainage area to Outlet EW5 which results in changes to the existing hydrologic regime. Namely, runoff peak flow rates and volume are reduced as presented in Table 25. This portion of the road is designed as an urban section with storm sewers to collect runoff from the ROW and side ditches to collect external runoff. Oil and Grit Separators (OGS) are recommended to be installed at the most downstream end of the storm sewer system to provide water quality treatment prior to outletting to the creek. A Stormceptor® unit STC 5000, or equivalent, is required to provide 80% TSS removal. Wide bottom flat swales are designed along the roadway to collect adjacent overland flows to the roadway and provide quality treatment. Ditch locations and cross sections are indicated in the road plan and profile drawings. Specific measures for quantity control (peak flow and erosion) are not required since there are no increases in peak flows or volumes.

Table 24 - Outlet EW5 Catchment Hydrologic Parameters

Outlet Location	**Area (ha)**	**Existing**			**Future**		
		T_p (hr)	CN(AMCII)	CN(AMCIII)	T_p (hr)	CN(AMCII)	CN(AMCIII)
EW5	19.2[1]/18.3[2]	0.72	87.2	94.0	0.72	88.1	94.8

Notes: 1 existing drainage area

2 future drainage area

Table 25 Outlet EW5 Existing and Future Conditions

Storm Event	**Existing (Outlet EW5)**		**Future (Outlet EW5)**	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.147	7	0.150	7
2 yr	0.460	20	0.455	21
5 yr	0.799	35	0.785	36
10 yr	1.038	45	1.016	46
25 yr	1.357	59	1.323	60
50 yr	1.582	69	1.542	70
100 yr	1.815	79	1.764	80
Regional	2.236	192	2.135	194

<u>*Outlet EW6*</u>

At Outlet EW 6, runoff is discharged to at a tributary of Grindstone Creek parallel to the proposed new roadway. Based on the existing terrain, the road low point is designed at this location. Due to the construction of the new roadway, the existing hydrological pattern is modified. There is an increase in the contributing drainage areas to the outlet under the future conditions (see Table 26). Therefore, increases in peak flows and runoff volumes are expected compared to existing condition. However, due to the small catchment area (i.e., 3 ha), the absolute values of peak flows and the increases are small. For example, the in-stream Regional flow rate at this location is 27.4 m^3/s based on the total contributing area about 819 ha as reported in the HEC-RAS hydraulic model. The increased Regional flow of 0.09m^3/s due to the proposed road works is considered negligible compared to the total flow in the creek. The same assumption is made for all design events (i.e., 25 mm to 100 year) and therefore quantity control in not recommended.

To the west of the proposed road is the Upcountry Estates development and to the east side is existing rural development. This portion of the road is therefore designed as both an urban cross-section with curb-catch basin-sewer system as a rural cross-sections with side ditches. The storm sewer system captures drainage from the west side of the road while side ditches capture runoff from the east side of the road. Wide bottom flat swales are proposed along the east side to provide water quality treatment for runoff from ROW. It is recommended that runoff collected by the sewer along the west side be treated using an OGS device prior to discharging to the creek. Two Stormceptor® units STC 300 or equivalent are proposed at the south and north end of the sewer to provide 80% TSS removal. An alternative to the OGS is to coordinate with the Upcountry Phase 2 development on the west side and to treat runoff using proposed stormwater management facilities.

Table 26 - Outlet EW6 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		t_p (hr)	CN(AMCII)	CN(AMCIII)	t_p (hr)	CN(AMCII)	CN(AMCIII)
EW6	2.40[1]/3.32[2]	0.2	88.0	94.8	0.20	94.0	97.5

Note: 1 existing drainage area

2 future drainage area

Table 27 - Outlet EW6 Existing and Future conditions

Storm Event	Existing (Outlet EW6)		Future (Outlet EW6)	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.034	6	0.063	8
2 yr	0.102	19	0.180	22
5 yr	0.180	32	0.298	36
10 yr	0.235	41	0.379	46
25 yr	0.308	53	0.483	59
50 yr	0.359	62	0.556	68
100 yr	0.411	71	0.628	77
Regional	0.311	172	0.426	173

Outlet EW7

Outlet EW7 is located on a tributary of Grindstone Creek across Dundas Street. The proposed road improvements along Dundas include widening the existing 4 lane road to 6 lanes. The existing flow pattern is generally maintained but there is a small increase in the size and percent imperviousness of the drainage area to Outlet EW7. Table 28 shows the existing and proposed catchment hydrologic parameters. Since there is an increase in drainage area and percent imperviousness to Outlet EW7 under the future condition, peak flows and runoff volumes from the road drainage area increase moderately. Due to the limited road property, open detention facilities within the road right of way to mitigate these impacts are not feasible. Alternatives such as super pipe storage would be costly. Furthermore, when considering this 7.36 ha road drainage located near the end of about 680 ha larger rural subwatershed, these peak flow increases may be negligible.

This portion of Dundas Street has an urban cross-section with storm sewers collecting ROW runoff and side ditches collecting external area runoff. Wherever possible (i.e., no ROW area limitations), wide bottom flat swales along the road are recommended to improve runoff quality and attenuate flows. OGS devices are also recommended to be installed as part of the existing sewer system and to provide water quality treatment of runoff prior to discharging to the creek. A Stormceptor® unit STC 1000 or equivalent is required at the end of the sewer west of the outlet. East of the outlet, there are three culverts across the road; therefore, four Stormceptor® units are required along the sewer system east of Outlet EW7, which are STC 5000, STC 750, STC 1000 and STC 750.

Table 28 - Outlet EW7 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		T_p (hr)	CN(AMCII)	CN(AMCIII)	T_p (hr)	CN(AMCII)	CN(AMCIII)
EW7	6.47[1]/7.36[2]	0.30	91.6	97.0	0.30	93.9	97.5

Note: 1 existing drainage area

2 future drainage area

Table 29 - Outlet EW7 Existing and Future Hydrologic Conditions

Storm Event	Existing (Outlet EW7)		Future (Outlet EW7)	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.110	9	0.163	11
2 yr	0.105	25	0.417	27
5 yr	0.169	41	0.658	43
10 yr	0.212	52	0.817	54
25 yr	0.268	67	1.023	69
50 yr	0.306	77	1.165	79
100 yr	0.344	87	1.306	90
Regional	0.911	194	1.028	187

Outlet EW8

At Outlet EW 8, there is a 1400 mm culvert currently crossing Dundas Street which conveys the upstream overland flow to the downstream watercourse. Under the future conditions, a new crossing structure is proposed at the same location. Due to the large rural catchment area, widening of the road does not result in a significant change to the catchment hydrologic parameters. Existing and proposed catchment parameters are summarized in Table 30. Therefore, increases in runoff peak flows and volumes are marginal due to the road widening (see Table 31) and quantity control is not recommended for this outlet. Also, there are no increases in the 25 mm event and erosion control is not required.

This portion of Dundas Street has an urban cross-section with storm sewers collecting ROW runoff and side ditches collecting external area runoff. Wherever possible (i.e., no ROW area limitations), it is recommended to implement wide bottom flat swales along the road to improve runoff quality and attenuate flows. OGS devices are also recommended to be installed as part of the existing sewer system and provide water quality treatment of runoff prior to discharging to the creek. A Stormceptor® unit STC 6000 or equivalent is required here to provide 80% TSS removal.

Table 30 - Outlet EW8 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		t_p (hr)	CN(AMCII)	CN(AMCIII)	t_p (hr)	CN(AMCII)	CN(AMCIII)
EW8	18.3[1]/18.8[2]	0.37	88.3	94.8	0.37	88.8	95.0

Note: 1 existing drainage area

2 future drainage area

Table 31 - Outlet EW8 Existing and Future Hydrologic Conditions

Storm Event	Existing (Outlet EW8)		Future (Outlet EW8)	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.216	7	0.245	8
2 yr	0.704	21	0.744	21
5 yr	1.215	36	1.276	36
10 yr	1.572	46	1.646	47
25 yr	2.046	60	2.136	61
50 yr	2.378	70	2.478	71
100 yr	2.711	80	2.822	81
Regional	2.525	192	2.597	192

Outlet EW9

At Outlet EW9, there is a 1000 mm culvert across Dundas which conveys upstream overland flow to the downstream watercourse. This structure will be maintained following the road widening (i.e., replacement is not required). Due to the relatively small drainage area which includes both ROW surface and external areas, even a small increase in the ROW area represents a relatively large change in the catchment. For example, the road widening results in an increase in percent imperviousness and CN value of the catchment. This in turn causes increases in runoff peak flows and volumes. However, due to the limited ROW property a stormwater detention pond is not feasible.

As per Outlet EW8, recommended stormwater management measures include wide bottom flat swales and OGS devices. A Stormceptor® unit STC 6000 is required here to provide 80% TSS removal.

Table 32 Outlet EW9 Catchment Hydrologic Parameters

Outlet Location	Area (ha)	Existing			Future		
		t_p (hr)	CN(AMCII)	CN(AMCIII)	t_p (hr)	CN(AMCII)	CN(AMCIII)
EW9	3.31[1]/3.86[2]	0.13	86.5	94.0	0.13	91.1	96.0

Note: 1 existing drainage area

2 future drainage area

Table 33 Outlet EW9 Existing and Future Conditions

Storm Event	Existing (Outlet EW9)		Future (Outlet EW9)	
	Peak flow (m^3/s)	Runoff Volume (mm)	Peak flow (m^3/s)	Runoff Volume (mm)
25mm	0.031	4	0.055	6
2 yr	0.108	12	0.161	15
5 yr	0.191	21	0.270	25
10 yr	0.251	28	0.344	32
25 yr	0.330	36	0.441	41
50 yr	0.386	43	0.508	48
100 yr	0.442	49	0.575	54
Regional	0.304	121	0.357	124

In addition to the stormwater management measures recommended for each Outlet describe above, the following general guidelines should be used as a basis for stormwater management during the detailed design to provide source, conveyance, and end-of-pipe control of surface water runoff, minimizing any adverse impacts:

- Minimize disturbance of all existing well vegetated ditches and grassed slopes where grading is required.
- Promote some short-term stormwater ponding within the right-of-way ditches where sub-grade drainage is not adversely affected.
- Design the road storm sewers and ditch outlets with adequate erosion protection measures.
- Maximize the length of overland flow through ditches between outlets and points where stormwater leaves the right-of-way.
- Where ditch re-grading is required, consider utilization of flat bottom ditches in lieu of ‘v’ ditches to reduce velocities and erosion potential, promote peak flow attenuation and provide short-term stormwater storage.

- Appropriate erosion and sediment control plan during the road construction should be prepared and implemented.

3.4 Stormwater Management Summary

Outlet EW1: Runoff from the ROW and adjacent areas within the Waterdown North development will be managed by the proposed development stormwater management facilities. Under proposed conditions additional runoff (i.e., from areas between Hwy 6 and west boundary of the Waterdown North development) will be conveyed to Outlet EW1. This drainage should be considered in the design of the proposed stormwater pond at the west side of the main branch of Borer's Creek. Approximately 840 m^3 permanent pool storage is required for runoff quality control. Any additional erosion control requirements beyond what is provided in the proposed SWM to the west of Borer's Creek must be determined through continuous simulation modeling. The City and consulting team for the development will work together when updating the North Waterdown MDP to accommodate this additional runoff volume into site stormwater management facilities. Analysis will be required during the detail design phase of the SWM pond proposed on the west side of Borer's Creek.

Outlet EW2: The ROW and external areas tributary to Outlet EW2 is conveyed via the proposed drainage system to the Waterdown North development and therefore the runoff will be managed by the stormwater management pond within the development, proposed on the north side of the roadway. This facility will provide water quality and erosion control. Quantity control is not required.

Outlet EW3 and EW4: at these two outlets, due to the specific characteristics of receiving watercourses and rural cross-section of the road design, wide bottom flat grass swales are recommended to provide the required stormwater management controls and meet the SWM targets.

Outlet EW5, EW7, and EW8: at these three outlets, widening of the existing 4 lane road to 6 lane road result in minor increases to runoff peaks and volumes. OGS devices to treat the sewer runoff and open bottom flat swales to treat adjacent overland runoff towards the roadway are proposed.

Outlet EW6 and EW9: at these two outlets, the road improvement results in relatively large increases on runoff peaks and volumes compared to the existing condition. However, considering the relatively small drainage areas to the outlets, around 3 ha to 4 ha, the increases relative to the total creek flows are negligible. Due to the road property limitations, detention facilities are not feasible to provide the runoff quantity and erosion control. OGS devices to treat the sewer runoff and wide bottom flat swales to treat adjacent overland runoff are proposed.

Appendix A HEC-RAS Model Output

Borer's Creek Existing Condition HEC-RAS output- 2year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	2	0.29	240.59	240.67	240.65	240.67	0.004077	0.3	1.03	23.52	0.42
1	2268.132	2	0.29	239.79	239.84	239.84	239.85	0.034808	0.55	0.53	20.08	1.08
1	2043.529	2	0.76	238.24	239.39	238.4	239.39	0.000001	0.02	38.05	118.03	0.01
1	1814.61	2	0.76	238.64	239.37	238.98	239.39	0.000602	0.6	1.27	41.4	0.24
1	1799		Culvert									
1	1784.961	2	0.76	238.64	239.12	239.12	239.25	0.014656	1.6	0.48	6.75	1
1	1687.198	2	0.76	238.1	238.65	238.3	238.66	0.000131	0.22	4	20.85	0.11
1	1651.088	2	1.47	238.05	238.64	238.33	238.65	0.000366	0.4	4.4	20.93	0.18
1	1466.978	2	1.47	238.09	238.43		238.47	0.006029	0.92	1.59	7.41	0.64
1	1189.114	2	1.47	236.97	237.28	237.2	237.3	0.003118	0.59	2.73	27.93	0.45
1	908.9714	2	1.47	235.15	235.59	235.58	235.69	0.013564	1.42	1.04	4.64	0.95
1	824.0313	2	1.47	234.56	235.26	235.05	235.29	0.002206	0.74	1.98	5.89	0.41
1	757.4083	2	1.47	234.56	234.88	234.88	234.97	0.016697	1.29	1.14	6.97	1.01
1	587.4989	2	2.82	234.02	234.55	234.21	234.55	0.000093	0.15	19.35	64.08	0.08
1	561.6553	2	2.82	234.06	234.54		234.54	0.001132	0.4	6.97	32.15	0.28
1	466.8039	2	2.82	234.08	234.43		234.44	0.001171	0.35	7.57	36.43	0.27
1	380.7534	2	2.82	234.02	234.17	234.16	234.2	0.013438	0.77	3.76	46.46	0.83
1	157.2275	2	2.82	230.35	230.96	230.96	231.12	0.013978	1.76	1.6	5.19	1.01

Borer's Creek Existing Condition HEC-RAS output - 5year event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	5	0.49	240.59	240.69	240.66	240.69	0.004497	0.38	1.44	26.89	0.46
1	2268.132	5	0.49	239.79	239.85	239.85	239.87	0.026757	0.59	0.83	23.31	1
1	2043.529	5	1.3	238.24	239.67	238.43	239.67	0	0.02	81.92	205.64	0.01
1	1814.61	5	1.3	238.64	239.64	239.08	239.67	0.000534	0.71	1.82	147.29	0.24
1	1799		Culvert									
1	1784.961	5	1.3	238.64	239.23	239.23	239.4	0.013063	1.85	0.7	10.31	1
1	1687.198	5	1.3	238.1	238.79	238.36	238.79	0.000143	0.28	5.49	21.3	0.12
1	1651.088	5	2.5	238.05	238.77	238.42	238.78	0.000435	0.5	5.84	21.35	0.2
1	1466.978	5	2.5	238.09	238.53	238.44	238.58	0.005744	1.04	2.4	8.98	0.64
1	1189.114	5	2.5	236.97	237.33	237.25	237.35	0.003478	0.73	4.44	44.19	0.49
1	908.9714	5	2.5	235.15	235.72		235.83	0.009577	1.42	1.76	6	0.84
1	824.0313	5	2.5	234.56	235.38	235.16	235.42	0.002624	0.9	2.77	6.99	0.46
1	757.4083	5	2.5	234.56	234.96	234.96	235.06	0.015589	1.44	1.74	8.53	1.01
1	587.4989	5	5.1	234.02	234.65	234.26	234.65	0.000116	0.2	26	65.41	0.1
1	561.6553	5	5.1	234.06	234.63		234.65	0.001193	0.48	10.59	39.12	0.3
1	466.8039	5	5.1	234.08	234.52		234.53	0.001288	0.44	11.19	43.11	0.3
1	380.7534	5	5.1	234.02	234.19	234.19	234.25	0.017699	1.06	5.02	46.56	0.99
1	157.2275	5	5.1	230.35	231.13	231.13	231.33	0.012847	1.98	2.58	6.63	1.01

Borer's Creek Existing Condition HEC-RAS output - 10year event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	10	0.62	240.59	240.67	240.67	240.69	0.014963	0.61	1.11	24.23	0.81
1	2268.132	10	0.62	239.79	239.88		239.89	0.005766	0.37	1.65	29.02	0.5
1	2043.529	10	1.66	238.24	239.89	238.45	239.89	0	0.02	130.93	238.09	0.01
1	1814.61	10	1.66	238.64	239.86	239.15	239.88	0.000435	0.74	2.24	182.25	0.22
1	1799		Culvert									
1	1784.961	10	1.66	238.64	239.29	239.29	239.5	0.012337	2.01	0.83	24.11	1
1	1687.198	10	1.66	238.1	238.87	238.4	238.87	0.000149	0.31	6.32	21.55	0.12
1	1651.088	10	3.21	238.05	238.84	238.46	238.86	0.000478	0.57	6.63	21.58	0.22
1	1466.978	10	3.21	238.09	238.58	238.49	238.64	0.005895	1.12	2.86	9.77	0.66
1	1189.114	10	3.21	236.97	237.35	237.29	237.38	0.003563	0.79	5.72	56.34	0.5
1	908.9714	10	3.21	235.15	235.8		235.9	0.008475	1.45	2.22	6.72	0.8
1	824.0313	10	3.21	234.56	235.44	235.22	235.5	0.002866	0.99	3.23	7.57	0.49
1	757.4083	10	3.21	234.56	235	235	235.12	0.015068	1.51	2.12	9.39	1.01
1	587.4989	10	6.67	234.02	234.7	234.29	234.7	0.000136	0.23	29.15	66.03	0.11
1	561.6553	10	6.67	234.06	234.68		234.69	0.001258	0.54	12.34	39.9	0.31
1	466.8039	10	6.67	234.08	234.55		234.57	0.001479	0.52	12.66	43.4	0.33
1	380.7534	10	6.67	234.02	234.23	234.22	234.28	0.012363	1.05	6.63	46.68	0.86
1	157.2275	10	6.67	230.35	231.28	231.28	231.44	0.013038	1.77	3.76	11.64	0.99

Borer's Creek Existing Condition HEC-RAS output - 25year event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	25	0.75	240.59	240.67	240.67	240.7	0.02172	0.73	1.11	24.26	0.97
1	2268.132	25	0.75	239.79	240.15	239.86	240.15	0.000016	0.06	13.94	58.27	0.03
1	2043.529	25	2	238.24	240.15	238.47	240.15	0	0.02	195.33	246.54	0
1	1814.61	25	2	238.64	240.12	239.2	240.15	0.000309	0.72	2.78	219.23	0.19
1	1799		Culvert									
1	1784.961	25	2	238.64	239.17	239.35	239.79	0.060841	3.49	0.57	7.46	2.08
1	1687.198	25	2	238.1	238.93	238.44	238.93	0.000158	0.34	6.98	21.75	0.13
1	1651.088	25	3.87	238.05	238.9	238.49	238.92	0.00052	0.63	7.26	21.76	0.23
1	1466.978	25	3.87	238.09	238.61		238.68	0.006064	1.21	3.31	16.11	0.68
1	1189.114	25	3.87	236.97	237.37	237.31	237.4	0.003582	0.83	6.96	68.93	0.51
1	908.9714	25	3.87	235.15	235.85		235.96	0.007839	1.47	2.62	7.29	0.78
1	824.0313	25	3.87	234.56	235.5	235.28	235.55	0.003067	1.07	3.63	8.02	0.51
1	757.4083	25	3.87	234.56	235.04	235.04	235.16	0.014644	1.57	2.47	10.1	1.01
1	587.4989	25	8.08	234.02	234.74	234.32	234.74	0.000151	0.26	31.78	66.55	0.12
1	561.6553	25	8.08	234.06	234.72		234.73	0.001292	0.58	13.83	40.55	0.32
1	466.8039	25	8.08	234.08	234.58		234.6	0.001575	0.57	13.98	43.67	0.34
1	380.7534	25	8.08	234.02	234.25		234.31	0.011471	1.11	7.63	46.75	0.85
1	157.2275	25	8.08	230.35	231.35	231.35	231.49	0.013835	1.68	4.8	16.82	1.01

Borer's Creek Existing Condition HEC-RAS output - 50year event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	50	0.91	240.59	240.68	240.68	240.71	0.019991	0.77	1.32	25.91	0.96
1	2268.132	50	0.91	239.79	240.44	239.87	240.44	0.000002	0.03	35.23	105.13	0.01
1	2043.529	50	2.43	238.24	240.44	238.49	240.44	0	0.01	267.66	260.66	0
1	1814.61	50	2.43	238.64	240.44	239.27	240.44	0	0.02	196.26	263.29	0.01
1	1799		Culvert									
1	1784.961	50	2.43	238.64	239.41	239.41	239.68	0.011374	2.28	1.07	52.28	1
1	1687.198	50	2.43	238.1	238.99	238.47	239	0.00017	0.37	7.69	21.97	0.13
1	1651.088	50	4.69	238.05	238.96	238.53	238.98	0.000574	0.69	7.93	21.96	0.25
1	1466.978	50	4.69	238.09	238.64		238.73	0.006341	1.31	3.82	16.29	0.71
1	1189.114	50	4.69	236.97	237.39	237.34	237.42	0.003551	0.87	8.5	75.08	0.52
1	908.9714	50	4.69	235.15	235.92		236.03	0.007311	1.51	3.11	7.92	0.77
1	824.0313	50	4.69	234.56	235.55	235.33	235.62	0.003286	1.15	4.08	8.52	0.53
1	757.4083	50	4.69	234.56	235.08	235.08	235.21	0.014276	1.63	2.87	10.88	1.01
1	587.4989	50	9.71	234.02	234.78	234.34	234.79	0.000166	0.28	34.6	67.09	0.12
1	561.6553	50	9.71	234.06	234.76		234.78	0.001323	0.63	15.43	41.24	0.33
1	466.8039	50	9.71	234.08	234.62		234.64	0.00163	0.63	15.5	43.97	0.36
1	380.7534	50	9.71	234.02	234.27	234.25	234.34	0.01108	1.18	8.64	46.83	0.85
1	157.2275	50	9.71	230.35	231.4	231.4	231.54	0.014146	1.67	5.81	20.96	1.01

Borer's Creek Existing Condition HEC-RAS output - 100year event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	100	1.02	240.59	240.69	240.69	240.72	0.019025	0.79	1.45	26.99	0.94
1	2268.132	100	1.02	239.79	240.47	239.87	240.47	0.000002	0.04	38.16	117.72	0.01
1	2043.529	100	2.73	238.24	240.47	238.5	240.47	0	0.02	274.58	262.57	0
1	1814.61	100	2.73	238.64	240.47	239.31	240.47	0	0.02	203.33	272.1	0.01
1	1799		Culvert									
1	1784.961	100	2.73	238.64	239.45	239.45	239.74	0.011128	2.37	1.15	62.36	1
1	1687.198	100	2.73	238.1	239.03	238.49	239.04	0.000178	0.39	8.15	22.11	0.14
1	1651.088	100	5.26	238.05	239	238.55	239.02	0.000609	0.73	8.36	22.08	0.25
1	1466.978	100	5.26	238.09	238.66		238.75	0.00657	1.39	4.12	16.39	0.73
1	1189.114	100	5.26	236.97	237.41	237.36	237.44	0.003512	0.9	9.6	80.55	0.52
1	908.9714	100	5.26	235.15	235.96		236.08	0.007057	1.52	3.45	8.43	0.76
1	824.0313	100	5.26	234.56	235.59	235.37	235.66	0.003439	1.2	4.39	9.48	0.54
1	757.4083	100	5.26	234.56	235.1	235.1	235.24	0.014027	1.67	3.15	11.38	1.01
1	587.4989	100	10.8	234.02	234.81	234.35	234.81	0.000176	0.3	36.33	67.42	0.13
1	561.6553	100	10.8	234.06	234.78		234.8	0.001349	0.66	16.42	41.66	0.33
1	466.8039	100	10.8	234.08	234.64		234.66	0.0017	0.67	16.34	44.13	0.37
1	380.7534	100	10.8	234.02	234.29	234.27	234.36	0.010688	1.21	9.32	46.88	0.85
1	157.2275	100	10.8	230.35	231.43	231.43	231.57	0.014617	1.7	6.34	22.87	1.03

Borer's Creek Existing Condition HEC-RAS output - Regional event(Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	Reg	3.44	240.59	240.8	240.76	240.83	0.005116	0.78	6.04	52.36	0.58
1	2268.132	Reg	3.44	239.79	240.82		240.82	0.000003	0.06	93.17	177.99	0.02
1	2043.529	Reg	9.19	238.24	240.82	238.67	240.82	0	0.04	371.57	302.64	0.01
1	1814.61	Reg	9.19	238.64	240.82	240.03	240.82	0.000001	0.05	306.97	306.63	0.01
1	1799		Culvert									
1	1784.961	Reg	9.19	238.64	240.17	240.17	240.82	0.008449	3.55	2.59	224.15	1
1	1687.198	Reg	9.19	238.1	239.66	238.74	239.68	0.000274	0.71	15.02	24	0.19
1	1651.088	Reg	17.74	238.05	239.57	238.91	239.65	0.001125	1.4	14.58	23.89	0.38
1	1466.978	Reg	17.74	238.09	238.94	238.94	239.19	0.008982	2.35	8.87	17.96	0.93
1	1189.114	Reg	17.74	236.97	237.59	237.51	237.62	0.002603	1.06	30.48	127.78	0.48
1	908.9714	Reg	17.74	235.15	236.41	236.31	236.53	0.006301	1.58	12.77	61.98	0.74
1	824.0313	Reg	17.74	234.56	235.91	235.89	236.07	0.004669	1.96	13.85	47.3	0.69
1	757.4083	Reg	17.74	234.56	235.47	235.47	235.63	0.009824	1.84	10.69	35.54	0.91
1	587.4989	Reg	40.64	234.02	235.29	234.59	235.31	0.000308	0.6	70.3	74.24	0.19
1	561.6553	Reg	40.64	234.06	235.22		235.29	0.001622	1.12	36.13	46.95	0.41
1	466.8039	Reg	40.64	234.08	235.04		235.11	0.002137	1.23	34.74	47.53	0.46
1	380.7534	Reg	40.64	234.02	234.52	234.52	234.73	0.012036	2.11	20.22	47.69	1.02
1	157.2275	Reg	40.64	230.35	231.8	231.81	232.08	0.011776	2.34	17.43	34.7	1.03

Borer's Creek Future Condition HEC-RAS output- 2year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	2	0.29	240.59	240.67	240.65	240.67	0.004077	0.3	1.03	23.52	0.42
1	2268.132	2	0.29	239.79	239.84	239.84	239.85	0.034808	0.55	0.53	20.08	1.08
1	2043.529	2	0.29	238.24	239.61	238.4	239.61	0	0.01	63.37	182.46	0
1	2023		Culvert									
1	2003.869	2	0.76	238.14	239.61	238.33	239.61	0	0.01	77.73	208.78	0
1	1814.61	2	0.76	239.21	239.48	239.48	239.6	0.013891	1.54	0.49	35.91	0.99
1	1799		Culvert									
1	1784.961	2	0.76	238.4	238.64	238.64	238.77	0.014238	1.55	0.49	7.58	1
1	1687.198	2	0.76	238.1	238.65	238.3	238.65	0.000139	0.23	3.93	20.83	0.11
1	1669		Culvert									
1	1651.088	2	1.47	238.05	238.64	238.33	238.65	0.000366	0.4	4.4	20.93	0.18
1	1466.978	2	1.47	238.09	238.43		238.47	0.006029	0.92	1.59	7.41	0.64
1	1189.114	2	1.47	236.97	237.28	237.2	237.3	0.003118	0.59	2.73	27.93	0.45
1	908.9714	2	1.47	235.15	235.59	235.58	235.69	0.013564	1.42	1.04	4.64	0.95
1	824.0313	2	1.47	234.56	235.26	235.05	235.29	0.002206	0.74	1.98	5.89	0.41
1	757.4083	2	1.47	234.56	234.88	234.88	234.97	0.016697	1.29	1.14	6.97	1.01
1	587.4989	2	2.82	234.02	234.52	234.21	234.52	0.000135	0.16	17.28	63.66	0.1
1	561.6553	2	2.82	234.06	234.49	234.35	234.51	0.001593	0.56	5.08	28.23	0.34
1	538		Culvert									
1	527.6707	2	2.82	234.06	234.48	234.28	234.49	0.000777	0.45	6.3	30.85	0.25
1	466.8039	2	2.82	234.08	234.43		234.44	0.001171	0.35	7.57	36.43	0.27
1	380.7534	2	2.82	234.02	234.17	234.16	234.2	0.013438	0.77	3.76	46.46	0.83
1	157.2275	2	2.82	230.35	230.96	230.96	231.12	0.013978	1.76	1.6	5.19	1.01

Borer's Creek Future Condition HEC-RAS output- 5 year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	5	0.49	240.59	240.69	240.66	240.69	0.004497	0.38	1.44	26.89	0.46
1	2268.132	5	0.49	239.79	239.85	239.85	239.87	0.026757	0.59	0.83	23.31	1
1	2043.529	5	0.49	238.24	239.77	238.42	239.77	0	0.01	96.5	234.9	0
1	2023		Culvert									
1	2003.869	5	1.3	238.14	239.77	238.37	239.77	0	0.02	111.43	218.52	0.01
1	1814.61	5	1.3	239.21	239.58	239.58	239.75	0.012635	1.86	0.7	51.93	1
1	1799		Culvert									
1	1784.961	5	1.3	238.4	238.75	238.75	238.93	0.012563	1.86	0.7	10	1
1	1687.198	5	1.3	238.1	238.78	238.36	238.79	0.00015	0.28	5.41	21.28	0.12
1	1669		Culvert									
1	1651.088	5	2.5	238.05	238.77	238.42	238.78	0.000435	0.5	5.84	21.35	0.2
1	1466.978	5	2.5	238.09	238.53	238.44	238.58	0.005744	1.04	2.4	8.98	0.64
1	1189.114	5	2.5	236.97	237.33	237.25	237.35	0.003478	0.73	4.44	44.19	0.49
1	908.9714	5	2.5	235.15	235.72		235.83	0.009577	1.42	1.76	6	0.84
1	824.0313	5	2.5	234.56	235.38	235.16	235.42	0.002624	0.9	2.77	6.99	0.46
1	757.4083	5	2.5	234.56	234.96	234.96	235.06	0.015589	1.44	1.74	8.53	1.01
1	587.4989	5	5.1	234.02	234.63	234.26	234.64	0.000134	0.21	24.84	65.18	0.11
1	561.6553	5	5.1	234.06	234.6	234.42	234.63	0.001726	0.72	7.07	38.21	0.38
1	538		Culvert									
1	527.6707	5	5.1	234.06	234.58	234.34	234.6	0.001063	0.62	8.18	32.28	0.3
1	466.8039	5	5.1	234.08	234.52		234.53	0.001288	0.44	11.19	43.11	0.3
1	380.7534	5	5.1	234.02	234.19	234.19	234.25	0.017699	1.06	5.02	46.56	0.99
1	157.2275	5	5.1	230.35	231.13	231.13	231.33	0.012847	1.98	2.58	6.63	1.01

Borer's Creek Future Condition HEC-RAS output- 10 year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	10	0.62	240.59	240.67	240.67	240.69	0.022454	0.69	0.96	22.95	0.97
1	2268.132	10	0.62	239.79	239.89	239.86	239.9	0.003454	0.31	1.97	30.73	0.4
1	2043.529	10	0.62	238.24	239.9	238.44	239.9	0	0.01	124.37	238.36	0
1	2023		Culvert									
1	2003.869	10	1.66	238.14	239.9	238.39	239.9	0	0.02	137.34	222.15	0.01
1	1814.61	10	1.66	239.21	239.76	239.64	239.88	0.00523	1.57	1.06	81.52	0.69
1	1799		Culvert									
1	1784.961	10	1.66	238.4	238.81	238.81	239.02	0.011812	2.01	0.83	16.87	1
1	1687.198	10	1.66	238.1	238.86	238.4	238.86	0.000156	0.31	6.23	21.52	0.12
1	1669		Culvert									
1	1651.088	10	3.21	238.05	238.84	238.46	238.86	0.000478	0.57	6.63	21.58	0.22
1	1466.978	10	3.21	238.09	238.58	238.49	238.64	0.005895	1.12	2.86	9.77	0.66
1	1189.114	10	3.21	236.97	237.35	237.29	237.38	0.003563	0.79	5.72	56.34	0.5
1	908.9714	10	3.21	235.15	235.8		235.9	0.008475	1.45	2.22	6.72	0.8
1	824.0313	10	3.21	234.56	235.44	235.22	235.5	0.002866	0.99	3.23	7.57	0.49
1	757.4083	10	3.21	234.56	235	235	235.12	0.015068	1.51	2.12	9.39	1.01
1	587.4989	10	6.67	234.02	234.69	234.29	234.7	0.000143	0.23	28.74	65.95	0.11
1	561.6553	10	6.67	234.06	234.65	234.46	234.68	0.001953	0.83	8	39.37	0.41
1	538		Culvert									
1	527.6707	10	6.67	234.06	234.63	234.38	234.66	0.001315	0.74	9.01	32.88	0.34
1	466.8039	10	6.67	234.08	234.55		234.57	0.001479	0.52	12.66	43.4	0.33
1	380.7534	10	6.67	234.02	234.23	234.22	234.28	0.012363	1.05	6.63	46.68	0.86
1	157.2275	10	6.67	230.35	231.28	231.28	231.44	0.013038	1.77	3.76	11.64	0.99

Borer's Creek Future Condition HEC-RAS output- 25 year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	25	0.75	240.59	240.67	240.67	240.7	0.02172	0.73	1.11	24.26	0.97
1	2268.132	25	0.75	239.79	240.16	239.86	240.16	0.000015	0.06	14.24	58.69	0.03
1	2043.529	25	0.75	238.24	240.16	238.45	240.16	0	0.01	185.24	246.72	0
1	2023		Culvert									
1	2003.869	25	2	238.14	240.16	238.4	240.16	0	0.02	193.97	229.84	0
1	1814.61	25	2	239.21	240.08	239.7	240.15	0.001545	1.18	1.7	111.33	0.41
1	1799		Culvert									
1	1784.961	25	2	238.4	238.87	238.87	239.1	0.011387	2.14	0.93	17.62	1
1	1687.198	25	2	238.1	238.92	238.44	238.92	0.000165	0.34	6.88	21.72	0.13
1	1669		Culvert									
1	1651.088	25	3.87	238.05	238.9	238.49	238.92	0.00052	0.63	7.26	21.76	0.23
1	1466.978	25	3.87	238.09	238.61		238.68	0.006065	1.21	3.31	16.11	0.68
1	1189.114	25	3.87	236.97	237.37	237.31	237.4	0.003581	0.83	6.96	68.94	0.51
1	908.9714	25	3.87	235.15	235.85		235.96	0.00784	1.47	2.62	7.29	0.78
1	824.0313	25	3.87	234.56	235.5	235.28	235.55	0.003065	1.07	3.63	8.03	0.51
1	757.4083	25	3.87	234.56	235.04	235.04	235.16	0.014659	1.57	2.47	10.1	1.01
1	587.4989	25	8.08	234.02	234.74	234.32	234.75	0.000148	0.26	31.99	66.59	0.12
1	561.6553	25	8.08	234.06	234.69	234.49	234.73	0.002113	0.92	8.77	40.09	0.43
1	538		Culvert									
1	527.6707	25	8.08	234.06	234.66	234.41	234.7	0.001515	0.83	9.69	33.36	0.37
1	466.8039	25	8.08	234.08	234.58		234.6	0.001575	0.57	13.98	43.67	0.34
1	380.7534	25	8.08	234.02	234.25		234.31	0.011471	1.11	7.63	46.75	0.85
1	157.2275	25	8.08	230.35	231.35	231.35	231.49	0.013835	1.68	4.8	16.82	1.01

Borer's Creek Future Condition HEC-RAS output- 50 year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	50	0.91	240.59	240.68	240.68	240.71	0.019991	0.77	1.32	25.91	0.96
1	2268.132	50	0.91	239.79	240.44	239.87	240.44	0.000002	0.03	35.29	105.31	0.01
1	2043.529	50	0.91	238.24	240.44	238.46	240.44	0	0.01	253.79	260.72	0
1	2023		Culvert									
1	2003.869	50	2.43	238.14	240.44	238.42	240.44	0	0.01	257.2	238.52	0
1	1814.61	50	2.43	239.21	240.44	239.76	240.44	0.000001	0.04	97.83	130.36	0.01
1	1799		Culvert									
1	1784.961	50	2.43	238.4	238.93	238.93	239.2	0.010994	2.29	1.06	18.5	1
1	1687.198	50	2.43	238.1	238.98	238.47	238.99	0.000177	0.37	7.6	21.94	0.14
1	1669		Culvert									
1	1651.088	50	4.69	238.05	238.96	238.53	238.98	0.000574	0.69	7.93	21.96	0.25
1	1466.978	50	4.69	238.09	238.64		238.73	0.006341	1.31	3.82	16.29	0.71
1	1189.114	50	4.69	236.97	237.39	237.34	237.42	0.003551	0.87	8.5	75.08	0.52
1	908.9714	50	4.69	235.15	235.92		236.03	0.007311	1.51	3.11	7.92	0.77
1	824.0313	50	4.69	234.56	235.55	235.33	235.62	0.003286	1.15	4.08	8.52	0.53
1	757.4083	50	4.69	234.56	235.08	235.08	235.21	0.014276	1.63	2.87	10.88	1.01
1	587.4989	50	9.71	234.02	234.8	234.34	234.8	0.000149	0.28	35.77	67.32	0.12
1	561.6553	50	9.71	234.06	234.74	234.52	234.79	0.002203	1	9.67	40.93	0.45
1	538		Culvert									
1	527.6707	50	9.71	234.06	234.7	234.45	234.75	0.001722	0.93	10.41	33.88	0.4
1	466.8039	50	9.71	234.08	234.62		234.64	0.00163	0.63	15.5	43.97	0.36
1	380.7534	50	9.71	234.02	234.27	234.25	234.34	0.01108	1.18	8.64	46.83	0.85
1	157.2275	50	9.71	230.35	231.4	231.4	231.54	0.014146	1.67	5.81	20.96	1.01

Borer's Creek Future Condition HEC-RAS output- 100 year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	100	1.02	240.59	240.69	240.69	240.72	0.019025	0.79	1.45	26.99	0.94
1	2268.132	100	1.02	239.79	240.47	239.87	240.47	0.000002	0.04	38.24	118.3	0.01
1	2043.529	100	1.02	238.24	240.47	238.47	240.47	0	0.01	260.48	262.61	0
1	2023		Culvert									
1	2003.869	100	2.73	238.14	240.47	238.43	240.47	0	0.02	263.26	239.46	0
1	1814.61	100	2.73	239.21	240.47	239.8	240.47	0.000001	0.04	101.29	132.11	0.01
1	1799		Culvert									
1	1784.961	100	2.73	238.4	238.97	238.97	239.26	0.010744	2.38	1.15	19.08	1.01
1	1687.198	100	2.73	238.1	239.02	238.49	239.03	0.000185	0.4	8.05	22.08	0.14
1	1669		Culvert									
1	1651.088	100	5.26	238.05	239	238.55	239.02	0.000609	0.73	8.36	22.08	0.25
1	1466.978	100	5.26	238.09	238.66		238.75	0.00657	1.39	4.12	16.39	0.73
1	1189.114	100	5.26	236.97	237.41	237.36	237.44	0.003512	0.9	9.6	80.55	0.52
1	908.9714	100	5.26	235.15	235.96		236.08	0.007057	1.52	3.45	8.43	0.76
1	824.0313	100	5.26	234.56	235.59	235.37	235.66	0.003439	1.2	4.39	9.48	0.54
1	757.4083	100	5.26	234.56	235.1	235.1	235.24	0.014027	1.67	3.15	11.38	1.01
1	587.4989	100	10.8	234.02	234.83	234.35	234.84	0.000152	0.29	38.03	67.75	0.12
1	561.6553	100	10.8	234.06	234.76	234.55	234.82	0.002296	1.06	10.18	41.41	0.46
1	538		Culvert									
1	527.6707	100	10.8	234.06	234.72	234.47	234.78	0.001865	1	10.83	34.18	0.42
1	466.8039	100	10.8	234.08	234.64		234.66	0.0017	0.67	16.34	44.13	0.37
1	380.7534	100	10.8	234.02	234.29	234.27	234.36	0.010688	1.21	9.32	46.88	0.85
1	157.2275	100	10.8	230.35	231.43	231.43	231.57	0.014617	1.7	6.34	22.87	1.03

Borer's Creek Future Condition HEC-RAS output- Regional year event (Associated with Crossing EW1, EW2, EW3)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	2358.876	Reg	3.44	240.59	240.76	240.76	240.81	0.014548	1.11	4	42.29	0.93
1	2268.132	Reg	3.44	239.79	240.61	239.94	240.61	0.00001	0.09	58.58	150.12	0.03
1	2043.529	Reg	3.44	238.24	240.61	238.59	240.61	0	0.02	297.81	271.56	0
1	2023		Culvert									
1	2003.869	Reg	9.19	238.14	240.6	238.61	240.6	0.000001	0.05	295.12	244.28	0.01
1	1814.61	Reg	9.19	239.21	240.6	240.4	240.6	0.00001	0.13	120.49	146.55	0.03
1	1799		Culvert									
1	1784.961	Reg	9.19	238.4	239.69	239.69	240.34	0.008109	3.56	2.58	97.11	1
1	1687.198	Reg	9.19	238.1	239.66	238.74	239.68	0.000271	0.7	15.06	24	0.19
1	1669		Culvert									
1	1651.088	Reg	17.74	238.05	239.57	238.91	239.65	0.001126	1.4	14.58	23.89	0.38
1	1466.978	Reg	17.74	238.09	238.94	238.94	239.19	0.008982	2.35	8.87	17.96	0.93
1	1189.114	Reg	17.74	236.97	237.59	237.51	237.62	0.002774	1.09	29.78	127.07	0.5
1	908.9714	Reg	17.74	235.15	236.42	236.31	236.53	0.00564	1.53	13.6	66.8	0.7
1	824.0313	Reg	17.74	234.56	235.89	235.89	236.07	0.005183	2.03	13.1	45.57	0.72
1	757.4083	Reg	17.74	234.56	235.5	235.47	235.64	0.007519	1.69	11.82	37.13	0.8
1	587.4989	Reg	40.64	234.02	235.54		235.55	0.000145	0.48	89.68	77.7	0.13
1	561.6553	Reg	40.64	234.06	235.33	235.01	235.53	0.002981	1.95	20.85	48.13	0.59
1	538		Culvert									
1	527.6707	Reg	40.64	234.06	235.09	234.93	235.36	0.005113	2.29	17.73	39.13	0.75
1	466.8039	Reg	40.64	234.08	235.04		235.11	0.002137	1.23	34.74	47.53	0.46
1	380.7534	Reg	40.64	234.02	234.52	234.52	234.73	0.012036	2.11	20.22	47.69	1.02
1	157.2275	Reg	40.64	230.35	231.8	231.81	232.08	0.01168	2.33	17.48	34.73	1.03

Grindstone Creek Mainstream Existing Condition HEC-RAS Output Associated with Crossing EW5 (RS 1335.743)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Main	1520.333	Regional	76.3	232.18	234.6	233.8	234.85	0.001613	2.3	47.67	30.19	0.49
Main	1520.333	100 yr	20.1	232.18	233.96	232.95	234	0.000362	0.87	30.09	24.79	0.22
Main	1520.333	50 yr	19.3	232.18	233.93	232.94	233.97	0.000356	0.86	29.33	24.53	0.22
Main	1520.333	25 yr	18.1	232.18	233.88	232.91	233.92	0.000349	0.83	28.17	24.14	0.21
Main	1520.333	10 yr	16.1	232.18	233.8	232.87	233.83	0.000335	0.78	26.19	23.49	0.21
Main	1520.333	5 yr	14.2	232.18	233.72	232.83	233.74	0.00032	0.74	24.24	22.84	0.2
Main	1446.186	Regional	76.3	232.25	234.57	234.08	234.68	0.001974	1.93	100.22	87.62	0.49
Main	1446.186	100 yr	20.1	232.25	233.51	233.51	233.89	0.010633	2.74	7.34	9.64	1
Main	1446.186	50 yr	19.3	232.25	233.48	233.48	233.86	0.010628	2.71	7.13	9.53	1
Main	1446.186	25 yr	18.1	232.25	233.45	233.45	233.81	0.010701	2.66	6.8	9.36	1
Main	1446.186	10 yr	16.1	232.25	233.39	233.39	233.73	0.010865	2.59	6.22	9.04	1
Main	1446.186	5 yr	14.2	232.25	233.32	233.32	233.64	0.01127	2.53	5.61	8.68	1
Main	1347.187	Regional	128.8	230.27	234.35	233.31	234.54	0.001106	2.09	118.77	105.88	0.4
Main	1347.187	100 yr	32	230.27	232.16	231.76	232.59	0.003683	2.91	10.98	11.5	0.69
Main	1347.187	50 yr	30.4	230.27	232.1	231.71	232.52	0.003705	2.86	10.63	11.3	0.69
Main	1347.187	25 yr	28.2	230.27	232.02	231.65	232.41	0.003733	2.78	10.14	11.01	0.69
Main	1347.187	10 yr	24.9	230.27	231.89	231.54	232.25	0.003796	2.66	9.36	10.57	0.68
Main	1347.187	5 yr	21.7	230.27	231.76	231.44	232.09	0.003854	2.53	8.58	10.07	0.68
Main	1335.743		Bridge									
Main	1320.581	Regional	128.8	230.11	232.8	232.8	233.42	0.00401	3.73	67.19	70.16	0.77
Main	1320.581	100 yr	32	230.11	231.59	231.59	232.3	0.007835	3.73	8.58	23.26	1
Main	1320.581	50 yr	30.4	230.11	231.54	231.54	232.23	0.007984	3.68	8.27	21.41	1
Main	1320.581	25 yr	28.2	230.11	231.47	231.47	232.12	0.008162	3.59	7.85	19.21	1
Main	1320.581	10 yr	24.9	230.11	231.37	231.37	231.97	0.008272	3.43	7.26	17.79	1
Main	1320.581	5 yr	21.7	230.11	231.26	231.26	231.81	0.008528	3.28	6.62	15.87	1
Main	1200	Regional	128.8	229.46	230.25	230.64	231.8	0.094159	5.52	23.4	59.67	2.8
Main	1200	100 yr	32	229.46	230.05	230.15	230.38	0.033855	2.53	12.66	47.8	1.57
Main	1200	50 yr	30.4	229.46	230.06	230.15	230.35	0.03023	2.39	12.71	47.9	1.48
Main	1200	25 yr	28.2	229.46	230.06	230.12	230.31	0.025819	2.21	12.74	47.96	1.37
Main	1200	10 yr	24.9	229.46	230.05	230.1	230.25	0.0214	2	12.45	47.41	1.25
Main	1200	5 yr	21.7	229.46	230.09	230.06	230.21	0.010914	1.49	14.59	52.26	0.9
Main	1100.28	Regional	128.8	228	229.59	229.59	230.04	0.011001	3.57	68.47	78.09	1.12
Main	1100.28	100 yr	32	228	229	229	229.19	0.013225	2.24	24.86	65.59	1.07
Main	1100.28	50 yr	30.4	228	228.99	228.99	229.18	0.012558	2.16	24.41	63.4	1.04
Main	1100.28	25 yr	28.2	228	228.97	228.97	229.15	0.012555	2.12	23.11	62.91	1.03
Main	1100.28	10 yr	24.9	228	228.94	228.94	229.11	0.012266	2.04	21.21	61.94	1.01
Main	1100.28	5 yr	21.7	228	228.91	228.91	229.06	0.01222	1.98	19.04	59.97	1

Grindstone Creek Mainstream Future Condition HEC-RAS Output Associated with Crossing EW5 (RS 1335.743)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Main	1520.333	Regional	76.3	232.18	234.54	233.8	234.8	0.001785	2.37	45.77	29.65	0.51
Main	1520.333	100 yr	20.1	232.18	233.96	232.95	234	0.000361	0.87	30.09	24.79	0.22
Main	1520.333	50 yr	19.3	232.18	233.93	232.94	233.97	0.000356	0.86	29.33	24.53	0.22
Main	1520.333	25 yr	18.1	232.18	233.88	232.91	233.92	0.000348	0.83	28.17	24.14	0.21
Main	1520.333	10 yr	16.1	232.18	233.8	232.87	233.83	0.000334	0.78	26.19	23.5	0.21
Main	1520.333	5 yr	14.2	232.18	233.72	232.83	233.74	0.00032	0.74	24.25	22.84	0.2
Main	1446.186	Regional	76.3	232.25	234.49	234.08	234.61	0.002474	2.08	92.63	86.82	0.54
Main	1446.186	100 yr	20.1	232.25	233.51	233.51	233.89	0.010633	2.74	7.34	9.64	1
Main	1446.186	50 yr	19.3	232.25	233.48	233.48	233.86	0.010628	2.71	7.13	9.53	1
Main	1446.186	25 yr	18.1	232.25	233.45	233.45	233.81	0.010701	2.66	6.8	9.36	1
Main	1446.186	10 yr	16.1	232.25	233.39	233.39	233.73	0.010865	2.59	6.22	9.04	1
Main	1446.186	5 yr	14.2	232.25	233.32	233.32	233.64	0.01127	2.53	5.61	8.68	1
Main	1347.187	Regional	128.8	230.27	234.28	233.03	234.46	0.001209	2.25	137.75	103.22	0.42
Main	1347.187	100 yr	32	230.27	232.12	231.68	232.32	0.002214	2.14	24.21	25.21	0.53
Main	1347.187	50 yr	30.4	230.27	232.07	231.64	232.27	0.002218	2.1	23.29	24.97	0.52
Main	1347.187	25 yr	28.2	230.27	232.02	231.6	232.2	0.002187	2.04	22.13	24.66	0.52
Main	1347.187	10 yr	24.9	230.27	231.92	231.52	232.09	0.002166	1.94	20.21	24.16	0.51
Main	1347.187	5 yr	21.7	230.27	231.82	231.45	231.97	0.002147	1.85	18.22	23.63	0.5
Main	1335.743		Bridge									
Main	1320.581	Regional	128.8	230.11	232.42	232.42	233.28	0.007277	4.12	32.9	44.7	0.99
Main	1320.581	100 yr	32	230.11	231.33	231.33	231.69	0.01014	2.67	12	17.19	1
Main	1320.581	50 yr	30.4	230.11	231.3	231.3	231.65	0.010144	2.62	11.62	16.85	1
Main	1320.581	25 yr	28.2	230.11	231.27	231.26	231.6	0.009827	2.55	11.06	16.01	0.98
Main	1320.581	10 yr	24.9	230.11	231.22	231.17	231.52	0.009029	2.43	10.26	14.99	0.94
Main	1320.581	5 yr	21.7	230.11	231.16	231.08	231.43	0.008307	2.32	9.36	13.77	0.9
Main	1200	Regional	128.8	229.46	230.34	230.64	231.37	0.051424	4.5	28.73	63.37	2.12
Main	1200	100 yr	32	229.46	230.19	230.15	230.32	0.009705	1.62	19.72	57.07	0.88
Main	1200	50 yr	30.4	229.46	230.17	230.15	230.3	0.010375	1.63	18.65	56.3	0.9
Main	1200	25 yr	28.2	229.46	230.15	230.12	230.28	0.010415	1.59	17.72	55.58	0.9
Main	1200	10 yr	24.9	229.46	230.12	230.1	230.24	0.010732	1.54	16.16	54.34	0.9
Main	1200	5 yr	21.7	229.46	230.09	230.06	230.21	0.010914	1.49	14.59	52.26	0.9
Main	1100.28	Regional	128.8	228	229.59	229.59	230.04	0.011001	3.57	68.47	78.09	1.12
Main	1100.28	100 yr	32	228	229	229	229.19	0.013446	2.25	24.72	63.52	1.08
Main	1100.28	50 yr	30.4	228	228.99	228.99	229.18	0.012558	2.16	24.41	63.4	1.04
Main	1100.28	25 yr	28.2	228	228.97	228.97	229.15	0.012555	2.12	23.11	62.91	1.03
Main	1100.28	10 yr	24.9	228	228.94	228.94	229.11	0.012266	2.04	21.21	61.94	1.01
Main	1100.28	5 yr	21.7	228	228.91	228.91	229.06	0.01222	1.98	19.04	59.97	1

Grindstone Creek Tibe 1Existing Condition HEC-RAS Output Associated with Crossing EW6 (RS 2525.37)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach1	2800	Regional	36.9	244.73	246.64	245.9	246.68	0.000595	0.89	50.53	79.73	0.26
Reach1	2800	100 yr	12	244.73	245.75	245.44	245.8	0.002197	1.02	11.82	22.42	0.45
Reach1	2800	50 yr	11.5	244.73	245.7	245.43	245.76	0.002462	1.06	10.84	20.95	0.47
Reach1	2800	25 yr	10.8	244.73	245.63	245.41	245.7	0.003177	1.16	9.32	19.12	0.53
Reach1	2800	10 yr	9.7	244.73	245.53	245.38	245.62	0.004407	1.28	7.58	17.14	0.61
Reach1	2800	5 yr	8.7	244.73	245.45	245.34	245.55	0.005767	1.38	6.3	15.52	0.69
Reach1	2700	Regional	36.9	244.26	246.61		246.64	0.000308	0.76	53.66	46.51	0.2
Reach1	2700	100 yr	12	244.26	245.7		245.72	0.000361	0.61	20.29	27.28	0.22
Reach1	2700	50 yr	11.5	244.26	245.65		245.67	0.000397	0.62	18.98	25.32	0.22
Reach1	2700	25 yr	10.8	244.26	245.56		245.58	0.000499	0.66	16.82	21.85	0.23
Reach1	2700	10 yr	9.7	244.26	245.44		245.46	0.000663	0.69	14.23	20.71	0.26
Reach1	2700	5 yr	8.7	244.26	245.29		245.32	0.001047	0.77	11.38	19.62	0.32
Reach1	2569.001	Regional	42.2	243.91	246.62	244.79	246.62	0.000033	0.29	197.52	145.79	0.07
Reach1	2569.001	100 yr	13.4	243.91	245.7	244.38	245.7	0.000028	0.19	83.27	102.59	0.06
Reach1	2569.001	50 yr	12.9	243.91	245.65	244.37	245.65	0.000031	0.2	78.17	100.51	0.06
Reach1	2569.001	25 yr	12	243.91	245.56	244.35	245.56	0.000036	0.2	69.29	94.34	0.06
Reach1	2569.001	10 yr	10.8	243.91	245.44	244.33	245.44	0.000044	0.21	57.97	88.63	0.07
Reach1	2569.001	5 yr	9.5	243.91	245.3	244.3	245.3	0.000058	0.22	46.12	76.16	0.08
Reach1	2546.369	Regional	42.2	243.47	246.62	246.01	246.62	0.000037	0.32	200.6	186.29	0.07
Reach1	2546.369	100 yr	13.4	243.47	245.41	244.85	245.68	0.002373	2.3	5.82	90.13	0.56
Reach1	2546.369	50 yr	12.9	243.47	245.36	244.82	245.63	0.002389	2.27	5.68	89.24	0.56
Reach1	2546.369	25 yr	12	243.47	245.29	244.76	245.54	0.002416	2.21	5.42	86.76	0.56
Reach1	2546.369	10 yr	10.8	243.47	245.18	244.69	245.41	0.002436	2.13	5.08	70.84	0.55
Reach1	2546.369	5 yr	9.5	243.47	245.06	244.61	245.27	0.002488	2.03	4.67	57.52	0.55
Reach1	2525.37		Bridge									
Reach1	2504.364	Regional	42.2	242.71	245.08	245.08	246.19	0.006761	4.67	9.03	69.15	1
Reach1	2504.364	100 yr	13.4	242.71	243.69	243.89	244.47	0.017387	3.92	3.42	11.46	1.36
Reach1	2504.364	50 yr	12.9	242.71	243.7	243.86	244.41	0.015702	3.74	3.45	11.59	1.29
Reach1	2504.364	25 yr	12	242.71	243.69	243.81	244.32	0.013849	3.5	3.43	11.5	1.21
Reach1	2504.364	10 yr	10.8	242.71	243.68	243.74	244.2	0.011716	3.19	3.38	11.29	1.11
Reach1	2504.364	5 yr	9.5	242.71	243.62	243.67	244.09	0.011721	3.03	3.13	10.72	1.1
Reach1	2300	Regional	42.2	241.85	243.3	242.59	243.32	0.000373	0.71	68.42	96.02	0.21
Reach1	2300	100 yr	13.4	241.85	242.78	242.36	242.79	0.000314	0.44	32.65	60.35	0.18
Reach1	2300	50 yr	12.9	241.85	242.77	242.36	242.78	0.000311	0.43	31.96	60.02	0.17
Reach1	2300	25 yr	12	241.85	242.75	242.34	242.76	0.000304	0.42	30.72	59.43	0.17
Reach1	2300	10 yr	10.8	241.85	242.72	242.32	242.72	0.000298	0.4	28.85	58.53	0.17
Reach1	2300	5 yr	9.5	241.85	242.68	242.3	242.69	0.000296	0.38	26.62	57.45	0.17

Grindstone Creek Tibe 1 Future Condition HEC-RAS Output Associated with Crossing EW6 (RS 2525.37)

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach1	2800	Regional	36.9	244.73	246.29	245.9	246.38	0.001762	1.31	29.69	43.78	0.45
Reach1	2800	100 yr	12	244.73	245.57	245.44	245.68	0.005351	1.45	8.28	17.97	0.68
Reach1	2800	50 yr	11.5	244.73	245.55	245.43	245.66	0.005477	1.45	7.95	17.58	0.69
Reach1	2800	25 yr	10.8	244.73	245.53	245.41	245.63	0.005648	1.44	7.49	17.03	0.69
Reach1	2800	10 yr	9.7	244.73	245.49	245.38	245.59	0.005713	1.41	6.87	16.26	0.69
Reach1	2800	5 yr	8.7	244.73	245.46	245.34	245.55	0.005552	1.36	6.39	15.64	0.68
Reach1	2700	Regional	36.9	244.26	246.21		246.26	0.000769	1.06	36.64	37.56	0.32
Reach1	2700	100 yr	12	244.26	245.39		245.43	0.001231	0.91	13.34	20.37	0.35
Reach1	2700	50 yr	11.5	244.26	245.37		245.41	0.001282	0.91	12.79	20.17	0.35
Reach1	2700	25 yr	10.8	244.26	245.32		245.36	0.001425	0.92	11.85	19.8	0.37
Reach1	2700	10 yr	9.7	244.26	245.25		245.3	0.001617	0.92	10.59	19.31	0.39
Reach1	2700	5 yr	8.7	244.26	245.19		245.23	0.001948	0.94	9.29	18.81	0.42
Reach1	2569.001	Regional	42.2	243.91	246.22	245.48	246.22	0.000075	0.39	142.37	130.39	0.1
Reach1	2569.001	100 yr	13.4	243.91	245.08	244.65	245.22	0.002078	1.67	8.04	55.82	0.5
Reach1	2569.001	50 yr	12.9	243.91	245.05	244.63	245.18	0.002101	1.65	7.83	51.27	0.5
Reach1	2569.001	25 yr	12	243.91	244.99	244.59	245.12	0.002147	1.61	7.45	45.05	0.5
Reach1	2569.001	10 yr	10.8	243.91	244.92	244.55	245.04	0.002215	1.56	6.93	40.52	0.5
Reach1	2569.001	5 yr	9.5	243.91	244.83	244.5	244.95	0.002304	1.5	6.34	37.17	0.5
Reach1	2525.37		Culvert									
Reach1	2504.364	Regional	42.2	242.71	244.48	244.48	245.26	0.031471	3.91	10.81	28.96	1
Reach1	2504.364	100 yr	13.4	242.71	243.4	243.66	244.3	0.183831	4.2	3.19	8.77	1.98
Reach1	2504.364	50 yr	12.9	242.71	243.37	243.65	244.3	0.201396	4.27	3.02	8.56	2.06
Reach1	2504.364	25 yr	12	242.71	243.37	243.61	244.19	0.178654	4.01	2.99	8.53	1.94
Reach1	2504.364	10 yr	10.8	242.71	243.33	243.57	244.12	0.186333	3.92	2.75	8.24	1.96
Reach1	2504.364	5 yr	9.5	242.71	243.51	243.51	243.8	0.043857	2.38	4	9.78	1
Reach1	2300	Regional	42.2	241.85	243.3	242.59	243.32	0.000373	0.71	68.42	96.02	0.21
Reach1	2300	100 yr	13.4	241.85	242.78	242.36	242.79	0.000314	0.44	32.65	60.35	0.18
Reach1	2300	50 yr	12.9	241.85	242.77	242.36	242.78	0.000311	0.43	31.96	60.02	0.17
Reach1	2300	25 yr	12	241.85	242.75	242.34	242.76	0.000304	0.42	30.72	59.43	0.17
Reach1	2300	10 yr	10.8	241.85	242.72	242.32	242.72	0.000298	0.4	28.85	58.53	0.17
Reach1	2300	5 yr	9.5	241.85	242.68	242.3	242.69	0.000296	0.38	26.62	57.45	0.17

Grindstone Creek Tibe 1West Existing Condition HEC-RAS Output Associated with Flood Plain Encroachment East of Upcountry Development

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
WestPilot	705.9489	PF 1	26.95	248.16	248.99	248.68	249.03	0.001127	0.86	49.56	112.78	0.33
WestPilot	606.0817	PF 1	26.95	248.16	248.9	248.57	248.93	0.000877	0.78	60.96	135.8	0.3
WestPilot	506.6523	PF 1	27.4	247.78	248.76	248.48	248.81	0.001606	1	36.55	98.05	0.4
WestPilot	406.1851	PF 1	27.4	247.23	248.38	248.32	248.5	0.007095	1.57	21.05	62.37	0.77
WestPilot	305.5756	PF 1	27.4	246.87	247.69		247.83	0.005916	1.8	24.11	57.61	0.75
WestPilot	204.9612	PF 1	27.83	246.34	247.3	247.12	247.38	0.003161	1.25	23.02	54.29	0.57
WestPilot	21.82503	PF 1	27.98	244.96	246.92	246.63	246.98	0.001634	1.1	33.45	70.03	0.41

Grindstone Creek Tibe 1West Future Condition HEC-RAS Output Associated with Flood Plain Encroachment East of Upcountry Development

Reach	River Station	Profile	Q Total	Minimum Channel Elevation	Water Surface Elevation	Critical Water Surface Elevation	Energy Gradeline Elevation	Energy Grideline Slope	Channel Velocity	Flow Area	Top Width	Froude # in channel
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
WestPilot	705.9489	PF 1	26.95	248.16	248.99	248.68	249.03	0.001134	0.86	49.43	112.66	0.34
WestPilot	606.0817	PF 1	26.95	248.16	248.9	248.57	248.92	0.000887	0.78	60.68	135.56	0.3
WestPilot	506.6523	PF 1	27.4	247.78	248.76	248.48	248.81	0.001647	1.01	36.1	97.39	0.4
WestPilot	406.1851	PF 1	27.4	247.23	248.52	248.32	248.59	0.002782	1.19	25.95	52.81	0.51
WestPilot	305.5756	PF 1	27.4	246.87	247.73	247.73	248.07	0.010387	2.6	10.53	15.5	1.01
WestPilot	204.9612	PF 1	27.83	246.34	247.3	247.11	247.38	0.003161	1.25	23.02	54.29	0.57
WestPilot	21.82503	PF 1	27.98	244.96	246.92	246.63	246.98	0.001634	1.1	33.45	70.03	0.41

Appendix B CulvertMaster Output

Crossing EW4 Hydraulic Conditions-50 Year Event

Culvert Summary					
Computed Headwater Elevation	241.33	m	Discharge	1.0000	m^3/s
Inlet Control HW Elev.	241.30	m	Tailwater Elevation	241.30	m
Outlet Control HW Elev.	241.33	m	Control Type	Outlet Control	
Headwater Depth/Height	0.28				

Grades					
Upstream Invert	241.05	m	Downstream Invert	240.80	m
Length	20.00	m	Constructed Slope	0.012500	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.50	m
Slope Type	Steep		Normal Depth	0.10	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.33	m/s	Critical Slope	0.004503	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.015	
Section Material	Concrete		Span	6.00	m
Section Size	6000 x 1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	241.33	m	Upstream Velocity Head	0.03	m
Ke	0.70		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	241.30	m	Flow Control	N/A	
Inlet Type	0° wingwall flares		Area Full	6.0	m^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	3	
C	0.04230		Equation Form	1	
Y	0.82000				

Crossing EW4 Hydraulic Conditions-Regional Event

Culvert Summary

Computed Headwater Elevation	241.44	m	Discharge	1.8000	m³/s
Inlet Control HW Elev.	241.40	m	Tailwater Elevation	241.30	m
Outlet Control HW Elev.	241.44	m	Control Type	Entrance Control	
Headwater Depth/Height	0.39				

Grades

Upstream Invert	241.05	m	Downstream Invert	240.80	m
Length	20.00	m	Constructed Slope	0.012500	m/m

Hydraulic Profile

Profile	CompositeS1S2		Depth, Downstream	0.50	m
Slope Type	Steep		Normal Depth	0.15	m
Flow Regime	N/A		Critical Depth	0.21	m
Velocity Downstream	0.60	m/s	Critical Slope	0.004066	m/m

Section

Section Shape	Box		Mannings Coefficient	0.015	
Section Material	Concrete		Span	6.00	m
Section Size	6000 x 1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	241.44	m	Upstream Velocity Head	0.10	m
Ke	0.70		Entrance Loss	0.07	m

Inlet Control Properties

Inlet Control HW Elev.	241.40	m	Flow Control	Unsubmerged	
Inlet Type	0° wingwall flares		Area Full	6.0	m²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	3	
C	0.04230		Equation Form	1	
Y	0.82000				

Crossing EW7 Existing Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	248.22	m	Discharge	0.4302	m³/s
Inlet Control HW Elev.	248.12	m	Tailwater Elevation	N/A	m
Outlet Control HW Elev.	248.22	m	Control Type	Entrance Control	
Headwater Depth/Height	0.88				

Grades					
Upstream Invert	247.55	m	Downstream Invert	247.25	m
Length	32.80	m	Constructed Slope	0.009299	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.33	m
Slope Type	Steep		Normal Depth	0.33	m
Flow Regime	Supercritical		Critical Depth	0.40	m
Velocity Downstream	2.29	m/s	Critical Slope	0.004632	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	248.22	m	Upstream Velocity Head	0.16	m
Ke	0.70		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	248.12	m	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	0.5	m²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Crossing EW7 Existing Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	248.35	m	Discharge	0.5752	m³/s
Inlet Control HW Elev.	248.24	m	Tailwater Elevation	N/A	m
Outlet Control HW Elev.	248.35	m	Control Type	Entrance Control	
Headwater Depth/Height	1.05				

Grades

Upstream Invert	247.55	m	Downstream Invert	247.25	m
Length	32.80	m	Constructed Slope	0.009299	m/m

Hydraulic Profile

Profile	S2		Depth, Downstream	0.39	m
Slope Type	Steep		Normal Depth	0.39	m
Flow Regime	Supercritical		Critical Depth	0.47	m
Velocity Downstream	2.47	m/s	Critical Slope	0.005110	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	248.35	m	Upstream Velocity Head	0.20	m
Ke	0.70		Entrance Loss	0.14	m

Inlet Control Properties

Inlet Control HW Elev.	248.24	m	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	0.5	m²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Crossing EW7 Proposed Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	248.22	m	Discharge	0.4302	m³/s
Inlet Control HW Elev.	248.12	m	Tailwater Elevation	N/A	m
Outlet Control HW Elev.	248.22	m	Control Type	Entrance Control	
Headwater Depth/Height	0.88				

Grades					
Upstream Invert	247.55	m	Downstream Invert	247.10	m
Length	50.00	m	Constructed Slope	0.007640	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.35	m
Slope Type	Steep		Normal Depth	0.35	m
Flow Regime	Supercritical		Critical Depth	0.40	m
Velocity Downstream	2.13	m/s	Critical Slope	0.004632	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	248.22	m	Upstream Velocity Head	0.16	m
Ke	0.70		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	248.12	m	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	0.5	m²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Crossing EW7 Proposed Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	248.35	m	Discharge	0.5752	m³/s
Inlet Control HW Elev.	248.24	m	Tailwater Elevation	N/A	m
Outlet Control HW Elev.	248.35	m	Control Type	Entrance Control	
Headwater Depth/Height	1.05				

Grades

Upstream Invert	247.55	m	Downstream Invert	247.10	m
Length	50.00	m	Constructed Slope	0.007640	m/m

Hydraulic Profile

Profile	S2		Depth, Downstream	0.41	m
Slope Type	Steep		Normal Depth	0.41	m
Flow Regime	Supercritical		Critical Depth	0.47	m
Velocity Downstream	2.30	m/s	Critical Slope	0.005110	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	248.35	m	Upstream Velocity Head	0.20	m
Ke	0.70		Entrance Loss	0.14	m

Inlet Control Properties

Inlet Control HW Elev.	248.24	m	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	0.5	m²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Crossing EW8 Existing Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	252.62	m	Discharge	0.0763	m³/s
Inlet Control HW Elev.	252.61	m	Tailwater Elevation	252.61	m
Outlet Control HW Elev.	252.62	m	Control Type	Outlet Control	
Headwater Depth/Height	0.73				

Grades					
Upstream Invert	252.06	m	Downstream Invert	251.85	m
Length	32.90	m	Constructed Slope	0.006383	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.76	m
Slope Type	Steep		Normal Depth	0.15	m
Flow Regime	Subcritical		Critical Depth	0.16	m
Velocity Downstream	0.17	m/s	Critical Slope	0.004218	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	252.62	m	Upstream Velocity Head	0.00	m
Ke	0.70		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	252.61	m	Flow Control	N/A	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW8 Existing Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	252.62	m	Discharge	0.1109	m³/s
Inlet Control HW Elev.	252.61	m	Tailwater Elevation	252.61	m
Outlet Control HW Elev.	252.62	m	Control Type	Outlet Control	
Headwater Depth/Height	0.73				

Grades

Upstream Invert	252.06	m	Downstream Invert	251.85	m
Length	32.90	m	Constructed Slope	0.006383	m/m

Hydraulic Profile

Profile	S1		Depth, Downstream	0.76	m
Slope Type	Steep		Normal Depth	0.18	m
Flow Regime	Subcritical		Critical Depth	0.20	m
Velocity Downstream	0.24	m/s	Critical Slope	0.004154	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	252.62	m	Upstream Velocity Head	0.01	m
Ke	0.70		Entrance Loss	0.00	m

Inlet Control Properties

Inlet Control HW Elev.	252.61	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW8 Proposed Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	252.00	m	Discharge	0.2961	m³/s
Inlet Control HW Elev.	251.91	m	Tailwater Elevation	251.65	m
Outlet Control HW Elev.	252.00	m	Control Type	Entrance Control	
Headwater Depth/Height	0.71				

Grades					
Upstream Invert	251.46	m	Downstream Invert	250.90	m
Length	44.00	m	Constructed Slope	0.012727	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.75	m
Slope Type	Steep		Normal Depth	0.25	m
Flow Regime	N/A		Critical Depth	0.33	m
Velocity Downstream	0.65	m/s	Critical Slope	0.004311	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	252.00	m	Upstream Velocity Head	0.13	m
Ke	0.70		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	251.91	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW8 Proposed Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	252.09	m	Discharge	0.3951	m³/s
Inlet Control HW Elev.	251.99	m	Tailwater Elevation	251.65	m
Outlet Control HW Elev.	252.09	m	Control Type	Entrance Control	
Headwater Depth/Height	0.84				

Grades

Upstream Invert	251.46	m	Downstream Invert	250.90	m
Length	44.00	m	Constructed Slope	0.012727	m/m

Hydraulic Profile

Profile	CompositeS1S2		Depth, Downstream	0.75	m
Slope Type	Steep		Normal Depth	0.29	m
Flow Regime	N/A		Critical Depth	0.38	m
Velocity Downstream	0.87	m/s	Critical Slope	0.004536	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	252.09	m	Upstream Velocity Head	0.15	m
Ke	0.70		Entrance Loss	0.11	m

Inlet Control Properties

Inlet Control HW Elev.	251.99	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW9 Existing Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	253.39	m	Discharge	0.4678	m³/s
Inlet Control HW Elev.	253.27	m	Tailwater Elevation	252.82	m
Outlet Control HW Elev.	253.39	m	Control Type	Entrance Control	
Headwater Depth/Height	0.93				

Grades					
Upstream Invert	252.68	m	Downstream Invert	252.06	m
Length	33.30	m	Constructed Slope	0.018619	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.76	m
Slope Type	Steep		Normal Depth	0.28	m
Flow Regime	N/A		Critical Depth	0.42	m
Velocity Downstream	1.03	m/s	Critical Slope	0.004744	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	253.39	m	Upstream Velocity Head	0.17	m
Ke	0.70		Entrance Loss	0.12	m

Inlet Control Properties					
Inlet Control HW Elev.	253.27	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW9 Existing Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	253.59	m	Discharge	0.7028	m³/s
Inlet Control HW Elev.	253.45	m	Tailwater Elevation	252.82	m
Outlet Control HW Elev.	253.59	m	Control Type	Entrance Control	
Headwater Depth/Height	1.20				

Grades

Upstream Invert	252.68	m	Downstream Invert	252.06	m
Length	33.30	m	Constructed Slope	0.018619	m/m

Hydraulic Profile

Profile	CompositeS1S2		Depth, Downstream	0.76	m
Slope Type	Steep		Normal Depth	0.36	m
Flow Regime	N/A		Critical Depth	0.52	m
Velocity Downstream	1.54	m/s	Critical Slope	0.005664	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	253.59	m	Upstream Velocity Head	0.23	m
Ke	0.70		Entrance Loss	0.16	m

Inlet Control Properties

Inlet Control HW Elev.	253.45	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW9 Proposed Hydraulic Condition – 50 Year Event

Culvert Summary					
Computed Headwater Elevation	252.85	m	Discharge	0.4681	m³/s
Inlet Control HW Elev.	252.73	m	Tailwater Elevation	252.37	m
Outlet Control HW Elev.	252.85	m	Control Type	Entrance Control	
Headwater Depth/Height	0.93				

Grades					
Upstream Invert	252.14	m	Downstream Invert	251.62	m
Length	48.00	m	Constructed Slope	0.010750	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.75	m
Slope Type	Steep		Normal Depth	0.33	m
Flow Regime	N/A		Critical Depth	0.42	m
Velocity Downstream	1.03	m/s	Critical Slope	0.004745	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	252.85	m	Upstream Velocity Head	0.17	m
Ke	0.70		Entrance Loss	0.12	m

Inlet Control Properties					
Inlet Control HW Elev.	252.73	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW9 Proposed Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	253.05	m	Discharge	0.7030	m³/s
Inlet Control HW Elev.	252.91	m	Tailwater Elevation	252.37	m
Outlet Control HW Elev.	253.05	m	Control Type	Entrance Control	
Headwater Depth/Height	1.20				

Grades

Upstream Invert	252.14	m	Downstream Invert	251.62	m
Length	48.00	m	Constructed Slope	0.010750	m/m

Hydraulic Profile

Profile	CompositeS1S2		Depth, Downstream	0.75	m
Slope Type	Steep		Normal Depth	0.42	m
Flow Regime	N/A		Critical Depth	0.52	m
Velocity Downstream	1.55	m/s	Critical Slope	0.005665	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	253.05	m	Upstream Velocity Head	0.23	m
Ke	0.70		Entrance Loss	0.16	m

Inlet Control Properties

Inlet Control HW Elev.	252.91	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.5	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Crossing EW10 Existing Hydraulic Condition – 50 Year Event

Culvert Summary

Computed Headwater Elevation	252.24	m	Discharge	2.7084	m³/s
Inlet Control HW Elev.	251.89	m	Tailwater Elevation	251.88	m
Outlet Control HW Elev.	252.24	m	Control Type	Outlet Control	
Headwater Depth/Height	1.20				

Grades

Upstream Invert	250.56	m	Downstream Invert	250.48	m
Length	44.00	m	Constructed Slope	0.001705	m/m

Hydraulic Profile

Profile	Pressure Profile		Depth, Downstream	1.40	m
Slope Type	N/A		Normal Depth	N/A	m
Flow Regime	N/A		Critical Depth	0.87	m
Velocity Downstream	1.76	m/s	Critical Slope	0.004227	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.40	m
Section Size	Circular 1400 mm		Rise	1.40	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	252.24	m	Upstream Velocity Head	0.16	m
Ke	0.70		Entrance Loss	0.11	m

Inlet Control Properties

Inlet Control HW Elev.	251.89	m	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	1.5	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Crossing EW10 Existing Hydraulic Condition – Regional Event

Culvert Summary

Computed Headwater Elevation	252.82	m	Discharge	4.3549	m³/s
Inlet Control HW Elev.	252.54	m	Tailwater Elevation	251.88	m
Outlet Control HW Elev.	252.82	m	Control Type	Outlet Control	
Headwater Depth/Height	1.61				

Grades

Upstream Invert	250.56	m	Downstream Invert	250.48	m
Length	44.00	m	Constructed Slope	0.001705	m/m

Hydraulic Profile

Profile	Pressure Profile		Depth, Downstream	1.40	m
Slope Type	N/A		Normal Depth	N/A	m
Flow Regime	N/A		Critical Depth	1.10	m
Velocity Downstream	2.83	m/s	Critical Slope	0.005903	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.40	m
Section Size	Circular 1400 mm		Rise	1.40	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	252.82	m	Upstream Velocity Head	0.41	m
Ke	0.70		Entrance Loss	0.29	m

Inlet Control Properties

Inlet Control HW Elev.	252.54	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	1.5	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Crossing EW10 Proposed Hydraulic Condition – 50 Year Event

Culvert Summary

Computed Headwater Elevation	251.60	m	Discharge	2.7096	m³/s
Inlet Control HW Elev.	251.59	m	Tailwater Elevation	251.40	m
Outlet Control HW Elev.	251.60	m	Control Type	Entrance Control	
Headwater Depth/Height	0.70				

Grades

Upstream Invert	250.90	m	Downstream Invert	250.40	m
Length	44.00	m	Constructed Slope	0.011364	m/m

Hydraulic Profile

Profile	CompositeS1S2		Depth, Downstream	1.00	m
Slope Type	Steep		Normal Depth	0.29	m
Flow Regime	N/A		Critical Depth	0.44	m
Velocity Downstream	0.90	m/s	Critical Slope	0.003071	m/m

Section

Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	m
Section Size	3000x1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	251.60	m	Upstream Velocity Head	0.22	m
Ke	0.20		Entrance Loss	0.04	m

Inlet Control Properties

Inlet Control HW Elev.	251.59	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.0	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Crossing EW10 Proposed Hydraulic Condition – Regional Event

Culvert Summary					
Computed Headwater Elevation	252.08	m	Discharge	5.9381	m³/s
Inlet Control HW Elev.	252.07	m	Tailwater Elevation	251.40	m
Outlet Control HW Elev.	252.08	m	Control Type	Entrance Control	
Headwater Depth/Height	1.18				

Grades					
Upstream Invert	250.90	m	Downstream Invert	250.40	m
Length	44.00	m	Constructed Slope	0.011364	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	1.00	m
Slope Type	Steep		Normal Depth	0.48	m
Flow Regime	N/A		Critical Depth	0.74	m
Velocity Downstream	1.98	m/s	Critical Slope	0.003126	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	m
Section Size	3000x1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	252.08	m	Upstream Velocity Head	0.37	m
Ke	0.20		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	252.07	m	Flow Control	Transition	
Inlet Type	90° headwall w 45° bevels		Area Full	3.0	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Crossing EW11 Existing Hydraulic Condition – 50 Year Event

Culvert Summary

Computed Headwater Elevation	221.21	m	Discharge	0.8571	m³/s
Inlet Control HW Elev.	221.06	m	Tailwater Elevation	216.67	m
Outlet Control HW Elev.	221.21	m	Control Type	Entrance Control	
Headwater Depth/Height	0.89				

Grades

Upstream Invert	220.32	m	Downstream Invert	215.67	m
Length	54.00	m	Constructed Slope	0.086241	m/m

Hydraulic Profile

Profile	CompositePressureProfileS1S2		Depth, Downstream	1.00	m
Slope Type	N/A		Normal Depth	0.24	m
Flow Regime	N/A		Critical Depth	0.53	m
Velocity Downstream	1.09	m/s	Critical Slope	0.004242	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	221.21	m	Upstream Velocity Head	0.21	m
Ke	0.70		Entrance Loss	0.15	m

Inlet Control Properties

Inlet Control HW Elev.	221.06	m	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	0.8	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Crossing EW11 Existing Hydraulic Condition – Regional Event

Culvert Summary					
Computed Headwater Elevation	221.49	m	Discharge	1.3373	m³/s
Inlet Control HW Elev.	221.34	m	Tailwater Elevation	216.67	m
Outlet Control HW Elev.	221.49	m	Control Type	Entrance Control	
Headwater Depth/Height	1.17				

Grades					
Upstream Invert	220.32	m	Downstream Invert	215.67	m
Length	54.00	m	Constructed Slope	0.086241	m/m

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	1.00	m
Slope Type	N/A		Normal Depth	0.30	m
Flow Regime	N/A		Critical Depth	0.67	m
Velocity Downstream	1.70	m/s	Critical Slope	0.005066	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	221.49	m	Upstream Velocity Head	0.29	m
Ke	0.70		Entrance Loss	0.21	m

Inlet Control Properties					
Inlet Control HW Elev.	221.34	m	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	0.8	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Crossing EW11 Proposed Hydraulic Condition – 50 Year Event

Culvert Summary

Computed Headwater Elevation	221.21 m	Discharge	0.8571 m³/s
Inlet Control HW Elev.	221.06 m	Tailwater Elevation	216.67 m
Outlet Control HW Elev.	221.21 m	Control Type	Entrance Control
Headwater Depth/Height	0.89		

Grades

Upstream Invert	220.32 m	Downstream Invert	215.67 m
Length	56.00 m	Constructed Slope	0.083161 m/m

Hydraulic Profile

Profile	CompositePressureProfileS1S2	Depth, Downstream	1.00 m
Slope Type	N/A	Normal Depth	0.24 m
Flow Regime	N/A	Critical Depth	0.53 m
Velocity Downstream	1.09 m/s	Critical Slope	0.004242 m/m

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.00 m
Section Size	1000 mm	Rise	1.00 m
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	221.21 m	Upstream Velocity Head	0.21 m
Ke	0.70	Entrance Loss	0.15 m

Inlet Control Properties

Inlet Control HW Elev.	221.06 m	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	0.8 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Crossing EW11 Proposed Hydraulic Condition – Regional Event

Culvert Summary					
Computed Headwater Elevation	221.49	m	Discharge	1.3373	m³/s
Inlet Control HW Elev.	221.34	m	Tailwater Elevation	216.67	m
Outlet Control HW Elev.	221.49	m	Control Type	Entrance Control	
Headwater Depth/Height	1.17				

Grades					
Upstream Invert	220.32	m	Downstream Invert	215.67	m
Length	56.00	m	Constructed Slope	0.083161	m/m

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	1.00	m
Slope Type	N/A		Normal Depth	0.30	m
Flow Regime	N/A		Critical Depth	0.67	m
Velocity Downstream	1.70	m/s	Critical Slope	0.005066	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	221.49	m	Upstream Velocity Head	0.29	m
Ke	0.70		Entrance Loss	0.21	m

Inlet Control Properties					
Inlet Control HW Elev.	221.34	m	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	0.8	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Appendix C VO2 Hydrologic Modeling Output

VO2 Model Schematic - Crossing Flows 1

CROSSING FLOWS – DESIGN FLOW ANALYSIS

==

```
     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, Version 2.0
     O   O    T      T    H   H   Y Y   MM MM  O   O
     O   O    T      T    H   H    Y    M   M  O   O  Licensed To: Dillon Consulting Ltd
      OOO     T      T    H   H    Y    M   M   OOO              vo2-0082
```

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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\090113 crossing flows\Scenario
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\090113 crossing flows\Scenario

DATE: 5/18/2010   TIME: 11:47:32 AM

USER:

COMMENTS: ____

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

```
--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |          1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |          SCS12HII 15min.mst
| Ptotal= 44.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                 Duration of storm    = 12.00 hrs
                 Mass curve time step = 30.00 min
                 New Storm time step  = 15.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.44	3.25	1.78	6.25	23.98	9.25	1.78
.50	.89	3.50	1.78	6.50	7.99	9.50	1.78
.75	.89	3.75	1.78	6.75	5.77	9.75	1.33
1.00	.89	4.00	1.78	7.00	3.55	10.00	.89
1.25	.89	4.25	2.22	7.25	3.11	10.25	.89
1.50	.89	4.50	2.66	7.50	2.66	10.50	.89
1.75	.89	4.75	3.11	7.75	2.66	10.75	.89
2.00	.89	5.00	3.55	8.00	2.66	11.00	.89
2.25	1.33	5.25	4.44	8.25	2.22	11.25	.89
2.50	1.78	5.50	5.33	8.50	1.78	11.50	.89
2.75	1.78	5.75	22.64	8.75	1.78	11.75	.89
3.00	1.78	6.00	39.96	9.00	1.78	12.00	.89

```
-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   4.39   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .44
```

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	.44	3.250	1.78	6.250	23.98	9.25	1.78
.500	.89	3.500	1.78	6.500	7.99	9.50	1.78
.750	.89	3.750	1.78	6.750	5.77	9.75	1.33
1.000	.89	4.000	1.78	7.000	3.55	10.00	.89
1.250	.89	4.250	2.22	7.250	3.11	10.25	.89
1.500	.89	4.500	2.66	7.500	2.66	10.50	.89
1.750	.89	4.750	3.11	7.750	2.66	10.75	.89
2.000	.89	5.000	3.55	8.000	2.66	11.00	.89
2.250	1.33	5.250	4.44	8.250	2.22	11.25	.89
2.500	1.78	5.500	5.33	8.500	1.78	11.50	.89
2.750	1.78	5.750	22.64	8.750	1.78	11.75	.89
3.000	1.78	6.000	39.96	9.000	1.78	12.00	.89

Unit Hyd Qpeak (cms)= .381

PEAK FLOW (cms)= .110 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 16.139
TOTAL RAINFALL (mm)= 44.289
RUNOFF COEFFICIENT = .364

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

```
-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .262

    PEAK FLOW       (cms)=    .075 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  16.139
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .364

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .73

    Unit Hyd Qpeak  (cms)=    .821

    PEAK FLOW       (cms)=    .293 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  16.227
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .366

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .121 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  16.215
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .366

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   1.34

    Unit Hyd Qpeak  (cms)=   1.773

    PEAK FLOW       (cms)=    .685 (i)
```

TIME TO PEAK (hrs)= 7.500
RUNOFF VOLUME (mm)= 15.016
TOTAL RAINFALL (mm)= 44.289
RUNOFF COEFFICIENT = .339

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

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-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .34
```

Unit Hyd Qpeak (cms)= 1.135

PEAK FLOW (cms)= .194 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 10.614
TOTAL RAINFALL (mm)= 44.289
RUNOFF COEFFICIENT = .240

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

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-----------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |             1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |             SCS12HII 15min.mst
| Ptotal= 62.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
```

Duration of storm = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.62	3.25	2.50	6.25	33.70	9.25	2.50
.50	1.25	3.50	2.50	6.50	11.23	9.50	2.50
.75	1.25	3.75	2.50	6.75	8.11	9.75	1.87
1.00	1.25	4.00	2.50	7.00	4.99	10.00	1.25
1.25	1.25	4.25	3.12	7.25	4.37	10.25	1.25
1.50	1.25	4.50	3.74	7.50	3.74	10.50	1.25
1.75	1.25	4.75	4.37	7.75	3.74	10.75	1.25
2.00	1.25	5.00	4.99	8.00	3.74	11.00	1.25
2.25	1.87	5.25	6.24	8.25	3.12	11.25	1.25
2.50	2.50	5.50	7.49	8.50	2.50	11.50	1.25
2.75	2.50	5.75	31.82	8.75	2.50	11.75	1.25
3.00	2.50	6.00	56.16	9.00	2.50	12.00	1.25

```
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   4.39   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
                .250     .62 | 3.250    2.50 | 6.250   33.70 |  9.25    2.50
                .500    1.25 | 3.500    2.50 | 6.500   11.23 |  9.50    2.50
                .750    1.25 | 3.750    2.50 | 6.750    8.11 |  9.75    1.87
               1.000    1.25 | 4.000    2.50 | 7.000    4.99 | 10.00    1.25
               1.250    1.25 | 4.250    3.12 | 7.250    4.37 | 10.25    1.25
               1.500    1.25 | 4.500    3.74 | 7.500    3.74 | 10.50    1.25
               1.750    1.25 | 4.750    4.37 | 7.750    3.74 | 10.75    1.25
               2.000    1.25 | 5.000    4.99 | 8.000    3.74 | 11.00    1.25
               2.250    1.87 | 5.250    6.24 | 8.250    3.12 | 11.25    1.25
               2.500    2.50 | 5.500    7.49 | 8.500    2.50 | 11.50    1.25
               2.750    2.50 | 5.750   31.82 | 8.750    2.50 | 11.75    1.25
               3.000    2.50 | 6.000   56.16 | 9.000    2.50 | 12.00    1.25

     Unit Hyd Qpeak  (cms)=    .381

     PEAK FLOW       (cms)=    .202 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  28.817
     TOTAL RAINFALL   (mm)=  62.244
     RUNOFF COEFFICIENT   =    .463

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

     Unit Hyd Qpeak  (cms)=    .262

     PEAK FLOW       (cms)=    .139 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  28.817
     TOTAL RAINFALL   (mm)=  62.244
     RUNOFF COEFFICIENT   =    .463

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
```

```
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .73

     Unit Hyd Qpeak  (cms)=    .821

     PEAK FLOW       (cms)=    .533 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  28.973
     TOTAL RAINFALL   (mm)=  62.244
     RUNOFF COEFFICIENT   =    .465

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

     Unit Hyd Qpeak  (cms)=    .358

     PEAK FLOW       (cms)=    .221 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  28.953
     TOTAL RAINFALL   (mm)=  62.244
     RUNOFF COEFFICIENT   =    .465

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

     Unit Hyd Qpeak  (cms)=   1.773

     PEAK FLOW       (cms)=   1.258 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=  27.137
     TOTAL RAINFALL   (mm)=  62.244
     RUNOFF COEFFICIENT   =    .436

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

     Unit Hyd Qpeak  (cms)=   1.135
```

PEAK FLOW (cms)= .374 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 20.019
TOTAL RAINFALL (mm)= 62.244
RUNOFF COEFFICIENT = .322

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

****
** SIMULATION NUMBER: 3 **
****

| MASS STORM | Filename: M:\PROJECTS\DRAFT\08\089020~
| | 1\WATERR~1\DILLON~1\VO2MOD~1\
| | SCS12HII 15min.mst
| Ptotal= 74.40 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm = 12.00 hrs
Mass curve time step = 30.00 min
New Storm 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
.25	.74	3.25	2.98	6.25	40.18	9.25	2.98
.50	1.49	3.50	2.98	6.50	13.39	9.50	2.98
.75	1.49	3.75	2.98	6.75	9.67	9.75	2.23
1.00	1.49	4.00	2.98	7.00	5.95	10.00	1.49
1.25	1.49	4.25	3.72	7.25	5.21	10.25	1.49
1.50	1.49	4.50	4.46	7.50	4.46	10.50	1.49
1.75	1.49	4.75	5.21	7.75	4.46	10.75	1.49
2.00	1.49	5.00	5.95	8.00	4.46	11.00	1.49
2.25	2.23	5.25	7.44	8.25	3.72	11.25	1.49
2.50	2.98	5.50	8.93	8.50	2.98	11.50	1.49
2.75	2.98	5.75	37.94	8.75	2.98	11.75	1.49
3.00	2.98	6.00	66.96	9.00	2.98	12.00	1.49

| CALIB |
| NASHYD (0003) | Area (ha)= 4.39 Curve Number (CN)= 82.0
|ID= 1 DT=15.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)= .44

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
.250	.74	3.250	2.98	6.250	40.18	9.25	2.98
.500	1.49	3.500	2.98	6.500	13.39	9.50	2.98
.750	1.49	3.750	2.98	6.750	9.67	9.75	2.23
1.000	1.49	4.000	2.98	7.000	5.95	10.00	1.49

```
          1.250    1.49 | 4.250    3.72 | 7.250    5.21 | 10.25    1.49
          1.500    1.49 | 4.500    4.46 | 7.500    4.46 | 10.50    1.49
          1.750    1.49 | 4.750    5.21 | 7.750    4.46 | 10.75    1.49
          2.000    1.49 | 5.000    5.95 | 8.000    4.46 | 11.00    1.49
          2.250    2.23 | 5.250    7.44 | 8.250    3.72 | 11.25    1.49
          2.500    2.98 | 5.500    8.93 | 8.500    2.98 | 11.50    1.49
          2.750    2.98 | 5.750   37.94 | 8.750    2.98 | 11.75    1.49
          3.000    2.98 | 6.000   66.96 | 9.000    2.98 | 12.00    1.49

    Unit Hyd Qpeak  (cms)=    .381

    PEAK FLOW       (cms)=    .270 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  38.093
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .513

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .262

    PEAK FLOW       (cms)=    .185 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  38.093
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .513

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .73

    Unit Hyd Qpeak  (cms)=    .821

    PEAK FLOW       (cms)=    .708 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  38.300
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .516

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
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```
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .294 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  38.273
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .516

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

    Unit Hyd Qpeak  (cms)=   1.773

    PEAK FLOW       (cms)=   1.684 (i)
    TIME TO PEAK    (hrs)=   7.500
    RUNOFF VOLUME    (mm)=  36.094
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .486

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

    Unit Hyd Qpeak  (cms)=   1.135

    PEAK FLOW       (cms)=    .513 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  27.241
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .367

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

------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |              1\WATERR~1\DILLON~1\VO2MOD~1\
```

| | SCS12HII 15min.mst
| Ptotal= 90.00 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm   = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.90	3.25	3.60	6.25	48.60	9.25	3.60
.50	1.80	3.50	3.60	6.50	16.20	9.50	3.60
.75	1.80	3.75	3.60	6.75	11.70	9.75	2.70
1.00	1.80	4.00	3.60	7.00	7.20	10.00	1.80
1.25	1.80	4.25	4.50	7.25	6.30	10.25	1.80
1.50	1.80	4.50	5.40	7.50	5.40	10.50	1.80
1.75	1.80	4.75	6.30	7.75	5.40	10.75	1.80
2.00	1.80	5.00	7.20	8.00	5.40	11.00	1.80
2.25	2.70	5.25	9.00	8.25	4.50	11.25	1.80
2.50	3.60	5.50	10.80	8.50	3.60	11.50	1.80
2.75	3.60	5.75	45.90	8.75	3.60	11.75	1.80
3.00	3.60	6.00	81.00	9.00	3.60	12.00	1.80

| CALIB |
| NASHYD   (0003) | Area   (ha)=   4.39   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min | Ia   (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   .44

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	.90	3.250	3.60	6.250	48.60	9.25	3.60
.500	1.80	3.500	3.60	6.500	16.20	9.50	3.60
.750	1.80	3.750	3.60	6.750	11.70	9.75	2.70
1.000	1.80	4.000	3.60	7.000	7.20	10.00	1.80
1.250	1.80	4.250	4.50	7.250	6.30	10.25	1.80
1.500	1.80	4.500	5.40	7.500	5.40	10.50	1.80
1.750	1.80	4.750	6.30	7.750	5.40	10.75	1.80
2.000	1.80	5.000	7.20	8.000	5.40	11.00	1.80
2.250	2.70	5.250	9.00	8.250	4.50	11.25	1.80
2.500	3.60	5.500	10.80	8.500	3.60	11.50	1.80
2.750	3.60	5.750	45.90	8.750	3.60	11.75	1.80
3.000	3.60	6.000	81.00	9.000	3.60	12.00	1.80

Unit Hyd Qpeak (cms)=   .381

PEAK FLOW   (cms)=   .363 (i)
TIME TO PEAK   (hrs)=   6.250
RUNOFF VOLUME   (mm)= 50.819
TOTAL RAINFALL   (mm)= 89.775
RUNOFF COEFFICIENT   =   .566

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .262

    PEAK FLOW       (cms)=    .250 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  50.819
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .566

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .73

    Unit Hyd Qpeak  (cms)=    .821

    PEAK FLOW       (cms)=    .947 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  51.095
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .569

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .396 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  51.060
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .569

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

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```
| CALIB              |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

     Unit Hyd Qpeak  (cms)=   1.773

     PEAK FLOW       (cms)=   2.278 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  48.465
     TOTAL RAINFALL   (mm)=  89.775
     RUNOFF COEFFICIENT   =    .540

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

     Unit Hyd Qpeak  (cms)=   1.135

     PEAK FLOW       (cms)=    .711 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  37.493
     TOTAL RAINFALL   (mm)=  89.775
     RUNOFF COEFFICIENT   =    .418

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

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  *****************************
  ** SIMULATION NUMBER:   5 **
  *****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |              1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |              SCS12HII 15min.mst
| Ptotal=100.80 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 30.00 min
                        New Storm 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
                .25    1.01 |  3.25    4.03 |  6.25   54.43 |  9.25    4.03
                .50    2.02 |  3.50    4.03 |  6.50   18.14 |  9.50    4.03
                .75    2.02 |  3.75    4.03 |  6.75   13.10 |  9.75    3.02
               1.00    2.02 |  4.00    4.03 |  7.00    8.06 | 10.00    2.02
               1.25    2.02 |  4.25    5.04 |  7.25    7.06 | 10.25    2.02
               1.50    2.02 |  4.50    6.05 |  7.50    6.05 | 10.50    2.02
```

```
            1.75    2.02 |  4.75    7.06 |  7.75    6.05 | 10.75    2.02
            2.00    2.02 |  5.00    8.06 |  8.00    6.05 | 11.00    2.02
            2.25    3.02 |  5.25   10.08 |  8.25    5.04 | 11.25    2.02
            2.50    4.03 |  5.50   12.10 |  8.50    4.03 | 11.50    2.02
            2.75    4.03 |  5.75   51.41 |  8.75    4.03 | 11.75    2.02
            3.00    4.03 |  6.00   90.72 |  9.00    4.03 | 12.00    2.02

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   4.39   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

      NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
            .250    1.01 | 3.250    4.03 | 6.250   54.43 |  9.25    4.03
            .500    2.02 | 3.500    4.03 | 6.500   18.14 |  9.50    4.03
            .750    2.02 | 3.750    4.03 | 6.750   13.10 |  9.75    3.02
           1.000    2.02 | 4.000    4.03 | 7.000    8.06 | 10.00    2.02
           1.250    2.02 | 4.250    5.04 | 7.250    7.06 | 10.25    2.02
           1.500    2.02 | 4.500    6.05 | 7.500    6.05 | 10.50    2.02
           1.750    2.02 | 4.750    7.06 | 7.750    6.05 | 10.75    2.02
           2.000    2.02 | 5.000    8.06 | 8.000    6.05 | 11.00    2.02
           2.250    3.02 | 5.250   10.08 | 8.250    5.04 | 11.25    2.02
           2.500    4.03 | 5.500   12.10 | 8.500    4.03 | 11.50    2.02
           2.750    4.03 | 5.750   51.41 | 8.750    4.03 | 11.75    2.02
           3.000    4.03 | 6.000   90.72 | 9.000    4.03 | 12.00    2.02

    Unit Hyd Qpeak  (cms)=    .381

    PEAK FLOW       (cms)=    .430 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  59.959
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .596

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .262

    PEAK FLOW       (cms)=    .296 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  59.959
    TOTAL RAINFALL   (mm)= 100.548
```

```
    RUNOFF COEFFICIENT   =    .596

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .73

    Unit Hyd Qpeak  (cms)=    .821

    PEAK FLOW       (cms)=   1.119 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  60.285
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .600

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .468 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  60.243
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .599

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

    Unit Hyd Qpeak  (cms)=   1.773

    PEAK FLOW       (cms)=   2.709 (i)
    TIME TO PEAK    (hrs)=   7.250
    RUNOFF VOLUME    (mm)=  57.396
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .571

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

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

```
--------------------
| CALIB            |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

    Unit Hyd Qpeak  (cms)=   1.135

    PEAK FLOW       (cms)=    .857 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  45.053
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .448

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

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


--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |              1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |              SCS12HII 15min.mst
| Ptotal=111.60 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                    Duration of storm    = 12.00 hrs
                    Mass curve time step = 30.00 min
                    New Storm 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
               .25    1.12 |  3.25    4.46 |  6.25   60.26 |  9.25    4.46
               .50    2.23 |  3.50    4.46 |  6.50   20.09 |  9.50    4.46
               .75    2.23 |  3.75    4.46 |  6.75   14.51 |  9.75    3.35
              1.00    2.23 |  4.00    4.46 |  7.00    8.93 | 10.00    2.23
              1.25    2.23 |  4.25    5.58 |  7.25    7.81 | 10.25    2.23
              1.50    2.23 |  4.50    6.70 |  7.50    6.70 | 10.50    2.23
              1.75    2.23 |  4.75    7.81 |  7.75    6.70 | 10.75    2.23
              2.00    2.23 |  5.00    8.93 |  8.00    6.70 | 11.00    2.23
              2.25    3.35 |  5.25   11.16 |  8.25    5.58 | 11.25    2.23
              2.50    4.46 |  5.50   13.39 |  8.50    4.46 | 11.50    2.23
              2.75    4.46 |  5.75   56.92 |  8.75    4.46 | 11.75    2.23
              3.00    4.46 |  6.00  100.44 |  9.00    4.46 | 12.00    2.23

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   4.39   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44

       NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	1.12	3.250	4.46	6.250	60.26	9.25	4.46
.500	2.23	3.500	4.46	6.500	20.09	9.50	4.46
.750	2.23	3.750	4.46	6.750	14.51	9.75	3.35
1.000	2.23	4.000	4.46	7.000	8.93	10.00	2.23
1.250	2.23	4.250	5.58	7.250	7.81	10.25	2.23
1.500	2.23	4.500	6.70	7.500	6.70	10.50	2.23
1.750	2.23	4.750	7.81	7.750	6.70	10.75	2.23
2.000	2.23	5.000	8.93	8.000	6.70	11.00	2.23
2.250	3.35	5.250	11.16	8.250	5.58	11.25	2.23
2.500	4.46	5.500	13.39	8.500	4.46	11.50	2.23
2.750	4.46	5.750	56.92	8.750	4.46	11.75	2.23
3.000	4.46	6.000	100.44	9.000	4.46	12.00	2.23

Unit Hyd Qpeak (cms)= .381

PEAK FLOW (cms)= .498 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 69.307
TOTAL RAINFALL (mm)= 111.321
RUNOFF COEFFICIENT = .623

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

```
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .44
```

Unit Hyd Qpeak (cms)= .262

PEAK FLOW (cms)= .343 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 69.307
TOTAL RAINFALL (mm)= 111.321
RUNOFF COEFFICIENT = .623

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

```
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .73
```

Unit Hyd Qpeak (cms)= .821

PEAK FLOW (cms)= 1.293 (i)
TIME TO PEAK (hrs)= 6.750
RUNOFF VOLUME (mm)= 69.684

```
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .626

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 82.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .542 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  69.636
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .626

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 80.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

    Unit Hyd Qpeak  (cms)=   1.773

    PEAK FLOW       (cms)=   3.152 (i)
    TIME TO PEAK    (hrs)=   7.250
    RUNOFF VOLUME    (mm)=  66.560
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .598

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

    Unit Hyd Qpeak  (cms)=   1.135

    PEAK FLOW       (cms)=   1.009 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  52.925
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .475

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

FINISH

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CROSSING FLOWS – REGIONAL ANALYSIS

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

   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, Version 2.0
   O   O   T     T   H  H  Y Y   MM MM O   O
   O   O   T     T   H  H   Y    M   M O   O  Licensed To: Dillon Consulting Ltd
    OOO    T     T   H  H   Y    M   M  OOO               vo2-0082
```

Developed and Distributed by Greenland International Consulting Inc.

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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\090113 crossing flows\Regional
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\090113 crossing flows\Regional

DATE: 5/18/2010   TIME: 11:30:22 AM

USER:

COMMENTS: ____

```
-------------------------------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
|   READ STORM    |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                 |              Phases 3 & 4\Water Resources\Dillon Models\
|                 |              VO2 modeling\HAZEL.STM
| Ptotal=212.00 mm |   Comments: 12-Hour Hurricane Hazel
--------------------
        TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
         hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
         .25    6.00 |  3.25   13.00 |  6.25   23.00 |  9.25   53.00
         .50    6.00 |  3.50   13.00 |  6.50   23.00 |  9.50   53.00
         .75    6.00 |  3.75   13.00 |  6.75   23.00 |  9.75   53.00
```

```
              1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
              1.25    4.00 |  4.25   17.00 |  7.25   13.00 | 10.25   38.00
              1.50    4.00 |  4.50   17.00 |  7.50   13.00 | 10.50   38.00
              1.75    4.00 |  4.75   17.00 |  7.75   13.00 | 10.75   38.00
              2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
              2.25    6.00 |  5.25   13.00 |  8.25   13.00 | 11.25   13.00
              2.50    6.00 |  5.50   13.00 |  8.50   13.00 | 11.50   13.00
              2.75    6.00 |  5.75   13.00 |  8.75   13.00 | 11.75   13.00
              3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00

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

--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   4.39   Curve Number   (CN)= 92.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .381

    PEAK FLOW       (cms)=    .575 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 185.867
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .877

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0004) |   Area    (ha)=   3.02   Curve Number   (CN)= 92.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .44

    Unit Hyd Qpeak  (cms)=    .262

    PEAK FLOW       (cms)=    .395 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 185.867
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .877

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=  15.70   Curve Number   (CN)= 92.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .73

    Unit Hyd Qpeak  (cms)=    .821

    PEAK FLOW       (cms)=   1.803 (i)
    TIME TO PEAK    (hrs)=  10.500
```

```
    RUNOFF VOLUME    (mm)= 186.877
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .881

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0006) |   Area    (ha)=   5.90   Curve Number   (CN)= 92.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .63

    Unit Hyd Qpeak  (cms)=    .358

    PEAK FLOW       (cms)=    .703 (i)
    TIME TO PEAK    (hrs)=  10.500
    RUNOFF VOLUME    (mm)= 186.748
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .881

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0008) |   Area    (ha)=  62.20   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.34

    Unit Hyd Qpeak  (cms)=   1.773

    PEAK FLOW       (cms)=   5.937 (i)
    TIME TO PEAK    (hrs)=  11.250
    RUNOFF VOLUME    (mm)= 184.583
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .871

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0009) |   Area    (ha)=  10.10   Curve Number   (CN)= 85.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .34

    Unit Hyd Qpeak  (cms)=   1.135

    PEAK FLOW       (cms)=   1.337 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 168.518
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .795

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

FINISH
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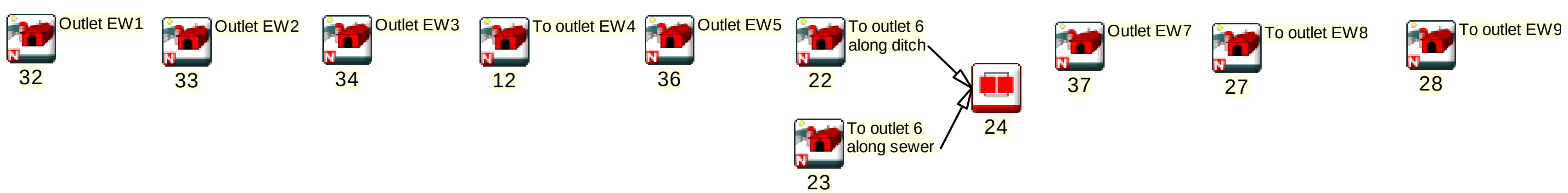
VO2 Model Schematic – SWM Existing Conditions



VO2 Model Schematic - SWM Future Conditions

EXISITING CONDTIONS DESIGN STORMS

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

     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, Version 2.0
     O   O    T      T    H   H   Y Y   MM MM  O   O
     O   O    T      T    H   H    Y    M   M  O   O  Licensed To: Dillon Consulting Ltd
      OOO     T      T    H   H    Y    M   M   OOO               vo2-0082
```

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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Existing design sto
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Existing design sto

DATE: 5/18/2010 TIME: 11:34:41 AM

USER:

COMMENTS: ____

```
--------------------------------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |             Phases 3 & 4\Water Resources\Dillon Models\
|                  |             VO2 modeling\SCS12HII 15min.mst
| Ptotal= 44.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                      Duration of storm    = 12.00 hrs
                      Mass curve time step = 30.00 min
                      New Storm 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
           .25     .44 |  3.25    1.78 |  6.25   23.98 |  9.25    1.78
           .50     .89 |  3.50    1.78 |  6.50    7.99 |  9.50    1.78
           .75     .89 |  3.75    1.78 |  6.75    5.77 |  9.75    1.33
          1.00     .89 |  4.00    1.78 |  7.00    3.55 | 10.00     .89
          1.25     .89 |  4.25    2.22 |  7.25    3.11 | 10.25     .89
          1.50     .89 |  4.50    2.66 |  7.50    2.66 | 10.50     .89
          1.75     .89 |  4.75    3.11 |  7.75    2.66 | 10.75     .89
          2.00     .89 |  5.00    3.55 |  8.00    2.66 | 11.00     .89
          2.25    1.33 |  5.25    4.44 |  8.25    2.22 | 11.25     .89
          2.50    1.78 |  5.50    5.33 |  8.50    1.78 | 11.50     .89
          2.75    1.78 |  5.75   22.64 |  8.75    1.78 | 11.75     .89
          3.00    1.78 |  6.00   39.96 |  9.00    1.78 | 12.00     .89

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .35

     NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
          .250     .44 | 3.250    1.78 | 6.250   23.98 |  9.25    1.78
          .500     .89 | 3.500    1.78 | 6.500    7.99 |  9.50    1.78
          .750     .89 | 3.750    1.78 | 6.750    5.77 |  9.75    1.33
         1.000     .89 | 4.000    1.78 | 7.000    3.55 | 10.00     .89
         1.250     .89 | 4.250    2.22 | 7.250    3.11 | 10.25     .89
         1.500     .89 | 4.500    2.66 | 7.500    2.66 | 10.50     .89
         1.750     .89 | 4.750    3.11 | 7.750    2.66 | 10.75     .89
         2.000     .89 | 5.000    3.55 | 8.000    2.66 | 11.00     .89
         2.250    1.33 | 5.250    4.44 | 8.250    2.22 | 11.25     .89
         2.500    1.78 | 5.500    5.33 | 8.500    1.78 | 11.50     .89
         2.750    1.78 | 5.750   22.64 | 8.750    1.78 | 11.75     .89
         3.000    1.78 | 6.000   39.96 | 9.000    1.78 | 12.00     .89

   Unit Hyd Qpeak  (cms)=    .550

   PEAK FLOW       (cms)=    .183 (i)
   TIME TO PEAK    (hrs)=   6.250
   RUNOFF VOLUME    (mm)=  19.255
   TOTAL RAINFALL   (mm)=  44.289
   RUNOFF COEFFICIENT   =    .435

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .102 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  18.558
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .419

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=    .704 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  20.894
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .472

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .108 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  12.311
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .278

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=    .411 (i)
```

```
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  20.010
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .452

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=    .483 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  20.761
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .469

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .081 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  14.258
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .322

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=    .460 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  20.166
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .455
```

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

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-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .832

    PEAK FLOW       (cms)=    .324 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  24.036
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .543

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

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  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |              Phases 3 & 4\Water Resources\Dillon Models\
|                  |              VO2 modeling\SCS12HII 15min.mst
| Ptotal= 62.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                  Duration of storm    = 12.00 hrs
                  Mass curve time step = 30.00 min
                  New Storm 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
.25	.62	3.25	2.50	6.25	33.70	9.25	2.50
.50	1.25	3.50	2.50	6.50	11.23	9.50	2.50
.75	1.25	3.75	2.50	6.75	8.11	9.75	1.87
1.00	1.25	4.00	2.50	7.00	4.99	10.00	1.25
1.25	1.25	4.25	3.12	7.25	4.37	10.25	1.25
1.50	1.25	4.50	3.74	7.50	3.74	10.50	1.25
1.75	1.25	4.75	4.37	7.75	3.74	10.75	1.25
2.00	1.25	5.00	4.99	8.00	3.74	11.00	1.25
2.25	1.87	5.25	6.24	8.25	3.12	11.25	1.25
2.50	2.50	5.50	7.49	8.50	2.50	11.50	1.25
2.75	2.50	5.75	31.82	8.75	2.50	11.75	1.25
3.00	2.50	6.00	56.16	9.00	2.50	12.00	1.25

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-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35
```

```
NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
          .250     .62 | 3.250    2.50 | 6.250   33.70 |  9.25    2.50
          .500    1.25 | 3.500    2.50 | 6.500   11.23 |  9.50    2.50
          .750    1.25 | 3.750    2.50 | 6.750    8.11 |  9.75    1.87
         1.000    1.25 | 4.000    2.50 | 7.000    4.99 | 10.00    1.25
         1.250    1.25 | 4.250    3.12 | 7.250    4.37 | 10.25    1.25
         1.500    1.25 | 4.500    3.74 | 7.500    3.74 | 10.50    1.25
         1.750    1.25 | 4.750    4.37 | 7.750    3.74 | 10.75    1.25
         2.000    1.25 | 5.000    4.99 | 8.000    3.74 | 11.00    1.25
         2.250    1.87 | 5.250    6.24 | 8.250    3.12 | 11.25    1.25
         2.500    2.50 | 5.500    7.49 | 8.500    2.50 | 11.50    1.25
         2.750    2.50 | 5.750   31.82 | 8.750    2.50 | 11.75    1.25
         3.000    2.50 | 6.000   56.16 | 9.000    2.50 | 12.00    1.25

    Unit Hyd Qpeak  (cms)=    .550

    PEAK FLOW       (cms)=    .320 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  33.304
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .535

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .180 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  31.697
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .509

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894
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```
    PEAK FLOW       (cms)=   1.215 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  35.597
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .572

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .191 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  21.300
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .342

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=    .718 (i)
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  34.457
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .554

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=    .846 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  35.461
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .570
```

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

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-----------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .151 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  25.953
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .417

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

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=    .799 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  34.670
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .557

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

-----------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .832

    PEAK FLOW       (cms)=    .530 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  39.637
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .637

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

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** SIMULATION NUMBER: 3 **
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| MASS STORM | Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
| | Phases 3 & 4\Water Resources\Dillon Models\
| | VO2 modeling\SCS12HII 15min.mst
| Ptotal= 74.40 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.74	3.25	2.98	6.25	40.18	9.25	2.98
.50	1.49	3.50	2.98	6.50	13.39	9.50	2.98
.75	1.49	3.75	2.98	6.75	9.67	9.75	2.23
1.00	1.49	4.00	2.98	7.00	5.95	10.00	1.49
1.25	1.49	4.25	3.72	7.25	5.21	10.25	1.49
1.50	1.49	4.50	4.46	7.50	4.46	10.50	1.49
1.75	1.49	4.75	5.21	7.75	4.46	10.75	1.49
2.00	1.49	5.00	5.95	8.00	4.46	11.00	1.49
2.25	2.23	5.25	7.44	8.25	3.72	11.25	1.49
2.50	2.98	5.50	8.93	8.50	2.98	11.50	1.49
2.75	2.98	5.75	37.94	8.75	2.98	11.75	1.49
3.00	2.98	6.00	66.96	9.00	2.98	12.00	1.49

| CALIB |
| NASHYD (0007) | Area (ha)= 5.03 Curve Number (CN)= 86.5
|ID= 1 DT=15.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)= .35

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	.74	3.250	2.98	6.250	40.18	9.25	2.98
.500	1.49	3.500	2.98	6.500	13.39	9.50	2.98
.750	1.49	3.750	2.98	6.750	9.67	9.75	2.23
1.000	1.49	4.000	2.98	7.000	5.95	10.00	1.49
1.250	1.49	4.250	3.72	7.250	5.21	10.25	1.49
1.500	1.49	4.500	4.46	7.500	4.46	10.50	1.49
1.750	1.49	4.750	5.21	7.750	4.46	10.75	1.49
2.000	1.49	5.000	5.95	8.000	4.46	11.00	1.49
2.250	2.23	5.250	7.44	8.250	3.72	11.25	1.49
2.500	2.98	5.500	8.93	8.500	2.98	11.50	1.49
2.750	2.98	5.750	37.94	8.750	2.98	11.75	1.49
3.000	2.98	6.000	66.96	9.000	2.98	12.00	1.49

Unit Hyd Qpeak (cms)= .550

```
    PEAK FLOW       (cms)=    .417 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  43.336
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .584

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .235 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  40.998
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .552

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=   1.572 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  45.987
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .620

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .251 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  27.720
    TOTAL RAINFALL   (mm)=  74.214
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    RUNOFF COEFFICIENT   =    .374

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=    .936 (i)
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  44.743
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .603

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=   1.102 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  45.866
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .618

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .203 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  34.648
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .467

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

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--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=   1.038 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  44.982
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .606

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .832

    PEAK FLOW       (cms)=    .669 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  50.441
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .680

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

-----------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |              Phases 3 & 4\Water Resources\Dillon Models\
|                  |              VO2 modeling\SCS12HII 15min.mst
| Ptotal= 90.00 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                     Duration of storm    = 12.00 hrs
                     Mass curve time step = 30.00 min
                     New Storm 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
                .25     .90 |  3.25    3.60 |  6.25   48.60 |  9.25    3.60
                .50    1.80 |  3.50    3.60 |  6.50   16.20 |  9.50    3.60
                .75    1.80 |  3.75    3.60 |  6.75   11.70 |  9.75    2.70
               1.00    1.80 |  4.00    3.60 |  7.00    7.20 | 10.00    1.80
               1.25    1.80 |  4.25    4.50 |  7.25    6.30 | 10.25    1.80
```

```
            1.50    1.80 |  4.50    5.40 |  7.50    5.40 | 10.50    1.80
            1.75    1.80 |  4.75    6.30 |  7.75    5.40 | 10.75    1.80
            2.00    1.80 |  5.00    7.20 |  8.00    5.40 | 11.00    1.80
            2.25    2.70 |  5.25    9.00 |  8.25    4.50 | 11.25    1.80
            2.50    3.60 |  5.50   10.80 |  8.50    3.60 | 11.50    1.80
            2.75    3.60 |  5.75   45.90 |  8.75    3.60 | 11.75    1.80
            3.00    3.60 |  6.00   81.00 |  9.00    3.60 | 12.00    1.80

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35

      NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
            .250     .90 | 3.250    3.60 | 6.250   48.60 |  9.25    3.60
            .500    1.80 | 3.500    3.60 | 6.500   16.20 |  9.50    3.60
            .750    1.80 | 3.750    3.60 | 6.750   11.70 |  9.75    2.70
           1.000    1.80 | 4.000    3.60 | 7.000    7.20 | 10.00    1.80
           1.250    1.80 | 4.250    4.50 | 7.250    6.30 | 10.25    1.80
           1.500    1.80 | 4.500    5.40 | 7.500    5.40 | 10.50    1.80
           1.750    1.80 | 4.750    6.30 | 7.750    5.40 | 10.75    1.80
           2.000    1.80 | 5.000    7.20 | 8.000    5.40 | 11.00    1.80
           2.250    2.70 | 5.250    9.00 | 8.250    4.50 | 11.25    1.80
           2.500    3.60 | 5.500   10.80 | 8.500    3.60 | 11.50    1.80
           2.750    3.60 | 5.750   45.90 | 8.750    3.60 | 11.75    1.80
           3.000    3.60 | 6.000   81.00 | 9.000    3.60 | 12.00    1.80

     Unit Hyd Qpeak  (cms)=    .550

     PEAK FLOW       (cms)=    .548 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  56.883
     TOTAL RAINFALL   (mm)=  89.775
     RUNOFF COEFFICIENT   =    .634

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .470

     PEAK FLOW       (cms)=    .308 (i)
     TIME TO PEAK    (hrs)=   6.000
     RUNOFF VOLUME    (mm)=  53.491
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    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .596

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=   2.046 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  59.928
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .668

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .330 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  36.392
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .405

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=   1.230 (i)
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  58.605
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .653

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=   1.444 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  59.841
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .667

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .276 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  46.709
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .520

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=   1.357 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  58.872
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .656

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .832

    PEAK FLOW       (cms)=    .850 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  64.766
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .721

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

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  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |              Phases 3 & 4\Water Resources\Dillon Models\
|                  |              VO2 modeling\SCS12HII 15min.mst
| Ptotal=100.80 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                      Duration of storm    = 12.00 hrs
                      Mass curve time step = 30.00 min
                      New Storm 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
                .25    1.01 |  3.25    4.03 |  6.25   54.43 |  9.25    4.03
                .50    2.02 |  3.50    4.03 |  6.50   18.14 |  9.50    4.03
                .75    2.02 |  3.75    4.03 |  6.75   13.10 |  9.75    3.02
               1.00    2.02 |  4.00    4.03 |  7.00    8.06 | 10.00    2.02
               1.25    2.02 |  4.25    5.04 |  7.25    7.06 | 10.25    2.02
               1.50    2.02 |  4.50    6.05 |  7.50    6.05 | 10.50    2.02
               1.75    2.02 |  4.75    7.06 |  7.75    6.05 | 10.75    2.02
               2.00    2.02 |  5.00    8.06 |  8.00    6.05 | 11.00    2.02
               2.25    3.02 |  5.25   10.08 |  8.25    5.04 | 11.25    2.02
               2.50    4.03 |  5.50   12.10 |  8.50    4.03 | 11.50    2.02
               2.75    4.03 |  5.75   51.41 |  8.75    4.03 | 11.75    2.02
               3.00    4.03 |  6.00   90.72 |  9.00    4.03 | 12.00    2.02

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--------------------
| CALIB            |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .35

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
```

.250	1.01	3.250	4.03	6.250	54.43	9.25	4.03
.500	2.02	3.500	4.03	6.500	18.14	9.50	4.03
.750	2.02	3.750	4.03	6.750	13.10	9.75	3.02
1.000	2.02	4.000	4.03	7.000	8.06	10.00	2.02
1.250	2.02	4.250	5.04	7.250	7.06	10.25	2.02
1.500	2.02	4.500	6.05	7.500	6.05	10.50	2.02
1.750	2.02	4.750	7.06	7.750	6.05	10.75	2.02
2.000	2.02	5.000	8.06	8.000	6.05	11.00	2.02
2.250	3.02	5.250	10.08	8.250	5.04	11.25	2.02
2.500	4.03	5.500	12.10	8.500	4.03	11.50	2.02
2.750	4.03	5.750	51.41	8.750	4.03	11.75	2.02
3.000	4.03	6.000	90.72	9.000	4.03	12.00	2.02

```
    Unit Hyd Qpeak  (cms)=    .550

    PEAK FLOW       (cms)=    .639 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  66.502
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .661

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .359 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  62.326
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .620

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=   2.378 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  69.781
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .694

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------------------------------------------------------------------
--------------------
| CALIB          |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .386 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  42.549
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .423

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

--------------------------------------------------------------------------------
--------------------
| CALIB          |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=   1.438 (i)
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  68.435
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .681

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

--------------------------------------------------------------------------------
--------------------
| CALIB          |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=   1.684 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  69.726
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .693

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

--------------------------------------------------------------------------------
--------------------
| CALIB          |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
```

```
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .286

     PEAK FLOW       (cms)=    .328 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  55.443
     TOTAL RAINFALL   (mm)= 100.548
     RUNOFF COEFFICIENT   =    .551

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .72

     Unit Hyd Qpeak  (cms)=   1.021

     PEAK FLOW       (cms)=   1.582 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  68.716
     TOTAL RAINFALL   (mm)= 100.548
     RUNOFF COEFFICIENT   =    .683

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .30

     Unit Hyd Qpeak  (cms)=    .832

     PEAK FLOW       (cms)=    .975 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  74.808
     TOTAL RAINFALL   (mm)= 100.548
     RUNOFF COEFFICIENT   =    .744

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

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

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |              Phases 3 & 4\Water Resources\Dillon Models\
|                  |              VO2 modeling\SCS12HII 15min.mst
```

| Ptotal=111.60 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm   = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	1.12	3.25	4.46	6.25	60.26	9.25	4.46
.50	2.23	3.50	4.46	6.50	20.09	9.50	4.46
.75	2.23	3.75	4.46	6.75	14.51	9.75	3.35
1.00	2.23	4.00	4.46	7.00	8.93	10.00	2.23
1.25	2.23	4.25	5.58	7.25	7.81	10.25	2.23
1.50	2.23	4.50	6.70	7.50	6.70	10.50	2.23
1.75	2.23	4.75	7.81	7.75	6.70	10.75	2.23
2.00	2.23	5.00	8.93	8.00	6.70	11.00	2.23
2.25	3.35	5.25	11.16	8.25	5.58	11.25	2.23
2.50	4.46	5.50	13.39	8.50	4.46	11.50	2.23
2.75	4.46	5.75	56.92	8.75	4.46	11.75	2.23
3.00	4.46	6.00	100.44	9.00	4.46	12.00	2.23

| CALIB |
| NASHYD   (0007) | Area   (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min | Ia   (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)=   .35

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	1.12	3.250	4.46	6.250	60.26	9.25	4.46
.500	2.23	3.500	4.46	6.500	20.09	9.50	4.46
.750	2.23	3.750	4.46	6.750	14.51	9.75	3.35
1.000	2.23	4.000	4.46	7.000	8.93	10.00	2.23
1.250	2.23	4.250	5.58	7.250	7.81	10.25	2.23
1.500	2.23	4.500	6.70	7.500	6.70	10.50	2.23
1.750	2.23	4.750	7.81	7.750	6.70	10.75	2.23
2.000	2.23	5.000	8.93	8.000	6.70	11.00	2.23
2.250	3.35	5.250	11.16	8.250	5.58	11.25	2.23
2.500	4.46	5.500	13.39	8.500	4.46	11.50	2.23
2.750	4.46	5.750	56.92	8.750	4.46	11.75	2.23
3.000	4.46	6.000	100.44	9.000	4.46	12.00	2.23

Unit Hyd Qpeak (cms)=   .550

PEAK FLOW   (cms)=   .732 (i)
TIME TO PEAK   (hrs)=   6.250
RUNOFF VOLUME   (mm)= 76.268
TOTAL RAINFALL   (mm)= 111.321
RUNOFF COEFFICIENT   =   .685

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .411 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  71.275
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .640

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=   2.711 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  79.755
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .716

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .442 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  48.801
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .438

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=   1.649 (i)
    TIME TO PEAK    (hrs)=   8.250
    RUNOFF VOLUME    (mm)=  78.405
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .704

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=   1.926 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  79.737
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .716

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .382 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  64.425
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .579

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021
```

PEAK FLOW (cms)= 1.815 (i)
TIME TO PEAK (hrs)= 6.500
RUNOFF VOLUME (mm)= 78.697
TOTAL RAINFALL (mm)= 111.321
RUNOFF COEFFICIENT = .707

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

| CALIB |
| NASHYD (0025) | Area (ha)= 6.47 Curve Number (CN)= 91.6
|ID= 1 DT=15.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)= .30

Unit Hyd Qpeak (cms)= .832

PEAK FLOW (cms)= 1.099 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 84.924
TOTAL RAINFALL (mm)= 111.321
RUNOFF COEFFICIENT = .763

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

****
** SIMULATION NUMBER: 7 **
****

| MASS STORM | Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
| | Phases 3 & 4\Water Resources\Dillon Models\
| | VO2 modeling\SCS12HII 15min.mst
| Ptotal= 25.00 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 10.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.17	.17	3.17	1.00	6.17	16.50	9.17	1.00
.33	.33	3.33	1.00	6.33	10.50	9.33	1.00
.50	.50	3.50	1.00	6.50	4.50	9.50	1.00
.67	.50	3.67	1.00	6.67	3.67	9.67	.83
.83	.50	3.83	1.00	6.83	2.83	9.83	.67
1.00	.50	4.00	1.00	7.00	2.00	10.00	.50
1.17	.50	4.17	1.17	7.17	1.83	10.17	.50
1.33	.50	4.33	1.33	7.33	1.67	10.33	.50
1.50	.50	4.50	1.50	7.50	1.50	10.50	.50
1.67	.50	4.67	1.67	7.67	1.50	10.67	.50
1.83	.50	4.83	1.83	7.83	1.50	10.83	.50
2.00	.50	5.00	2.00	8.00	1.50	11.00	.50

```
          2.17     .67 |  5.17    2.33 |  8.17    1.33 | 11.17     .50
          2.33     .83 |  5.33    2.67 |  8.33    1.17 | 11.33     .50
          2.50    1.00 |  5.50    3.00 |  8.50    1.00 | 11.50     .50
          2.67    1.00 |  5.67    9.50 |  8.67    1.00 | 11.67     .50
          2.83    1.00 |  5.83   16.00 |  8.83    1.00 | 11.83     .50
          3.00    1.00 |  6.00   22.50 |  9.00    1.00 | 12.00     .50

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 86.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .35

     NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
          .250     .22 | 3.250    1.00 | 6.250   14.50 |  9.25    1.00
          .500     .44 | 3.500    1.00 | 6.500    6.50 |  9.50    1.00
          .750     .50 | 3.750    1.00 | 6.750    3.39 |  9.75     .78
         1.000     .50 | 4.000    1.00 | 7.000    2.28 | 10.00     .56
         1.250     .50 | 4.250    1.22 | 7.250    1.78 | 10.25     .50
         1.500     .50 | 4.500    1.44 | 7.500    1.56 | 10.50     .50
         1.750     .50 | 4.750    1.72 | 7.750    1.50 | 10.75     .50
         2.000     .50 | 5.000    1.94 | 8.000    1.50 | 11.00     .50
         2.250     .72 | 5.250    2.44 | 8.250    1.28 | 11.25     .50
         2.500     .94 | 5.500    2.89 | 8.500    1.06 | 11.50     .50
         2.750    1.00 | 5.750   11.67 | 8.750    1.00 | 11.75     .50
         3.000    1.00 | 6.000   20.33 | 9.000    1.00 | 12.00     .50

    Unit Hyd Qpeak  (cms)=    .550

    PEAK FLOW       (cms)=    .054 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   6.557
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .263

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .470

    PEAK FLOW       (cms)=    .034 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   6.463
    TOTAL RAINFALL   (mm)=  24.917
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    RUNOFF COEFFICIENT   =    .259

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.894

    PEAK FLOW       (cms)=    .216 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=   7.310
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .293

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 86.4
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.011

    PEAK FLOW       (cms)=    .031 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   4.190
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .168

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 87.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=    .135 (i)
    TIME TO PEAK    (hrs)=   8.500
    RUNOFF VOLUME    (mm)=   6.866
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .276

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

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--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 88.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=    .160 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=   7.230
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .290

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 78.7
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .023 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=   4.465
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .179

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 87.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=    .147 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=   6.940
    TOTAL RAINFALL   (mm)=  24.917
    RUNOFF COEFFICIENT   =    .279

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 91.6
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30
```

Unit Hyd Qpeak (cms)= .832

PEAK FLOW (cms)= .110 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 8.952
TOTAL RAINFALL (mm)= 24.917
RUNOFF COEFFICIENT = .359

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

FINISH
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EXISITING CONDTIONS REGIONAL STORM

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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, Version 2.0
     O   O    T      T    H   H   Y Y   MM MM  O   O
     O   O    T      T    H   H    Y    M   M  O   O  Licensed To: Dillon Consulting Ltd
      OOO     T      T    H   H    Y    M   M   OOO              vo2-0082
```


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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Existing regional s
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Existing regional s

DATE: 5/18/2010   TIME: 11:42:40 AM

USER:

COMMENTS: ____

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


--------------------
|   READ STORM    |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                 |             Phases 3 & 4\Water Resources\Dillon Models\
|                 |             VO2 modeling\HAZEL.STM
| Ptotal=212.00 mm |    Comments: 12-Hour Hurricane Hazel
--------------------
           TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
            hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
            .25    6.00 |  3.25   13.00 |  6.25   23.00 |  9.25   53.00
            .50    6.00 |  3.50   13.00 |  6.50   23.00 |  9.50   53.00
```

```
 .75    6.00 |  3.75   13.00 |  6.75   23.00 |  9.75   53.00
1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
1.25    4.00 |  4.25   17.00 |  7.25   13.00 | 10.25   38.00
1.50    4.00 |  4.50   17.00 |  7.50   13.00 | 10.50   38.00
1.75    4.00 |  4.75   17.00 |  7.75   13.00 | 10.75   38.00
2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
2.25    6.00 |  5.25   13.00 |  8.25   13.00 | 11.25   13.00
2.50    6.00 |  5.50   13.00 |  8.50   13.00 | 11.50   13.00
2.75    6.00 |  5.75   13.00 |  8.75   13.00 | 11.75   13.00
3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00

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

--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=  37.86   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   2.04

    Unit Hyd Qpeak  (cms)=    .708

    PEAK FLOW       (cms)=   3.059 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)= 191.962
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .905

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=  14.82   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .45

    Unit Hyd Qpeak  (cms)=   1.255

    PEAK FLOW       (cms)=   1.948 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 192.837
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .910

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   4.19   Curve Number   (CN)= 90.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=    .286

    PEAK FLOW       (cms)=    .513 (i)
```

```
    TIME TO PEAK    (hrs)=  10.250
    RUNOFF VOLUME    (mm)= 181.711
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .857

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0024) |   Area    (ha)=  19.20   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=   1.021

    PEAK FLOW       (cms)=   2.236 (i)
    TIME TO PEAK    (hrs)=  10.500
    RUNOFF VOLUME    (mm)= 191.784
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .905

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0025) |   Area    (ha)=   6.47   Curve Number   (CN)= 97.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .832

    PEAK FLOW       (cms)=    .911 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 194.059
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .915

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0007) |   Area    (ha)=   5.03   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .35

    Unit Hyd Qpeak  (cms)=    .550

    PEAK FLOW       (cms)=    .697 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 189.090
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .892
```

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0014) |   Area    (ha)=   2.40   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .470

     PEAK FLOW       (cms)=    .311 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)= 172.373
     TOTAL RAINFALL   (mm)= 212.000
     RUNOFF COEFFICIENT   =    .813

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0016) |   Area    (ha)=  18.30   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

     Unit Hyd Qpeak  (cms)=   1.894

     PEAK FLOW       (cms)=   2.525 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)= 191.583
     TOTAL RAINFALL   (mm)= 212.000
     RUNOFF COEFFICIENT   =    .904

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

-----------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0017) |   Area    (ha)=   3.31   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

     Unit Hyd Qpeak  (cms)=   1.011

     PEAK FLOW       (cms)=    .304 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)= 121.104
     TOTAL RAINFALL   (mm)= 212.000
     RUNOFF COEFFICIENT   =    .571

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

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

 FINISH
```

FUTURE CONDTIONS DESIGN STORMS

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

     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, Version 2.0
     O   O    T      T    H   H   Y Y   MM MM  O   O
     O   O    T      T    H   H    Y    M   M  O   O  Licensed To: Dillon Consulting Ltd
      OOO     T      T    H   H    Y    M   M   OOO               vo2-0082
```

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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Future design storm
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Future design storm

DATE: 5/18/2010 TIME: 11:43:30 AM

USER:

COMMENTS: ____

```
--------------------------------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| MASS STORM      |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                 |          1\WATERR~1\DILLON~1\VO2MOD~1\
|                 |          SCS12HII 15min.mst
| Ptotal= 44.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                    Duration of storm    = 12.00 hrs
                    Mass curve time step = 30.00 min
                    New Storm time step  = 15.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.44	3.25	1.78	6.25	23.98	9.25	1.78
.50	.89	3.50	1.78	6.50	7.99	9.50	1.78
.75	.89	3.75	1.78	6.75	5.77	9.75	1.33
1.00	.89	4.00	1.78	7.00	3.55	10.00	.89
1.25	.89	4.25	2.22	7.25	3.11	10.25	.89
1.50	.89	4.50	2.66	7.50	2.66	10.50	.89
1.75	.89	4.75	3.11	7.75	2.66	10.75	.89
2.00	.89	5.00	3.55	8.00	2.66	11.00	.89
2.25	1.33	5.25	4.44	8.25	2.22	11.25	.89
2.50	1.78	5.50	5.33	8.50	1.78	11.50	.89
2.75	1.78	5.75	22.64	8.75	1.78	11.75	.89
3.00	1.78	6.00	39.96	9.00	1.78	12.00	.89

```
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .24
```

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	.44	3.250	1.78	6.250	23.98	9.25	1.78
.500	.89	3.500	1.78	6.500	7.99	9.50	1.78
.750	.89	3.750	1.78	6.750	5.77	9.75	1.33
1.000	.89	4.000	1.78	7.000	3.55	10.00	.89
1.250	.89	4.250	2.22	7.250	3.11	10.25	.89
1.500	.89	4.500	2.66	7.500	2.66	10.50	.89
1.750	.89	4.750	3.11	7.750	2.66	10.75	.89
2.000	.89	5.000	3.55	8.000	2.66	11.00	.89
2.250	1.33	5.250	4.44	8.250	2.22	11.25	.89
2.500	1.78	5.500	5.33	8.500	1.78	11.50	.89
2.750	1.78	5.750	22.64	8.750	1.78	11.75	.89
3.000	1.78	6.000	39.96	9.000	1.78	12.00	.89

Unit Hyd Qpeak (cms)= .800

PEAK FLOW (cms)= .217 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 19.928
TOTAL RAINFALL (mm)= 44.289
RUNOFF COEFFICIENT = .450

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

```
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .112 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  20.790
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .469

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .068 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  24.726
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .558

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

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--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0023):     2.21    .112     6.00    20.79
      + ID2= 2 (0022):     1.12    .068     6.00    24.73
        ==================================================
        ID = 3 (0024):     3.32    .180     6.00    22.11

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=    .744 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  21.407
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .483
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```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

     Unit Hyd Qpeak  (cms)=   1.178

     PEAK FLOW       (cms)=    .161 (i)
     TIME TO PEAK    (hrs)=   6.000
     RUNOFF VOLUME    (mm)=  15.162
     TOTAL RAINFALL   (mm)=  44.289
     RUNOFF COEFFICIENT   =    .342

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=   2.582

     PEAK FLOW       (cms)=   1.128 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  20.996
     TOTAL RAINFALL   (mm)=  44.289
     RUNOFF COEFFICIENT   =    .474

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

     Unit Hyd Qpeak  (cms)=   1.236

     PEAK FLOW       (cms)=    .505 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  21.810
     TOTAL RAINFALL   (mm)=  44.289
     RUNOFF COEFFICIENT   =    .492

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

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```
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .104 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  18.228
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .412

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=    .455 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  20.907
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .472

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=    .417 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  26.937
    TOTAL RAINFALL   (mm)=  44.289
    RUNOFF COEFFICIENT   =    .608

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

-----------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
```

| | 1\WATERR~1\DILLON~1\VO2MOD~1\
| | SCS12HII 15min.mst
| Ptotal= 62.40 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm   = 12.00 hrs
Mass curve time step = 30.00 min
New Storm time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.62	3.25	2.50	6.25	33.70	9.25	2.50
.50	1.25	3.50	2.50	6.50	11.23	9.50	2.50
.75	1.25	3.75	2.50	6.75	8.11	9.75	1.87
1.00	1.25	4.00	2.50	7.00	4.99	10.00	1.25
1.25	1.25	4.25	3.12	7.25	4.37	10.25	1.25
1.50	1.25	4.50	3.74	7.50	3.74	10.50	1.25
1.75	1.25	4.75	4.37	7.75	3.74	10.75	1.25
2.00	1.25	5.00	4.99	8.00	3.74	11.00	1.25
2.25	1.87	5.25	6.24	8.25	3.12	11.25	1.25
2.50	2.50	5.50	7.49	8.50	2.50	11.50	1.25
2.75	2.50	5.75	31.82	8.75	2.50	11.75	1.25
3.00	2.50	6.00	56.16	9.00	2.50	12.00	1.25

| CALIB |
| NASHYD   (0012) | Area   (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min | Ia   (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)=   .24

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.250	.62	3.250	2.50	6.250	33.70	9.25	2.50
.500	1.25	3.500	2.50	6.500	11.23	9.50	2.50
.750	1.25	3.750	2.50	6.750	8.11	9.75	1.87
1.000	1.25	4.000	2.50	7.000	4.99	10.00	1.25
1.250	1.25	4.250	3.12	7.250	4.37	10.25	1.25
1.500	1.25	4.500	3.74	7.500	3.74	10.50	1.25
1.750	1.25	4.750	4.37	7.750	3.74	10.75	1.25
2.000	1.25	5.000	4.99	8.000	3.74	11.00	1.25
2.250	1.87	5.250	6.24	8.250	3.12	11.25	1.25
2.500	2.50	5.500	7.49	8.500	2.50	11.50	1.25
2.750	2.50	5.750	31.82	8.750	2.50	11.75	1.25
3.000	2.50	6.000	56.16	9.000	2.50	12.00	1.25

Unit Hyd Qpeak (cms)=   .800

PEAK FLOW   (cms)=   .366 (i)
TIME TO PEAK   (hrs)=   6.250
RUNOFF VOLUME   (mm)= 33.959
TOTAL RAINFALL   (mm)= 62.244

```
    RUNOFF COEFFICIENT   =    .546

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

----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .189 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  34.502
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .554

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

----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .109 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  39.655
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .637

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

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


--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0023):     2.21    .189     6.00    34.50
      + ID2= 2 (0022):     1.12    .109     6.00    39.66
        ==================================================
        ID = 3 (0024):     3.32    .298     6.00    36.23

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=   1.276 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  36.295
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .583

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178

    PEAK FLOW       (cms)=    .270 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  25.155
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .404

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582

    PEAK FLOW       (cms)=   1.947 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  35.805
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .575

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=    .874 (i)
```

```
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  36.890
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .593

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .186 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  31.914
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .513

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=    .785 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  35.695
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .573

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=    .658 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  43.255
    TOTAL RAINFALL   (mm)=  62.244
    RUNOFF COEFFICIENT   =    .695
```

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

```
-----------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

--------------------
| MASS STORM      |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                 |              1\WATERR~1\DILLON~1\VO2MOD~1\
|                 |              SCS12HII 15min.mst
| Ptotal= 74.40 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                  Duration of storm    = 12.00 hrs
                  Mass curve time step = 30.00 min
                  New Storm 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
              .25     .74 |  3.25    2.98 |  6.25   40.18 |  9.25    2.98
              .50    1.49 |  3.50    2.98 |  6.50   13.39 |  9.50    2.98
              .75    1.49 |  3.75    2.98 |  6.75    9.67 |  9.75    2.23
             1.00    1.49 |  4.00    2.98 |  7.00    5.95 | 10.00    1.49
             1.25    1.49 |  4.25    3.72 |  7.25    5.21 | 10.25    1.49
             1.50    1.49 |  4.50    4.46 |  7.50    4.46 | 10.50    1.49
             1.75    1.49 |  4.75    5.21 |  7.75    4.46 | 10.75    1.49
             2.00    1.49 |  5.00    5.95 |  8.00    4.46 | 11.00    1.49
             2.25    2.23 |  5.25    7.44 |  8.25    3.72 | 11.25    1.49
             2.50    2.98 |  5.50    8.93 |  8.50    2.98 | 11.50    1.49
             2.75    2.98 |  5.75   37.94 |  8.75    2.98 | 11.75    1.49
             3.00    2.98 |  6.00   66.96 |  9.00    2.98 | 12.00    1.49

-----------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .24

    NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
             .250     .74 | 3.250    2.98 | 6.250   40.18 |  9.25    2.98
             .500    1.49 | 3.500    2.98 | 6.500   13.39 |  9.50    2.98
             .750    1.49 | 3.750    2.98 | 6.750    9.67 |  9.75    2.23
            1.000    1.49 | 4.000    2.98 | 7.000    5.95 | 10.00    1.49
            1.250    1.49 | 4.250    3.72 | 7.250    5.21 | 10.25    1.49
            1.500    1.49 | 4.500    4.46 | 7.500    4.46 | 10.50    1.49
            1.750    1.49 | 4.750    5.21 | 7.750    4.46 | 10.75    1.49
            2.000    1.49 | 5.000    5.95 | 8.000    4.46 | 11.00    1.49
            2.250    2.23 | 5.250    7.44 | 8.250    3.72 | 11.25    1.49
            2.500    2.98 | 5.500    8.93 | 8.500    2.98 | 11.50    1.49
```

```
          2.750    2.98 | 5.750   37.94 | 8.750    2.98 | 11.75    1.49
          3.000    2.98 | 6.000   66.96 | 9.000    2.98 | 12.00    1.49

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .468 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  43.877
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .591

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .242 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  44.033
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .593

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .136 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  49.847
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .672

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

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


--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0023):     2.21    .242     6.00    44.03
       + ID2= 2 (0022):     1.12    .136     6.00    49.85
         ==================================================
```

```
      ID = 3 (0024):     3.32    .379     6.00    45.98

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

   Unit Hyd Qpeak  (cms)=   1.947

   PEAK FLOW       (cms)=   1.646 (i)
   TIME TO PEAK    (hrs)=   6.250
   RUNOFF VOLUME    (mm)=  46.783
   TOTAL RAINFALL   (mm)=  74.214
   RUNOFF COEFFICIENT   =    .630

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

   Unit Hyd Qpeak  (cms)=   1.178

   PEAK FLOW       (cms)=    .344 (i)
   TIME TO PEAK    (hrs)=   6.000
   RUNOFF VOLUME    (mm)=  32.100
   TOTAL RAINFALL   (mm)=  74.214
   RUNOFF COEFFICIENT   =    .433

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

   Unit Hyd Qpeak  (cms)=   2.582

   PEAK FLOW       (cms)=   2.521 (i)
   TIME TO PEAK    (hrs)=   6.500
   RUNOFF VOLUME    (mm)=  46.277
   TOTAL RAINFALL   (mm)=  74.214
   RUNOFF COEFFICIENT   =    .624

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

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

```
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=   1.132 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  47.496
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .640

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .244 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  41.776
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .563

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=   1.016 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  46.159
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .622

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30
```

```
    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=    .817 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  54.403
    TOTAL RAINFALL   (mm)=  74.214
    RUNOFF COEFFICIENT   =    .733

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

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |             1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |             SCS12HII 15min.mst
| Ptotal= 90.00 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                    Duration of storm    = 12.00 hrs
                    Mass curve time step = 30.00 min
                    New Storm 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
               .25     .90 |  3.25    3.60 |  6.25   48.60 |  9.25    3.60
               .50    1.80 |  3.50    3.60 |  6.50   16.20 |  9.50    3.60
               .75    1.80 |  3.75    3.60 |  6.75   11.70 |  9.75    2.70
              1.00    1.80 |  4.00    3.60 |  7.00    7.20 | 10.00    1.80
              1.25    1.80 |  4.25    4.50 |  7.25    6.30 | 10.25    1.80
              1.50    1.80 |  4.50    5.40 |  7.50    5.40 | 10.50    1.80
              1.75    1.80 |  4.75    6.30 |  7.75    5.40 | 10.75    1.80
              2.00    1.80 |  5.00    7.20 |  8.00    5.40 | 11.00    1.80
              2.25    2.70 |  5.25    9.00 |  8.25    4.50 | 11.25    1.80
              2.50    3.60 |  5.50   10.80 |  8.50    3.60 | 11.50    1.80
              2.75    3.60 |  5.75   45.90 |  8.75    3.60 | 11.75    1.80
              3.00    3.60 |  6.00   81.00 |  9.00    3.60 | 12.00    1.80

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .24

      NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
              .250     .90 | 3.250    3.60 | 6.250   48.60 |  9.25    3.60
```

```
  .500    1.80 | 3.500    3.60 | 6.500   16.20 |  9.50    3.60
  .750    1.80 | 3.750    3.60 | 6.750   11.70 |  9.75    2.70
 1.000    1.80 | 4.000    3.60 | 7.000    7.20 | 10.00    1.80
 1.250    1.80 | 4.250    4.50 | 7.250    6.30 | 10.25    1.80
 1.500    1.80 | 4.500    5.40 | 7.500    5.40 | 10.50    1.80
 1.750    1.80 | 4.750    6.30 | 7.750    5.40 | 10.75    1.80
 2.000    1.80 | 5.000    7.20 | 8.000    5.40 | 11.00    1.80
 2.250    2.70 | 5.250    9.00 | 8.250    4.50 | 11.25    1.80
 2.500    3.60 | 5.500   10.80 | 8.500    3.60 | 11.50    1.80
 2.750    3.60 | 5.750   45.90 | 8.750    3.60 | 11.75    1.80
 3.000    3.60 | 6.000   81.00 | 9.000    3.60 | 12.00    1.80

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .612 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  57.184
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .637

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .312 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  56.697
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .632

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .172 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  63.254
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .705

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

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


--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0023):      2.21    .312     6.00    56.70
       + ID2= 2 (0022):      1.12    .172     6.00    63.25
         ===================================================
         ID = 3 (0024):      3.32    .483     6.00    58.90

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=   2.136 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  60.826
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .678

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178

    PEAK FLOW       (cms)=    .441 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  41.326
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .460

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582
```

```
    PEAK FLOW       (cms)=   3.284 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  60.333
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .672

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=   1.475 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  61.685
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .687

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .324 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  55.169
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .615

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=   1.323 (i)
    TIME TO PEAK    (hrs)=   6.750
    RUNOFF VOLUME    (mm)=  60.211
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .671
```

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

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------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=   1.023 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  69.071
    TOTAL RAINFALL   (mm)=  89.775
    RUNOFF COEFFICIENT   =    .769

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

------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020~
|                  |              1\WATERR~1\DILLON~1\VO2MOD~1\
|                  |              SCS12HII 15min.mst
| Ptotal=100.80 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                   Duration of storm    = 12.00 hrs
                   Mass curve time step = 30.00 min
                   New Storm time step  = 15.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	1.01	3.25	4.03	6.25	54.43	9.25	4.03
.50	2.02	3.50	4.03	6.50	18.14	9.50	4.03
.75	2.02	3.75	4.03	6.75	13.10	9.75	3.02
1.00	2.02	4.00	4.03	7.00	8.06	10.00	2.02
1.25	2.02	4.25	5.04	7.25	7.06	10.25	2.02
1.50	2.02	4.50	6.05	7.50	6.05	10.50	2.02
1.75	2.02	4.75	7.06	7.75	6.05	10.75	2.02
2.00	2.02	5.00	8.06	8.00	6.05	11.00	2.02
2.25	3.02	5.25	10.08	8.25	5.04	11.25	2.02
2.50	4.03	5.50	12.10	8.50	4.03	11.50	2.02
2.75	4.03	5.75	51.41	8.75	4.03	11.75	2.02
3.00	4.03	6.00	90.72	9.00	4.03	12.00	2.02

```
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------  U.H. Tp(hrs)=    .24

      NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
           .250    1.01 | 3.250    4.03 | 6.250   54.43 |  9.25    4.03
           .500    2.02 | 3.500    4.03 | 6.500   18.14 |  9.50    4.03
           .750    2.02 | 3.750    4.03 | 6.750   13.10 |  9.75    3.02
          1.000    2.02 | 4.000    4.03 | 7.000    8.06 | 10.00    2.02
          1.250    2.02 | 4.250    5.04 | 7.250    7.06 | 10.25    2.02
          1.500    2.02 | 4.500    6.05 | 7.500    6.05 | 10.50    2.02
          1.750    2.02 | 4.750    7.06 | 7.750    6.05 | 10.75    2.02
          2.000    2.02 | 5.000    8.06 | 8.000    6.05 | 11.00    2.02
          2.250    3.02 | 5.250   10.08 | 8.250    5.04 | 11.25    2.02
          2.500    4.03 | 5.500   12.10 | 8.500    4.03 | 11.50    2.02
          2.750    4.03 | 5.750   51.41 | 8.750    4.03 | 11.75    2.02
          3.000    4.03 | 6.000   90.72 | 9.000    4.03 | 12.00    2.02

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .715 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  66.591
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .662

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .360 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  65.587
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .652

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219
```

```
    PEAK FLOW       (cms)=    .196 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  72.605
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .722

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

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

--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0023):     2.21    .360     6.00    65.59
      + ID2= 2 (0022):     1.12    .196     6.00    72.60
        ==================================================
        ID = 3 (0024):     3.32    .556     6.00    67.94

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=   2.478 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  70.738
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .704

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178

    PEAK FLOW       (cms)=    .508 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  47.802
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .475

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582

    PEAK FLOW       (cms)=   3.819 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  70.270
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .699

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

--------------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=   1.715 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  71.693
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .713

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

--------------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .380 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  64.718
    TOTAL RAINFALL   (mm)= 100.548
    RUNOFF COEFFICIENT   =    .644

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

--------------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

-------------------- U.H. Tp(hrs)= .72

Unit Hyd Qpeak (cms)= .972

PEAK FLOW (cms)= 1.542 (i)
TIME TO PEAK (hrs)= 6.500
RUNOFF VOLUME (mm)= 70.149
TOTAL RAINFALL (mm)= 100.548
RUNOFF COEFFICIENT = .698

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

| CALIB |
| NASHYD (0037) | Area (ha)= 7.36 Curve Number (CN)= 93.9
|ID= 1 DT=15.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)= .30

Unit Hyd Qpeak (cms)= .947

PEAK FLOW (cms)= 1.165 (i)
TIME TO PEAK (hrs)= 6.250
RUNOFF VOLUME (mm)= 79.303
TOTAL RAINFALL (mm)= 100.548
RUNOFF COEFFICIENT = .789

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

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

| MASS STORM | Filename: M:\PROJECTS\DRAFT\08\089020~
| | 1\WATERR~1\DILLON~1\VO2MOD~1\
| | SCS12HII 15min.mst
| Ptotal=111.60 mm | Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION

Duration of storm = 12.00 hrs
Mass curve time step = 30.00 min
New Storm 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
.25	1.12	3.25	4.46	6.25	60.26	9.25	4.46
.50	2.23	3.50	4.46	6.50	20.09	9.50	4.46
.75	2.23	3.75	4.46	6.75	14.51	9.75	3.35
1.00	2.23	4.00	4.46	7.00	8.93	10.00	2.23
1.25	2.23	4.25	5.58	7.25	7.81	10.25	2.23
1.50	2.23	4.50	6.70	7.50	6.70	10.50	2.23
1.75	2.23	4.75	7.81	7.75	6.70	10.75	2.23
2.00	2.23	5.00	8.93	8.00	6.70	11.00	2.23
2.25	3.35	5.25	11.16	8.25	5.58	11.25	2.23

```
           2.50    4.46 |  5.50   13.39 |  8.50    4.46 | 11.50    2.23
           2.75    4.46 |  5.75   56.92 |  8.75    4.46 | 11.75    2.23
           3.00    4.46 |  6.00  100.44 |  9.00    4.46 | 12.00    2.23

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

      NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
           .250    1.12 | 3.250    4.46 | 6.250   60.26 |  9.25    4.46
           .500    2.23 | 3.500    4.46 | 6.500   20.09 |  9.50    4.46
           .750    2.23 | 3.750    4.46 | 6.750   14.51 |  9.75    3.35
          1.000    2.23 | 4.000    4.46 | 7.000    8.93 | 10.00    2.23
          1.250    2.23 | 4.250    5.58 | 7.250    7.81 | 10.25    2.23
          1.500    2.23 | 4.500    6.70 | 7.500    6.70 | 10.50    2.23
          1.750    2.23 | 4.750    7.81 | 7.750    6.70 | 10.75    2.23
          2.000    2.23 | 5.000    8.93 | 8.000    6.70 | 11.00    2.23
          2.250    3.35 | 5.250   11.16 | 8.250    5.58 | 11.25    2.23
          2.500    4.46 | 5.500   13.39 | 8.500    4.46 | 11.50    2.23
          2.750    4.46 | 5.750   56.92 | 8.750    4.46 | 11.75    2.23
          3.000    4.46 | 6.000  100.44 | 9.000    4.46 | 12.00    2.23

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .819 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  76.113
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .684

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .408 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  74.550
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .670

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .220 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  81.995
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .737

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

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--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0023):      2.21     .408      6.00    74.55
      + ID2= 2 (0022):      1.12     .220      6.00    81.99
        ==================================================
        ID = 3 (0024):      3.32     .628      6.00    77.05

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=   2.822 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  80.764
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .726

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178
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```
    PEAK FLOW       (cms)=    .575 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=  54.331
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .488

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582

    PEAK FLOW       (cms)=   4.357 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  80.332
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .722

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=   1.956 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  81.813
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .735

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .437 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  74.437
    TOTAL RAINFALL   (mm)= 111.321
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    RUNOFF COEFFICIENT   =    .669

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=   1.764 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=  80.213
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .721

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=   1.306 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=  89.579
    TOTAL RAINFALL   (mm)= 111.321
    RUNOFF COEFFICIENT   =    .805

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

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  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| MASS STORM       |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                  |              Phases 3 & 4\Water Resources\Dillon Models\
|                  |              VO2 modeling\SCS12HII 15min.mst
| Ptotal= 25.00 mm |    Comments: SCS 12 HOUR TYPE II STORM DISTRIBUTION
--------------------
                     Duration of storm    = 12.00 hrs
                     Mass curve time step = 30.00 min
                     New Storm 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
```

```
          .25     .25 |  3.25    1.00 |  6.25   13.50 |  9.25    1.00
          .50     .50 |  3.50    1.00 |  6.50    4.50 |  9.50    1.00
          .75     .50 |  3.75    1.00 |  6.75    3.25 |  9.75     .75
         1.00     .50 |  4.00    1.00 |  7.00    2.00 | 10.00     .50
         1.25     .50 |  4.25    1.25 |  7.25    1.75 | 10.25     .50
         1.50     .50 |  4.50    1.50 |  7.50    1.50 | 10.50     .50
         1.75     .50 |  4.75    1.75 |  7.75    1.50 | 10.75     .50
         2.00     .50 |  5.00    2.00 |  8.00    1.50 | 11.00     .50
         2.25     .75 |  5.25    2.50 |  8.25    1.25 | 11.25     .50
         2.50    1.00 |  5.50    3.00 |  8.50    1.00 | 11.50     .50
         2.75    1.00 |  5.75   12.75 |  8.75    1.00 | 11.75     .50
         3.00    1.00 |  6.00   22.50 |  9.00    1.00 | 12.00     .50

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--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 88.3
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .24

     NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
         .250     .25 | 3.250    1.00 | 6.250   13.50 |  9.25    1.00
         .500     .50 | 3.500    1.00 | 6.500    4.50 |  9.50    1.00
         .750     .50 | 3.750    1.00 | 6.750    3.25 |  9.75     .75
        1.000     .50 | 4.000    1.00 | 7.000    2.00 | 10.00     .50
        1.250     .50 | 4.250    1.25 | 7.250    1.75 | 10.25     .50
        1.500     .50 | 4.500    1.50 | 7.500    1.50 | 10.50     .50
        1.750     .50 | 4.750    1.75 | 7.750    1.50 | 10.75     .50
        2.000     .50 | 5.000    2.00 | 8.000    1.50 | 11.00     .50
        2.250     .75 | 5.250    2.50 | 8.250    1.25 | 11.25     .50
        2.500    1.00 | 5.500    3.00 | 8.500    1.00 | 11.50     .50
        2.750    1.00 | 5.750   12.75 | 8.750    1.00 | 11.75     .50
        3.000    1.00 | 6.000   22.50 | 9.000    1.00 | 12.00     .50

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .075 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   6.980
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .280

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 91.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .18
```

```
    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .038 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   7.657
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .307

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 94.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .025 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   9.778
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .392

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

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


--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0023):     2.21    .038     6.25     7.66
      + ID2= 2 (0022):     1.12    .025     6.25     9.78
        ==================================================
        ID = 3 (0024):     3.32    .063     6.25     8.37

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 88.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .37

    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=    .245 (i)
    TIME TO PEAK    (hrs)=   6.250
    RUNOFF VOLUME    (mm)=   7.569
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .304

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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-----------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 91.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178

    PEAK FLOW       (cms)=    .055 (i)
    TIME TO PEAK    (hrs)=   6.000
    RUNOFF VOLUME    (mm)=   5.588
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .224

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

-----------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 88.2
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582

    PEAK FLOW       (cms)=    .369 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=   7.345
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .295

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

-----------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 89.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=    .173 (i)
    TIME TO PEAK    (hrs)=   6.500
    RUNOFF VOLUME    (mm)=   7.746
    TOTAL RAINFALL   (mm)=  24.938
    RUNOFF COEFFICIENT   =    .311

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

-----------------------------------------------------------------------------
--------------------
| CALIB           |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 84.9
```

```
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .58

     Unit Hyd Qpeak  (cms)=    .276

     PEAK FLOW       (cms)=    .032 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=   6.088
     TOTAL RAINFALL   (mm)=  24.938
     RUNOFF COEFFICIENT   =    .244

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 88.1
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .72

     Unit Hyd Qpeak  (cms)=    .972

     PEAK FLOW       (cms)=    .150 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   7.299
     TOTAL RAINFALL   (mm)=  24.938
     RUNOFF COEFFICIENT   =    .293

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .30

     Unit Hyd Qpeak  (cms)=    .947

     PEAK FLOW       (cms)=    .163 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  10.623
     TOTAL RAINFALL   (mm)=  24.938
     RUNOFF COEFFICIENT   =    .426

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

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 FINISH
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FUTURE CONDTIONS REGIONAL STORM

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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, Version 2.0
     O   O    T      T    H   H   Y Y   MM MM  O   O
     O   O    T      T    H   H    Y    M   M  O   O  Licensed To: Dillon Consulting Ltd
      OOO     T      T    H   H    Y    M   M   OOO              vo2-0082
```

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

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Future regional sto
Summary filename: M:\PROJECTS\DRAFT\08\089020 WATMP Phases 3 & 4\Water Resources\Dillon Models\VO2 modeling\SWM 100125\Future regional sto

DATE: 5/18/2010 TIME: 11:46:14 AM

USER:

COMMENTS: ____

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


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|   READ STORM    |    Filename: M:\PROJECTS\DRAFT\08\089020 WATMP
|                 |              Phases 3 & 4\Water Resources\Dillon Models\
|                 |              VO2 modeling\HAZEL.STM
| Ptotal=212.00 mm |    Comments: 12-Hour Hurricane Hazel
--------------------
               TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                .25    6.00 |  3.25   13.00 |  6.25   23.00 |  9.25   53.00
                .50    6.00 |  3.50   13.00 |  6.50   23.00 |  9.50   53.00
```

```
          .75    6.00 |  3.75   13.00 |  6.75   23.00 |  9.75   53.00
         1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
         1.25    4.00 |  4.25   17.00 |  7.25   13.00 | 10.25   38.00
         1.50    4.00 |  4.50   17.00 |  7.50   13.00 | 10.50   38.00
         1.75    4.00 |  4.75   17.00 |  7.75   13.00 | 10.75   38.00
         2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
         2.25    6.00 |  5.25   13.00 |  8.25   13.00 | 11.25   13.00
         2.50    6.00 |  5.50   13.00 |  8.50   13.00 | 11.50   13.00
         2.75    6.00 |  5.75   13.00 |  8.75   13.00 | 11.75   13.00
         3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00

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--------------------
| CALIB            |
| NASHYD    (0032) |   Area    (ha)=  37.86   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .56

    Unit Hyd Qpeak  (cms)=   2.582

    PEAK FLOW       (cms)=   4.738 (i)
    TIME TO PEAK    (hrs)=  10.250
    RUNOFF VOLUME    (mm)= 193.464
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .913

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

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0033) |   Area    (ha)=  14.82   Curve Number   (CN)= 95.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .46

    Unit Hyd Qpeak  (cms)=   1.236

    PEAK FLOW       (cms)=   1.939 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 193.394
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .912

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

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--------------------
| CALIB            |
| NASHYD    (0034) |   Area    (ha)=   4.19   Curve Number   (CN)= 93.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .58

    Unit Hyd Qpeak  (cms)=    .276

    PEAK FLOW       (cms)=    .516 (i)
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    TIME TO PEAK    (hrs)=  10.250
    RUNOFF VOLUME    (mm)= 190.316
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .898

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

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--------------------
| CALIB            |
| NASHYD    (0036) |   Area    (ha)=  18.28   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .72

    Unit Hyd Qpeak  (cms)=    .972

    PEAK FLOW       (cms)=   2.135 (i)
    TIME TO PEAK    (hrs)=  10.500
    RUNOFF VOLUME    (mm)= 193.763
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .914

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

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--------------------
| CALIB            |
| NASHYD    (0037) |   Area    (ha)=   7.36   Curve Number   (CN)= 93.9
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .947

    PEAK FLOW       (cms)=   1.028 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 186.577
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .880

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

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--------------------
| CALIB            |
| NASHYD    (0012) |   Area    (ha)=   5.03   Curve Number   (CN)= 94.8
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .24

    Unit Hyd Qpeak  (cms)=    .800

    PEAK FLOW       (cms)=    .691 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 182.964
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .863
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    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   1.12   Curve Number   (CN)= 97.5
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .19

    Unit Hyd Qpeak  (cms)=    .219

    PEAK FLOW       (cms)=    .146 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 178.328
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .841

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

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--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   2.21   Curve Number   (CN)= 96.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .18

    Unit Hyd Qpeak  (cms)=    .459

    PEAK FLOW       (cms)=    .280 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 170.591
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .805

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

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| ADD HYD   (0024) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0022):     1.12     .146    10.00   178.33
      + ID2= 2 (0023):     2.21     .280    10.00   170.59
        ==================================================
        ID = 3 (0024):     3.32     .426    10.00   173.19

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0027) |   Area    (ha)=  18.81   Curve Number   (CN)= 95.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .37
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    Unit Hyd Qpeak  (cms)=   1.947

    PEAK FLOW       (cms)=   2.597 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 192.074
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .906

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

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--------------------
| CALIB            |
| NASHYD    (0028) |   Area    (ha)=   3.86   Curve Number   (CN)= 96.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=   1.178

    PEAK FLOW       (cms)=    .357 (i)
    TIME TO PEAK    (hrs)=  10.000
    RUNOFF VOLUME    (mm)= 124.238
    TOTAL RAINFALL   (mm)= 212.000
    RUNOFF COEFFICIENT   =    .586

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

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 FINISH
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