



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers

## **MONTERRA PHASE II DEVELOPMENT**

### **Town of the Blue Mountains**

## **Stormwater Management Report**

prepared by:

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prepared for

Skyline Blue Mountain Development Inc.

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CCTA File 115185

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# 1 Introduction

C.C. Tatham & Associates Ltd. (CCTA) has been retained by Skyline Blue Mountain Development Inc. (Skyline) to prepare a Stormwater Management (SWM) Report in support of the proposed Monterra Phase II residential development in the Town of the Blue Mountains. Specifically, this report has been prepared to address internal and external servicing requirements related to stormwater management associated with this development.

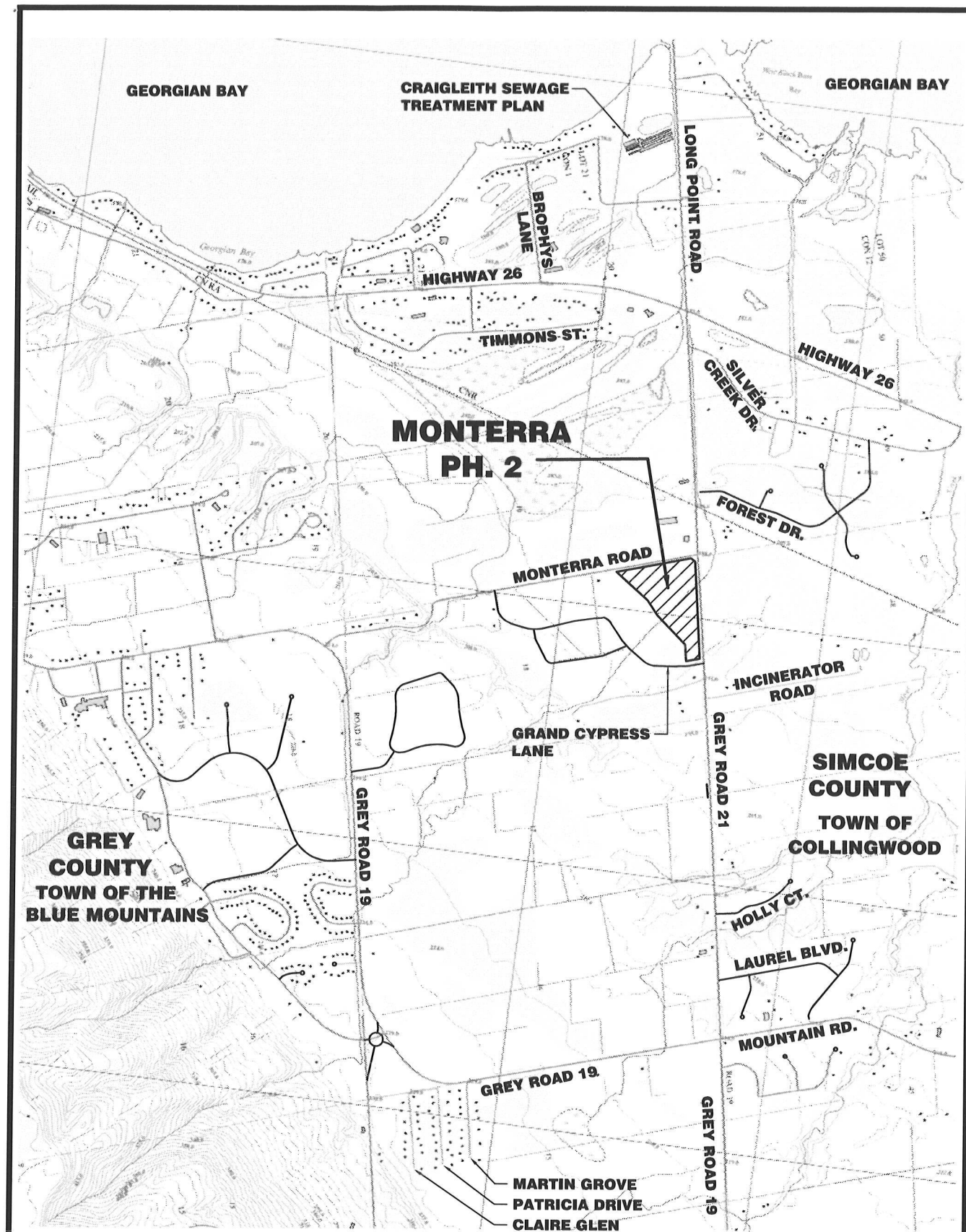
## 1.1 Site Description

The subject property consists of approximately 5.6 ha of undeveloped land located on the west side of Grey Road 21 (Osler Bluff Road) between Monterra Road and Grand Cypress Lane in the Town of the Blue Mountains. The property is part of the Craigleith-Camperdown Watershed 1 as identified in the Craigleith-Camperdown Subwatershed Study. The Monterra golf course borders the subject property along its southwest extent with Monterra Road bounding the property to the north and Grey Road 21 to the east. The property is legally described as Part Lot 18, Concession 1 (RP-16R8591 Part 1), Town of the Blue Mountains (formerly the Township of Collingwood), in the County of Grey. Figure 1 provided overleaf illustrates the location of the subject property.

The majority of the property is treed with an identified watercourse, known as Watercourse 1 in the Craigleith-Camperdown Subwatershed Study, bisecting the property. A letter report, the Monterra Phase 2 Natural Hazard Assessment, November 27, 2017, has been prepared to address the required flood hazard potential and development setbacks from Watercourse 1. The required setback is a 48 m corridor centred on the channel's centreline. It is included in Appendix A for reference.

## 1.2 Objectives

The primary objective of this report is to investigate the existing and future drainage conditions in the area of the site in order to develop a stormwater management plan that will minimize the impact of the development on the local drainage systems. In addition, this report has been prepared to demonstrate that the stormwater management plan for the development is in accordance with the applicable Municipal, Regional and Provincial guidelines.



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers

Collingwood Bracebridge Orillia Barrie

## MONTERRA PH. 2 SITE LOCATION PLAN

DWG. No.

# FIG. 1

SCALE: NTS

DATE: SEPT. 2017

JOB NO. 115185

### 1.3 Background and Guidelines

This report was prepared recognizing the pertinent Municipal and Provincial guidelines on water resources and the environment including the following publications:

- Stormwater Management Practices Planning and Design Manual. Ministry of the Environment (2003);
- Engineering Standards. Town of the Blue Mountains (April 2009);
- Craigleith-Camperdown Subwatershed Study. Gore and Storrie Limited (1993);
- Monterra Phase 2 Natural Hazards Assessment. C.C. Tatham & Associates Ltd. (January 12, 2016)

The Grey Sauble Conservation Authority (GSCA) regulation maps have been reviewed to determine if the subject property is located in a GSCA regulated area under Ontario Regulation 151/06. Review of regulation mapping showed that a large portion of the subject property is located in the GSCA regulated area. The hazard assessment letter from 2016 is included in Appendix A and addressed the hazard potential on site and set an appropriate development setbacks and flood elevations. To eliminate the possibility of flooding, the site will be raised above the flood elevation with no buildings to be located below an elevation of 188.15 m.

### 1.4 Proposed Land Use

The proposal for the site is to develop 32 single family residential lots serviced by two rural roadways ending in cul-de-sacs. One of these roads will be accessed from Grey Road 21 (Osler Bluff Road) and the other from Monterra Road. The rural road cross-section was deemed to be most appropriate for the site due to the short street lengths and will include roadside ditches to collect and convey stormwater runoff to the wetland storm ponds as seen on Drawing DP-2. Water service will be provided from the Town of the Blue Mountain's water distribution network, specifically the 200 mm diameter water main installed along Grand Cypress Road. Sanitary service will be provided by the 450 mm diameter gravity trunk sanitary sewer running north on Grey Road 21 to the Craigleith Sewage Treatment Plant. Utilities (hydro, gas, telephone and cable) will be designed by the respective utility provider's in the surrounding area.

## 2 Natural Hazard Assessment

A natural hazard assessment was completed for the subject lands and came to the following conclusions based on modeling done for the watercourse in and around the Monterra Phase II lands. It is included in Appendix A for reference purposes and summarized as follows:

### 2.1 Natural Hazard Assessment Findings

1. The main channel of Watercourse 1 through the golf course property has a capacity of approximately 1.8 m<sup>3</sup>/s. When the capacity of the channel is exceeded, stream flow spills north into the existing golf course pond adjacent to Watercourse 1, upstream of the site then northwest overland to Monterra Road. This spill is identified on Drawing HAZ-1 included with this report. We are aware that the Town of the Blue Mountains has observed this spill to Monterra Road in the past. At Monterra Road, the spill drains west to Watercourse 6 (as identified in the Craighleith Camperdown Subwatershed Study) through a driveway culvert and roadside ditch and then overtops Monterra Road at an elevation of 187.41 m when the capacity of the driveway culvert is exceeded.
2. The existing 800 mm × 1100 mm CSP arch culvert crossing Grey Road 21 does not have sufficient capacity to convey the 100 year and Regional (Timmins) peak flows downstream. The capacity of the culvert is approximately 1.8 m<sup>3</sup>/s. As such, the culvert has a similar capacity to the existing channel across the golf course property.
3. When the capacity of the existing 800 mm × 1100 mm CSP arch culvert crossing Grey Road 21 is exceeded, stream flow will backup and spill north to Monterra Road. The spill north occurs at an elevation of approximately 187.58 m. At an elevation of 187.82 m, the spill north across the golf course property has been calculated to exceed the Regional (Timmins) peak flow of 20.7 m<sup>3</sup>/s. As such, the flood elevation for the site has been determined to be 187.85 m.
4. The twin CSP culverts under the golf cart path upstream of the site are known to have less capacity than the Grey Road 21 culvert crossing. When the capacity of the cart path crossing is exceeded, stream flow spills northwest into an existing drainage swale cut along the rear of the properties on Grand Cyprus Lane. The drainage swale eventually drains to Watercourse 6 and thus increases the quantity of the spill away from Watercourse 1 under existing conditions.
5. No flood flows are currently conveyed through the site as they either spill out before or utilize the roadside ditch system. When flows overtop Monterra Road they can backwater and pond in small areas on the property.
6. The reach of the Watercourse 1 through the subject property is defined as an unconfined watercourse. As per the MNRF River and Stream Systems Erosion Hazard Technical Guide, the erosion hazard limit is defined as the sum of the meander belt allowance and erosion access allowance. The meander belt allowance and erosion hazard allowance are defined as follows:

- Meander belt allowance – 20 times the bankfull width centred on the meander belt axis, where the meander belt axis is defined as the channel centreline as the channel has essentially no bends or meanders through the site. The measured bankfull width of the channel is 1.8 m resulting in a meander belt allowance of 36 m centered on the channel.
- Erosion access allowance – 6 m unless determine otherwise through additional study. In the absence of additional study, the erosion access allowance has been determined to be 6 m and is applied to both sides of the watercourse.
- Erosion Hazard Limit – the sum of the meander belt allowance and erosion access allowance. The erosion hazard limit is 48 m centered on the channel centerline.

## 2.2 Natural Hazard Assessment Recommendations

From the results of the flood and erosion hazard assessment, the allowable development limits for the property have been established. As illustrated, approximately 5.0 ha of land is available for development outside the erosion hazard limit. As flooding on-site has been identified as primarily backwater and a spill and as such development would be considered acceptable provided properties and homes are adequately flood proofed. As such, the properties should be graded to be above the Regional (Timmins) flood level established for the site (187.85 m) and the lowest openings of the homes should be set a minimum of 0.30 m higher. In addition, we recommend the following for Monterra Phase 2:

1. Additional watercourse crossings to facilitate development are not recommended and cul-de-sacs entering off Grey Road 21 and Monterra Road are recommended to service the two parcels of land separated by Watercourse 1.
2. The existing drainage channel from the golf course pond should be maintained.
3. Grading should be restricted to the area outside the meander belt allowance. It is recommended that minor grading works be allowed within the erosion access allowance to clearly delineate the floodplain on-site and provide the requisite access to the floodplain as per Provincial Policy.

## 3 Existing Drainage Conditions

### 3.1 Background

Existing site topography, ground cover, land use and drainage patterns on-site were established through site visitation, interpretation of the available topographic maps, aerial photography and a site survey. A Pre-Development Drainage Plan (Drawing DP-1) illustrating the existing drainage conditions is enclosed and should be referenced when reviewing the following sections.

The subject property is located in Watershed 1 as identified in the Craigleith-Camperdown Subwatershed Study and drains overland to Watercourse 1 and ultimately Georgian Bay. Watercourse 1 originates on the ski hills of Blue Mountain Resort and drains northeast to the subject property. Immediately upstream of Monterra Phase 2, Watercourse 1 drains under Grand Cyprus Lane via a 4500 mm wide concrete span culvert and then as an open channel across the Monterra Golf Course. On the Golf Course, a cart path complete with twin 580 mm x 800 mm CSPA culverts crosses Watercourse 1 along with a wooden foot bridge. Also, an existing overflow outlet channel from a golf course pond runs alongside Watercourse 1 on the property for 100 m before draining into Watercourse 1. It is noted that no outflow from the pond was found draining into the existing channel at the time of this study.

Through the subject lands, the channel is straight with essentially no bends or meanders and a 1.8 m bankfull width. Watercourse 1 drains northeast across the subject lands to Grey Road 21 (Osler Bluff Road) and an 800 mm x 1100 mm CSP arch culvert (equivalent 900 mm diameter CSP) conveys flow under the road downstream. At Grey Road 21, the watershed draining to Watercourse 1 totals approximately 226 ha of mixed use lands that include ski hill, residential, and undeveloped land.

Downstream of Grey Road 21, the watercourse runs alongside the roadway toward Highway 26. Upstream of Highway 26, Watercourse 1 drains north under Silver Creek Drive (twin 1200 mm diameter CSP culverts) and then west under Grey Road 21 (800 mm x 4100 mm concrete box culvert). Watercourse 1 then drains north under Highway 26 (1520 mm x 3660 mm concrete box culvert) and east under Long Point Road (1050 mm x 1350 mm CSP arch and 1170 mm x 1500 mm CSP arch culverts) before draining into Georgian Bay.

### 3.2 Subject Site Drainage Outlets

Two separate drainage outlets have been identified on-site and are described as follows:

1. **Watercourse 1 Outlet** - A portion of the property northwest as well as the entire portion of the property southeast of Watercourse 1 drain to Watercourse 1 exiting the site through a culvert under Grey Road 2. These areas correspond to drainage catchments 101 and 102 respectively and can be seen on the attached pre development drainage plan drawing DP-1.

2. **Monterra Road Roadside Ditch Outlet** - The northern most section of the property northwest of Watercourse 1 is a flat area that drains north-west towards Monterra Road. This area corresponds to catchment 103 in the attached pre development drainage plan DP-1.

To quantify pre-development flows to the two site outlets, a hydrologic model was generated using VisualOTTHYMO. The schematic and output file is included in Appendix B and the results are summarized in the following table:

**Table 1: Pre-Development Hydrologic Analysis Results Summary**

| Storm Event        | Peak Flow Rates (cms) |                              |                  |                              |
|--------------------|-----------------------|------------------------------|------------------|------------------------------|
|                    | Chicago Design Storm  |                              | SCS Design Storm |                              |
|                    | Watercourse 1         | Monterra Road Roadside Ditch | Watercourse 1    | Monterra Road Roadside Ditch |
| 25 mm              | 0.007                 | 0.005                        | -                | -                            |
| 2 Year             | 0.018                 | 0.012                        | 0.028            | 0.020                        |
| 5 Year             | 0.036                 | 0.026                        | 0.049            | 0.036                        |
| 10 Year            | 0.051                 | 0.037                        | 0.067            | 0.048                        |
| 25 Year            | 0.073                 | 0.053                        | 0.090            | 0.065                        |
| 50 Year            | 0.093                 | 0.067                        | 0.110            | 0.079                        |
| 100 Year           | 0.113                 | 0.081                        | 0.130            | 0.093                        |
| Regional (Timmins) | 0.186                 | 0.121                        | -                | -                            |



## 4 Stormwater Management Plan

The stormwater management plan developed for the subject development is in accordance with the criteria set forth in the MOE Stormwater Management Planning and Design Manual and the Town of the Blue Mountains Engineering Standards. The stormwater management plan has been designed in accordance with the SWM criteria established for the site and presented in the following sections.

### 4.1 Design Criteria

Based on the information gathered on-site, the background information collected and our analysis of this information, a clear understanding of the issues was gained. In summary, the following issues are to be addressed in the proposed stormwater management plan:

- The stormwater management plan must maintain existing stormwater runoff rates to Watercourse 1 and the Monterra Road roadside ditch by restricting post development peak flow rates to pre-development levels for the 2 through 100 year design storms;
- The stormwater management plan must achieve the required Level 1 “Enhanced” water quality treatment to Provincial standards in the form of 80% total suspended solids (TSS) removal for the site effluent as Georgian Bay receives runoff from the site and it is a cold water fishery.

### 4.2 Proposed Drainage Conditions

The proposed grading and servicing design of the development has been completed to maintain existing drainage conditions at the existing two site outlets. The proposed drainage conditions to the outlets are described as follows. A Post Development Drainage Plan (Drawing DP-2) illustrating the proposed drainage conditions is enclosed and should be referenced when reviewing the following sections.

1. **Watercourse 1 Outlet** – Drainage catchment 201, located north of Watercourse 1, will drain via roadside ditch to a wetland SWMF located in the northeast corner of the property. Catchment 202, located south of Watercourse 1, will drain via roadside ditch to a wetland SWMF abutting Grey Road 21. Both of these SWMF’s will outlet to the roadside ditch along Grey Road 21 which drains to Watercourse 1. Drainage catchments 204 and 205 will both drain by swale directly to Watercourse 1.
2. **Monterra Road Roadside Ditch Outlet** – Drainage catchment 203 will drain via roadside ditch to the Monterra Road roadside ditch which drains west away from the subject lands.

### 4.3 Water Quantity

As discussed, the pre-development flows to Watercourse 1 must be maintained under proposed conditions by restricting post development peak flow rates to pre-development levels for the 2 through

100 year design storms. This will be achieved on-site by storing the surface water runoff within the proposed SWMF's and releasing it off-site at attenuated rates via controlled outlets. The water quantity controls proposed to restrict post development peak flow rates to pre-development levels are describe next.

#### **4.3.1 North Wetland SWMF**

This SWMF has been designed as a wetland and sized to provide the requisite water quantity control to limit discharges to Watercourse 1 to pre-development levels. The North Wetland SWMF has been designed with approximately 775 m<sup>3</sup> of active storage, including approximately 302 m<sup>3</sup> of extended detention storage. Discharge from the SWMF will be controlled by a series of engineered outlets described as follows:

- A primary low flow outlet consisting of a perforated vertical riser, a 150 mm reverse grade pipe and 60 mm orifice plate controlling the discharge from frequent storm events to Watercourse 1;
- A secondary high flow outlet consisting of a DICB and 200 mm diameter outlet pipe controlling the discharge from less frequent storm events (greater than the 2 year storm event) to the Watercourse 1; and
- A 3 m wide emergency spillway with sufficient capacity to convey the uncontrolled pond inflow to Watercourse 1 during the Regional (Timmins) storm event and/or during emergency conditions.

#### **4.3.2 East Wetland SWMF**

This SWMF has also been designed as a wetland and sized to provide the requisite water quantity control to limit discharges to Watercourse 1 to pre-development levels. The East Wetland SWMF has been designed with approximately 703 m<sup>3</sup> of active storage, all of which is extended detention storage. Discharge from the SWMF will be controlled by two of engineered outlets described as follows:

- A primary low flow outlet consisting of a perforated vertical riser, a 150 mm reverse grade pipe and 60 mm orifice plate controlling the discharge from frequent storm events to Watercourse 1; and
- A 2 m wide emergency spillway with sufficient capacity to convey the uncontrolled pond inflow to Watercourse 1 during the Regional (Timmins) storm event and/or during emergency conditions.

#### **4.3.3 Post Development Hydrologic Analysis**

To quantify the post development flows to the noted drainage outlets under proposed conditions, a hydrologic analysis was completed using Visual OTTHYMO. The catchment area delineation and hydrologic model input parameters utilized in the model are illustrated on the Post Development Drainage Plan (Drawing DP-2) enclosed. The proposed SWMF's were included in the model to

simulate the attenuation provided and confirm adequate storage volume is provided to attenuate flow. The hydrologic model results are included in Appendix B and summarized in the following table.

Table 2: Post-Development Hydrologic Analysis Results Summary

| Storm Event        | Peak Flow Rates (cms) |                              |                  |                              |
|--------------------|-----------------------|------------------------------|------------------|------------------------------|
|                    | Chicago Design Storm  |                              | SCS Design Storm |                              |
|                    | Watercourse 1         | Monterra Road Roadside Ditch | Watercourse 1    | Monterra Road Roadside Ditch |
| 25 mm              | 0.008<br>(0.007)      | 0.008<br>(0.005)             | -                | -                            |
| 2 Year             | 0.014<br>(0.018)      | 0.017<br>(0.012)             | 0.018<br>(0.028) | 0.022<br>(0.020)             |
| 5 Year             | 0.029<br>(0.036)      | 0.032<br>(0.026)             | 0.046<br>(0.049) | 0.035<br>(0.036)             |
| 10 Year            | 0.051<br>(0.051)      | 0.042<br>(0.037)             | 0.069<br>(0.067) | 0.052<br>(0.048)             |
| 25 Year            | 0.081<br>(0.073)      | 0.063<br>(0.053)             | 0.094<br>(0.090) | 0.067<br>(0.065)             |
| 50 Year            | 0.099<br>(0.093)      | 0.076<br>(0.067)             | 0.104<br>(0.110) | 0.079<br>(0.079)             |
| 100 Year           | 0.108<br>(0.113)      | 0.091<br>(0.081)             | 0.115<br>(0.130) | 0.091<br>(0.093)             |
| Regional (Timmins) | 0.300<br>(0.186)      | 0.050<br>(0.121)             | -                | -                            |

Comparison of the post and pre-development flow summaries confirms that the two proposed SWMF's analyzed will attenuate the 2 year through 100 year post development flows to Watercourse 1 to levels at or below existing levels. As mentioned, the proposed SWMF's were included in the model to

simulate the attenuation provided and confirm adequate storage volume is provided. The model results confirm the proposed SWMF's as designed provide the requisite water quantity attenuation and storage volumes for the development. The stage-storage-discharge tables for each SWMF are provided in Appendix C and the model results for each SWMF are provided in the following tables:

Table 3: North Wetland SWMF Summary

| Storm Event              | Stage (m) |        | Storage (m <sup>3</sup> ) |     | Discharge (m <sup>3</sup> /s) |       |
|--------------------------|-----------|--------|---------------------------|-----|-------------------------------|-------|
|                          | CHI       | SCS    | CHI                       | SCS | CHI                           | SCS   |
| 25 mm Storm              | 187.62    | -      | 190                       | -   | 0.003                         | -     |
| 2 Year                   | 187.70    | 187.73 | 301                       | 344 | 0.004                         | 0.011 |
| 5 Year                   | 187.76    | 187.78 | 387                       | 427 | 0.020                         | 0.032 |
| 10 Year                  | 187.79    | 187.82 | 440                       | 486 | 0.035                         | 0.048 |
| 25 Year                  | 187.84    | 187.87 | 515                       | 570 | 0.056                         | 0.062 |
| 50 Year                  | 187.88    | 187.92 | 586                       | 648 | 0.063                         | 0.065 |
| 100 Year                 | 187.93    | 187.97 | 663                       | 733 | 0.066                         | 0.069 |
| Regional (Timmins) Storm | 188.07    | -      | 899                       | -   | 0.172                         | -     |

*Note: CHI – Chicago 4 Hour Design Storm; SCS – SCS Type II 24 Hour Design Storm*

Table 4: East Wetland SWMF Summary

| Storm Event              | Elevation (m) |        | Storage (m³) |     | Discharge (m³/s) |       |
|--------------------------|---------------|--------|--------------|-----|------------------|-------|
|                          | CHI           | SCS    | CHI          | SCS | CHI              | SCS   |
| 25 mm Storm              | 187.50        | -      | 100          | -   | 0.002            | -     |
| 2 Year                   | 187.55        | 187.59 | 162          | 205 | 0.003            | 0.003 |
| 5 Year                   | 187.62        | 187.66 | 244          | 298 | 0.003            | 0.004 |
| 10 Year                  | 187.66        | 187.71 | 300          | 364 | 0.004            | 0.004 |
| 25 Year                  | 187.72        | 187.77 | 376          | 450 | 0.004            | 0.005 |
| 50 Year                  | 187.76        | 187.81 | 437          | 516 | 0.005            | 0.005 |
| 100 Year                 | 187.80        | 187.85 | 495          | 583 | 0.005            | 0.005 |
| Regional (Timmins) Storm | 187.98        | -      | 792          | -   | 0.084            | -     |

*Note: CHI – Chicago 4 Hour Design Storm; SCS – SCS Type II 24 Hour Design Storm*

#### 4.4 Water Quality Control

As previously discussed, Level 1 “Enhanced” water quality treatment in the form of 80% total suspended solids (TSS) removal is required for the development. The proposed permanent North and East Wetland SWMF’s will provide the requisite water quality treatment for Monterra Phase II lands.

Under proposed conditions, approximately 1.9 ha will drain to the North Wetland SWMF. The imperviousness of the catchment area has been calculated to be 43%. For Level 1 water quality treatment, the required permanent pool and extended detention volumes are 96 m³ and 77 m³ respectively. The design permanent pool and extended detention volumes are approximately 128 m³ and 302 m³, respectively, and exceed the requirements. Also, the SWMF 25 mm design storm drawdown time is approximately 37 hours, exceeding the required 24 hours.

Approximately 1.1 ha will drain to the proposed East Wetland SWMF. The imperviousness of the catchment area has been calculated to be 39%. For Level 1 water quality treatment, the required permanent pool and extended detention volumes are 51 m³ and 45 m³ respectively. The design permanent pool and extended detention volumes are approximately 125 m³ and 703 m³, respectively, and exceed the requirements. The SWMF 25 mm design storm drawdown time is approximately 25 hours, exceeding the recommended 24 hours.

The sizing of the SWMF's also considered the erosion control requirements for the receiving watercourse. The simplified approach was used to determine the erosion control storage volume requirements for each SWMF. For the simplified approach, the North Wetland SWMF and the East Wetland SWMF require 212 m<sup>3</sup> and 125 m<sup>3</sup> of extended detention storage for erosion control, respectively. As previously discussed, the design extended detention storage volumes for the West Wetland SWMF and the temporary wet pond SWMF are 302 m<sup>3</sup> and 703 m<sup>3</sup>, respectively. As such, the proposed SWMF provide the requisite level of erosion control for Phase 1 of development.

Drainage catchments 204 and 205 constitute primarily rear lots and will be directed directly to Watercourse 1. As these catchments are considered clean water and are being routed to Watercourse 1 by grassed swale, no quality treatment is required.

Water quality and erosion control calculations demonstrating the level of treatment provided within the proposed SWMF's are enclosed in Appendix D for reference.

## 5 Siltation and Erosion Control

Siltation and erosion control will be implemented for all construction activities within the development site, including vegetation clearing, topsoil stripping, road construction and stockpiling of materials. The basic principles considered to minimize erosion and sedimentation and resultant negative environmental impacts include:

- Minimize disturbance activities where possible;
- Expose the smallest possible land area to erosion for the shortest possible time;
- Institute erosion control measures as-required immediately;
- Implement sediment control measures before the outset of construction activities; and
- Carry out regular inspections of erosion/sediment control measures and repair or maintain as necessary.

Detailed siltation and erosion control measures will be implemented during and after construction and will include the following:

- Heavy duty silt fences will be erected around the perimeter of the site before any grading operations commence to control sediment movement sites;
- A construction vehicle entrance will be constructed and maintained consisting of a stone mud mat to reduce off-site tracking of materials;
- Straw bale flow check dams will be installed in the on-site and off-site swales and ditches to prevent the movement of sediment downstream to Watercourse 1; and
- Straw bale flow check dams will be installed downstream of the proposed storm outlets to prevent the movement of sediment downstream to Watercourse 1.

## 6 Conclusions

The proposed Stormwater Management Plan demonstrates that the development will meet the established criteria with respect to stormwater management set forth in the governing documents and can proceed without negatively impacting the local drainage systems and Watercourse 1. Level 1 'Enhanced' water quality control in the form of 80% TSS removal will be provided by the proposed Wetland SWMF's. Water quantity control in the form of post to pre-development peak flow matching will be provided by the Wetland SWMF's and their controlled outlets. External drainage will continue to drain through the site to the appropriate outlets and siltation and erosion control measures will be implemented during and after construction to prevent the transport of deleterious materials downstream.

In conclusion, the proposed stormwater management plan supports the concept of an environmentally sustainable development. The proposed plan will mitigate anticipated stormwater impacts associated with the development of the proposed commercial and residential subdivision.



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## **Appendix A: Natural Hazard Letter**



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November 27, 2017

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CCTA File 115185

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Senior Vice President, Development

Skyline Investments

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**Re: Monterra Phase 2, Town of The Blue Mountains  
Natural Hazards Assessment**

Dear Paul:

We have completed our assessment of the natural hazards (flooding and erosion) across the Monterra Phase 2 lands, specifically Lot 18, Concession 1 (RP 16R8591 Part 1), Town of The Blue Mountains. The flooding and erosion hazards are associated with the watercourse that traverses the site that has been identified as Watercourse 1 in the Craigleith Camperdown Subwatershed Study. The watercourse is further defined in the following sections.

### **Background**

Watercourse 1 originates on the ski hills of Blue Mountain Resort and drains northeast to the subject property. Immediately upstream of Monterra Phase 2, Watercourse 1 drains under Grand Cyprus Lane via a 4500 mm wide concrete span culvert and then as an open channel across the Monterra Golf Course. On the Golf Course, a cart path complete with twin 580 mm x 800 mm CSPA culverts crosses Watercourse 1 along with a wooden foot bridge. Also, an existing overflow outlet channel from a golf course pond runs alongside Watercourse 1 on the property for 100 m before draining into Watercourse 1. It is noted that no outflow from the pond was found draining into the existing channel at the time of our site investigations.

Through the subject lands, the channel is straight with essentially no bends or meanders and a 1.8 m bankfull width. Watercourse 1 drains northeast across the subject lands to Grey Road 21 (Osler Bluff Road) and an 800 mm x 1100 mm CSP arch culvert (equivalent 900 mm diameter CSP) conveys flow under the road downstream. At Grey Road 21, the watershed draining to Watercourse 1 totals approximately 226 ha of mixed use lands that include ski hill, residential, and undeveloped land.

Downstream of Grey Road 21, the watercourse runs alongside the roadway toward Highway 26. Upstream of Highway 26, Watercourse 1 drains north under Silver Creek Drive (twin 1200 mm diameter CSP culverts) and then west under Grey Road 21 (800 mm × 4100 mm concrete box culvert). Watercourse 1 then drains north under Highway 26 (1520 mm × 3660 mm concrete box culvert) and east under Long Point Road (1050 mm × 1350 mm CSP arch and 1170 mm × 1500 mm CSP arch culverts) before draining into Georgian Bay.

As part of our assessment, a topographic survey of the site and watercourse through the subject property was completed to accurately define the channel shape and the topography of its overbanks. The 800 mm × 1100 mm CSP arch culvert crossing of Grey Road 21 immediately downstream of the site was also surveyed to determine its impact on flooding in the area. The centerline road elevations along Grey Road 21 and Monterra Road were also surveyed to establish the low point at which flood flow will first overtop the roadways, if applicable.

The available background documents were reviewed to establish the 100 year design storm and Regional (Timmins) peak flow for Watercourse 1. Specifically, The Craigleith Camperdown Subwatershed Study and Second Nature Development Final Stormwater Management Report (C.C. Tatham & Associates Ltd., October 2007) were reviewed. The peaks flows are summarized in the following table:

Table 1: Watercourse 1 Peak Flow Summary

| Study                                      | Peak Flow (m <sup>3</sup> /s) |                    |
|--------------------------------------------|-------------------------------|--------------------|
|                                            | 100 Year                      | Regional (Timmins) |
| Craigleith Camperdown Subwatershed Study   | 8.7 <sup>1</sup>              | -                  |
| Second Nature Development Final SWM Report | 16.2                          | 20.7               |

Note: 1 – Calculated from flow equation expressed in terms of drainage area (ha) – Flow Proration

The peak flows for the 100 year design storm established in the background reports differ significantly. The 100 year flow calculated using the empirical equation (flow proration) established in the Craigleith Camperdown Subwatershed Study is approximately 50% of the peak flow modelled in the Second Nature Development Final SWM Report. The flow proration methodology established for the estimation of peak flow in the Subwatershed Study is a procedure for use in ungauged and un-modelled watersheds. As such, the peak flows established from the Second Nature Development Final SWM Report which we expect to be conservative were used in this analysis.

## Flood Analysis

A site specific topographic survey and the peak flow data was used to generate a HEC RAS hydraulic model of the watercourse through the subject property. The hydraulic model was created to establish

the 1:100 year and Regulatory flood levels across the site and consequently the flood hazard limit. The results of the HEC RAS hydraulic model for the Regional (Timmins) storm event are summarized as follows:

1. Watercourse 1 through the golf course property has a capacity of approximately 1.8 m<sup>3</sup>/s. When the capacity of the channel is exceeded, stream flow spills north into the existing golf course pond adjacent to Watercourse 1, upstream of the site then northwest overland to Monterra Road. This spill is identified on Drawing HAZ-1 included with this report. We are aware that the Town of the Blue Mountains has observed this spill to Monterra Road in the past. At Monterra Road, the spill drains west to Watercourse 6 (as identified in the Craigleith Camperdown Subwatershed Study) through a driveway culvert and roadside ditch and then can overtop Monterra Road at an elevation of 187.41 m when the capacity of the driveway culvert is exceeded. In the past this driveway culvert has experienced washouts.
2. The existing 800 mm × 1100 mm CSP arch culvert crossing Grey Road 21 does not have sufficient capacity to convey the 100 year and Regional (Timmins) peak flows downstream. The capacity of the culvert is approximately 1.8 m<sup>3</sup>/s. As such, the culvert has a similar capacity to the existing channel across the golf course property.
3. When the capacity of the existing 800 mm × 1100 mm CSP arch culvert crossing Grey Road 21 is exceeded, stream flow will backup and spill north to Monterra Road. The spill north occurs at an elevation of approximately 187.58 m. At an elevation of 187.82 m, the spill north across the golf course property has been calculated to be 14.9 m<sup>3</sup>/s. At an elevation of 187.85 m, the spill north across the golf course property has been calculated to exceed the Regional (Timmins) storm peak flow of 20.7 m<sup>3</sup>/s. As such, the flood elevation for the site has been determined to be 187.85 m.
4. The twin CSP culverts under the golf cart path upstream of the site are known to have less capacity than the Grey Road 21 culvert crossing. When the capacity of the cart path crossing is exceeded, stream flow spills northwest into an existing drainage swale cut along the rear of the properties on Grand Cyprus Lane at a peak flow rate of 4.1 m<sup>3</sup>/s. This drainage swale eventually drains to Watercourse 6 and thus would increase the quantity of the spill from Watercourse 1 into Watercourse 6.
5. No flood flows are conveyed through the site as they either spill out before or utilize the roadside ditch system. When flows overtop Monterra Road they can backwater and pond in areas on the subject property.

The existing drainage features and locations of the existing spills are located on the Natural Hazards Plan (Drawing HAZ-1) enclosed.

To demonstrate that the proposed development will not adversely impact flood conveyance and levels, the existing conditions HEC RAS model has been updated to include the proposed site grading. The results of the proposed conditions are summarized as follows:

- 1) Watercourse #1 continues to convey 1.8 m<sup>3</sup>/s thorough the subject property.
- 2) 14.9 m<sup>3</sup>/s continues to spill north across the golf course.

- 3) 4.1 m<sup>3</sup>/s continues to spill northwest into the existing drainage swale.
- 4) The flows in Watercourse #1 downstream of the subject property and the flows directed to Watercourse #6 remain the same on existing and proposed conditions.
- 5) The water levels upstream, downstream and through the site remain the same under existing and proposed conditions.

The results of the proposed conditions HEC RAS hydraulic analysis demonstrate that the proposed development will not adversely impact flooding in the area. The existing flows downstream of the site and spills to Watercourse #6 will be maintained. As such, the existing flooding downstream along Watercourse #1 and #6 will not be exacerbated by development of the subject property.

### **Proposed Watercourse Setbacks**

The reach of the Watercourse #1 through the subject property is defined as an unconfined watercourse. As per the MNRF River and Stream Systems Erosion Hazard Technical Guide, the erosion hazard limit is defined as the sum of the meander belt allowance and erosion access allowance. The meander belt allowance and erosion hazard allowance are defined as follows:

- Meander belt allowance – 20 times the bankfull width centred on the meander belt axis, where the meander belt axis is defined as the channel centreline as the channel has essentially no bends or meanders through the site. The measured bankfull width of the channel is 1.8 m resulting in a meander belt allowance of 36 m centered on the channel.
- Erosion access allowance – 6 m unless determine otherwise through additional study. In the absence of additional study, the erosion access allowance has been determined to be 6 m and is applied to both sides of the watercourse.
- Erosion Hazard Limit – the sum of the meander belt allowance and erosion access allowance. The erosion hazard limit is 48 m centered on the channel centerline.

The erosion hazard limit is illustrated on the Natural Hazards Plan (Drawing HAZ-1) enclosed.

### **Summary**

From the results of the flood and erosion hazard assessment completed, the allowable development limits for the property have been established. A development concept is illustrated on the Natural Hazards Plan (Drawing HAZ-1) enclosed. As illustrated, approximately 5.0 ha of land is available for development outside the erosion hazard limit. As flooding on-site has been identified as primarily backwater and a spill, development would be considered acceptable provided properties and homes are adequately flood proofed. As such, the properties should be graded to be above the Regional (Timmins) flood level established for the site (187.85 m) and the lowest openings of the homes should be set a minimum of 0.30 m higher. In addition, we recommend the following for Monterra Phase 2:

1. Additional watercourse crossings to facilitate development are not recommended and cul-de-sacs entering off Grey Road 21 and Monterra Road are recommended to service the two parcels of land separated by Watercourse 1.
2. The existing drainage channel from the golf course pond should be maintained.
3. Grading should be restricted to the area outside the meander belt allowance. It is recommended that minor grading works be allowed within the erosion access allowance to clearly delineate the floodplain on-site and provide the requisite access to the floodplain as per Provincial Policy.

We trust this assessment of the natural hazards (flooding and erosion) across Monterra Phase 2 property provides the information required to advance discussions regarding the development of the site. In the meantime, if you have any questions or require further information please do not hesitate to contact the undersigned.

Yours truly,  
C.C. Tatham & Associates Ltd.



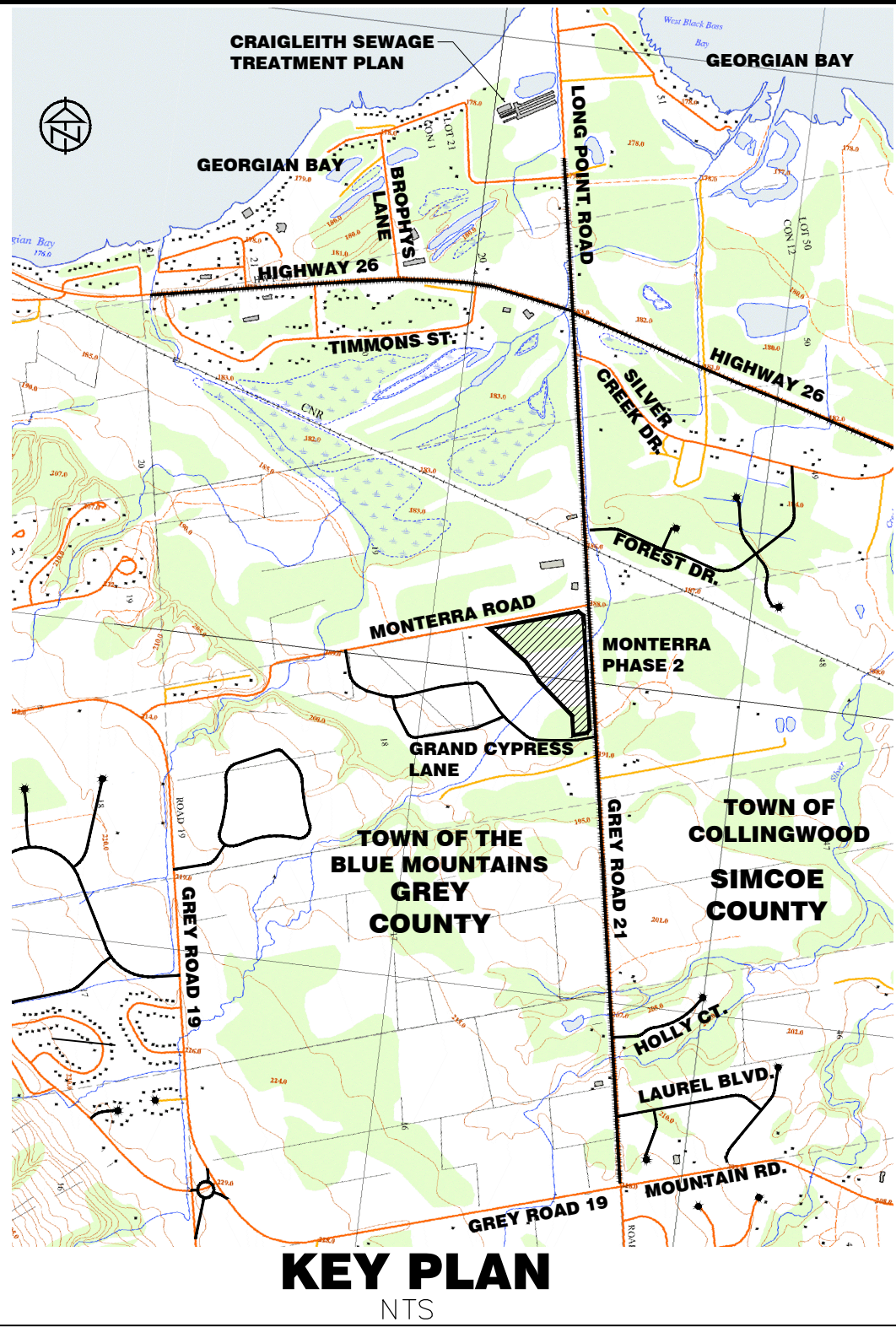
Daniel Twigger, B.Sc.Eng., P.Eng.  
Intermediate Engineer, Project Manager  
DRT:rlh  
Encl.



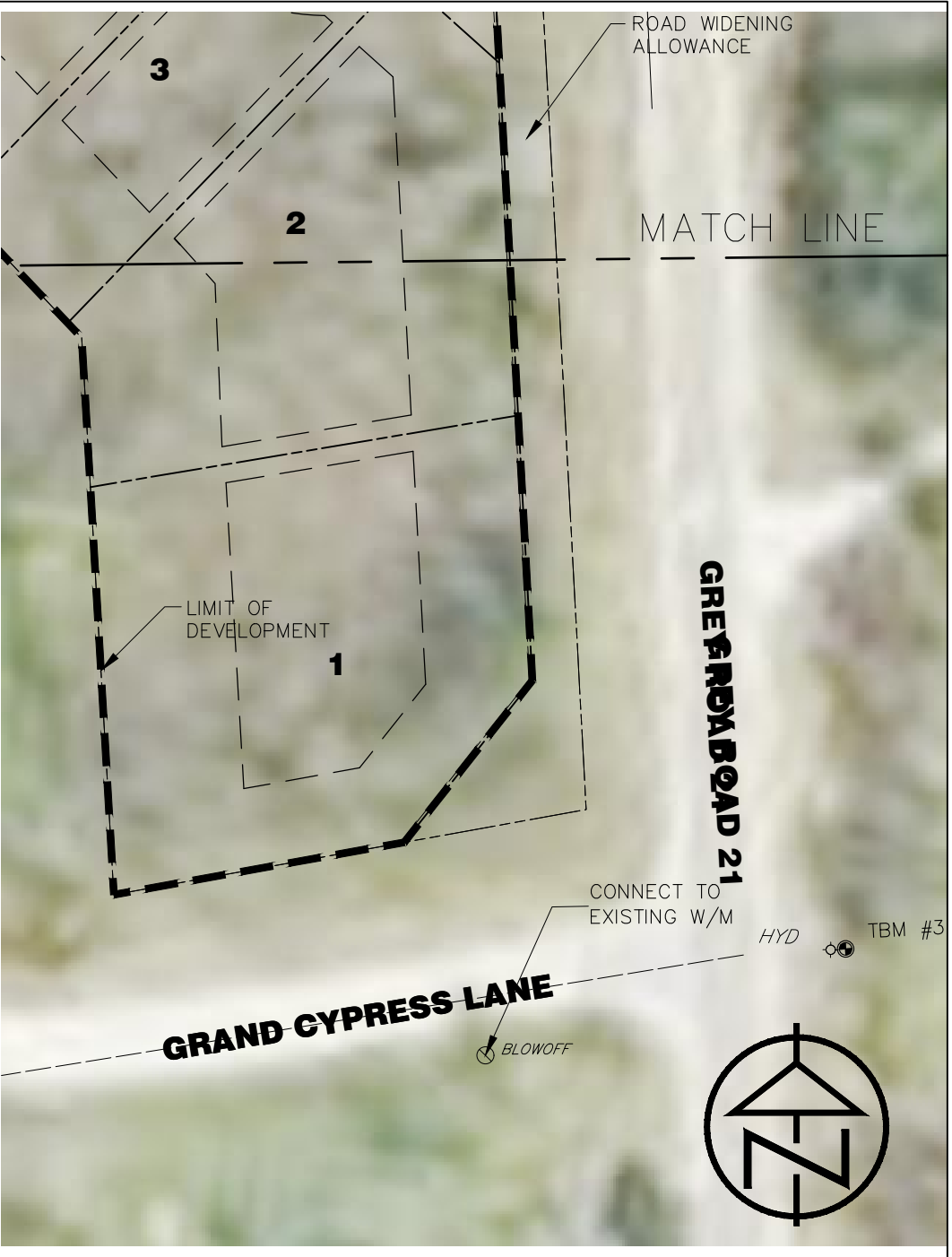
Dan Hurley, B.A.Sc., P.Eng., LEED AP  
Vice President,  
Manager – Water Resources Engineering

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| LEGEND                 |     |
|------------------------|-----|
| LIMIT OF DEVELOPMENT   | --- |
| EROSION HAZARD LIMIT   | --- |
| MEANDER BELT ALLOWANCE | --- |
| EX. PROPERTY LINE      | --- |
| CONCEPTUAL LOT LINE    | --- |
| CONCEPTUAL LOT NUMBER  | 24  |



CONTRACT DRAWINGS  
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.  
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TBM #1 - ELEVATION 189.260m  
TOP OPERATING NUT OF FIRE HYDRANT # A51 AT THE SOUTH EAST CORNER OF GREY ROAD 21 AND MONTERRA ROAD.  
TBM #2 - ELEVATION 187.920m  
NAIL AND WASHER IN HYDRO POLE 170m± SOUTH OF MONTERRA ROAD, ON EAST SIDE OF GREY ROAD 21.  
TBM #3 - ELEVATION 191.303m  
TOP OPERATING NUT OF FIRE HYDRANT AT THE SOUTH EAST CORNER OF ROAD 21 AND GRAND CYPRESS LANE.

|     |           |      |         |  |
|-----|-----------|------|---------|--|
|     |           |      |         |  |
|     |           |      |         |  |
|     |           |      |         |  |
|     |           |      |         |  |
|     |           |      |         |  |
| NO. | REVISIONS | DATE | INITIAL |  |

APPROVED

MONTERRA PHASE 2  
TOWN OF THE BLUE MOUNTAINS  
NATURAL HAZARD PLAN



C.C. Tatham & Associates Ltd.  
Consulting Engineers

|             |             |         |        |
|-------------|-------------|---------|--------|
| Collingwood | Bracebridge | Orillia | Barrie |
|-------------|-------------|---------|--------|

SCALE: 1:750  
DESIGN: DRT  
DRAWN: DEP

CHECKED: DRT  
DATE: DEC./15

JOB NO. 115185  
DWG. HAZ-1



## **Appendix B: Existing Conditions Hydrologic Analysis**



Existing Conditions OTTHYMO Model Schematic



103



101



102



901





|             |             |         |        |
|-------------|-------------|---------|--------|
| Collingwood | Bracebridge | Orillia | Barrie |
|-------------|-------------|---------|--------|

Bracebridge

Barrie

|                     |                                                               |
|---------------------|---------------------------------------------------------------|
| <b>Project:</b>     | Monterra Phase II                                             |
| <b>File No.:</b>    | 115185                                                        |
| <b>Date:</b>        | September 8, 2017                                             |
| <b>Designed By:</b> | AO                                                            |
| <b>Checked By:</b>  |                                                               |
| <b>Subject:</b>     | CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS |

## EXISTING CONDITIONS

Catchment 101

Area 1.29 ha

**CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS**

| Soil Series | Soil Series | Hydrologic Soil Group | Soil Texture | Runoff Coefficient Type | WEIGHTED CN VALUE              |         |                 |         |               |      |         |      |            |         |            |      |                   |      |                          |  |  |  |
|-------------|-------------|-----------------------|--------------|-------------------------|--------------------------------|---------|-----------------|---------|---------------|------|---------|------|------------|---------|------------|------|-------------------|------|--------------------------|--|--|--|
|             |             |                       |              |                         | Catchment Soil Characteristics |         | Forest/Woodland |         | Pasture/Lawns |      | Meadows |      | Cultivated |         | Impervious |      | Wetland/Lake/SWMP |      | Average CN for Soil Type |  |  |  |
|             |             |                       |              |                         | Area                           | Percent | Area            | Percent | CN            | Area | Percent | CN   | Area       | Percent | CN         | Area | Percent           | CN   |                          |  |  |  |
| Gf          | GRANBY      | B                     | Sand Loam    | 2                       | 1.29                           | 1       | 60              | 0       | 69            | 0    | 65      | 0    | 74         | 0       | 100        | 0    | 50                | 60   |                          |  |  |  |
|             | #/A         | #/A                   | #/A          | #/A                     | 0                              | 0       | #/A             | 0       | #/A           | 0    | #/A     | 0    | #/A        | 0       | #/A        | 0    | #/A               | 0    |                          |  |  |  |
|             | #/A         | #/A                   | #/A          | #/A                     | 0                              | 0       | #/A             | 0       | #/A           | 0    | #/A     | 0    | #/A        | 0       | #/A        | 0    | #/A               | 0    |                          |  |  |  |
|             | #/A         | #/A                   | #/A          | #/A                     | 0                              | 0       | #/A             | 0       | #/A           | 0    | #/A     | 0    | #/A        | 0       | #/A        | 0    | #/A               | 0    |                          |  |  |  |
|             | #/A         | #/A                   | #/A          | #/A                     | 0                              | 0       | #/A             | 0       | #/A           | 0    | #/A     | 0    | #/A        | 0       | #/A        | 0    | #/A               | 0    |                          |  |  |  |
|             |             |                       |              | Totals                  | 1.29                           | 1.00    | 1.29            | 1.00    | 0.00          | 0.00 | 0.00    | 0.00 | 0.00       | 0.00    | 0.00       | 0.00 | 80.0              | 80.0 |                          |  |  |  |

### Time of Concentration Calculations

**For Runoff Coefficients greater than 0.4**

### Bransby-Williams Formula

|                             |          |
|-----------------------------|----------|
| Maximum Catchment Elevation | 188.04 m |
| Minimum Catchment Elevation | 186.53 m |
| Catchment length            | 118 m    |
| Catchment Slope             | 1%       |
| Catchment Area              | 1.29 ha  |

Time of Concentration (Minutes)

Time of Concentration (Hours)

Time to Peak (2/3 x Time of Concentration)

Time to Peak

For Runoff Coefficients less than 0.4

### Airport Method

|                             |          |
|-----------------------------|----------|
| Maximum Catchment Elevation | 188.04 m |
| Minimum Catchment Elevation | 186.53 m |
| Catchment length            | 118 m    |
| Catchment Slope             | 1%       |
| Catchment Area              | 1.29 ha  |

Time of Concentration (Minutes)

Time of Concentration (Hours)

Time to Peak (2/3 x Time of Concentration)

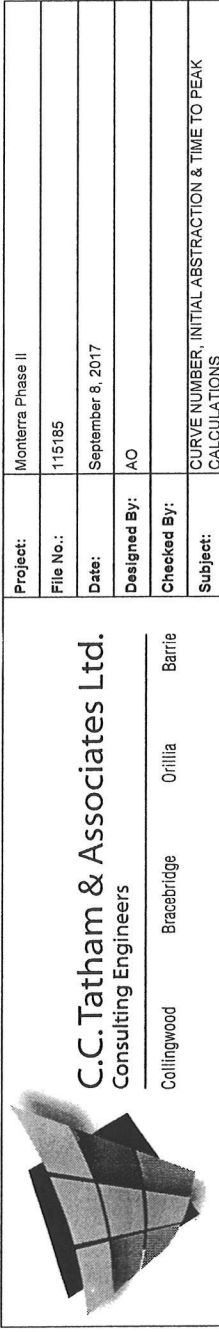
|              |          |
|--------------|----------|
| Time to Peak | 0.31 hrs |
|--------------|----------|

|                     |         |
|---------------------|---------|
| Initial Abstraction | 10.0 mm |
|---------------------|---------|

|            |    |
|------------|----|
| Woods      | 10 |
| Meadows    | 8  |
| Cultivated | 7  |
| Lawns      | 5  |
| Impervious | 2  |
| Wetlands   | 16 |

|                    |      |
|--------------------|------|
| Runoff Coefficient | 0.25 |
|--------------------|------|

| Landuse Type      | Soil Series |     |     |     |
|-------------------|-------------|-----|-----|-----|
|                   | Gf          | 0   | 0   | 0   |
| 2                 | #/A         | #/A | #/A | #/A |
| Forests/Woodland  | 0.25        | #/A | #/A | #/A |
| Cultivated        | 0.35        | #/A | #/A | #/A |
| Pasture/Lawn      | 0.28        | #/A | #/A | #/A |
| Impervious        | 0.95        | #/A | #/A | #/A |
| Wetland/Lake/SWMI | 0.05        | #/A | #/A | #/A |
| Meadows           | 0.27        | #/A | #/A | #/A |
| Soil Series Total | 0.95        | #/A | #/A | #/A |



### CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

## POST-DEVELOPMENT CONDITIONS

| Catchment | Area | ha |
|-----------|------|----|
| 102       | 1.77 | ha |

[illegible]

### Time of Concentration Calculations

**For Runoff Coefficients greater than 0.4**

**For Runoff Coefficients less than 0.4**

|                     |         |
|---------------------|---------|
| Initial Abstraction | 10.0 mm |
|---------------------|---------|

|            |    |
|------------|----|
| Woods      | 10 |
| Meadows    | 8  |
| Cultivated | 7  |
| Lawns      | 5  |
| Impervious | 2  |
| Wetlands   | 16 |

### Airport Method

|                             |        |        |
|-----------------------------|--------|--------|
| Maximum Catchment Elevation | m      | 189.43 |
| Minimum Catchment Elevation | m      | 187.04 |
| Catchment length            | m      | 230    |
| Catchment Slope             | 1%     |        |
| Catchment Area              | 177 ha |        |

|                             |          |
|-----------------------------|----------|
| Maximum Catchment Elevation | 189.43 m |
| Minimum Catchment Elevation | 187.04 m |
| Catchment length            | 230 m    |
| Catchment Slope             | 1%       |
| Catchment Area              | 1.77 ha  |

|                    |      |
|--------------------|------|
| Runoff Coefficient | 0.25 |
|--------------------|------|

| Landuse Type      | Soil Series |     |     |     |
|-------------------|-------------|-----|-----|-----|
|                   | Gf          | 0   | 0   | 0   |
| Forest/Woodland   | 2           | #/A | #/A | #/A |
| Cultivated        | 0.25        | #/A | #/A | #/A |
| Pasture/Lawn      | 0.35        | #/A | #/A | #/A |
| Impervious        | 0.28        | #/A | #/A | #/A |
| Wetland/Lake/SWMP | 0.05        | #/A | #/A | #/A |
| Meadows           | 0.95        | #/A | #/A | #/A |
| Soil Series Total | 0.27        | #/A | #/A | #/A |
|                   | 0.25        | #/A | #/A | #/A |

| Time of Concentration (Minutes)            | 12.29 |
|--------------------------------------------|-------|
| Time of Concentration (Hours)              | 0.20  |
| Time to Peak (2/3 x Time of Concentration) | 0.14  |

|              |          |
|--------------|----------|
| Time to Peak | 0.46 hrs |
|--------------|----------|



**CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS**

| Catchment | Area | 1.87 ha |
|-----------|------|---------|
| 103       |      |         |

| Landuse Type      | Soil Series |      |      |      |      |
|-------------------|-------------|------|------|------|------|
|                   | Gf          | 0    | 0    | 0    | 0    |
| Forest/Woodland   | 2           | #N/A | #N/A | #N/A | #N/A |
| Cultivated        | 0.35        | #N/A | #N/A | #N/A | #N/A |
| Pasture/Lawn      | 0.28        | #N/A | #N/A | #N/A | #N/A |
| Impervious        | 0.95        | #N/A | #N/A | #N/A | #N/A |
| Wetland/Lake/SWMP | 0.05        | #N/A | #N/A | #N/A | #N/A |
| Meadows           | 0.27        | #N/A | #N/A | #N/A | #N/A |
| Soil Series Total | 0.25        | #N/A | #N/A | #N/A | #N/A |

# Chicago - Pre

```
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   TTTT TTTT H   H   Y   Y   M   M   OOO
O   O   T   T   H   H   Y   Y   MM MM O   O
O   O   T   T   H   H   Y   M   M   O   O
OOO   T   T   H   H   Y   M   M   OOO
```

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.2\voin.dat  
Output filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Pre-development CHI.out  
Summary filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Pre-development CHI.sum

DATE: 9/19/2017 TIME: 11:24:27 AM

USER:

COMMENTS: \_\_\_\_\_

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

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| READ STORM | | Filename: I:\2015 Projects\115
| | | 185 - Monterra Phase 2 Natural Hazard Assessm
| | | \Design\Hydrology\115185 vo2\STORMS\CHIC25MM.
| Ptotal= 24.97 mm | | Comments: OWEN SOUND 25 mm (from a 2 year-4hr stor
-----
```

| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|-------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 1.29  | 1.10 | 2.81  | 2.10 | 13.05 | 3.10 | 2.04  |
| .20  | 1.36  | 1.20 | 3.22  | 2.20 | 8.44  | 3.20 | 1.89  |
| .30  | 1.44  | 1.30 | 3.77  | 2.30 | 6.21  | 3.30 | 1.76  |
| .40  | 1.53  | 1.40 | 4.55  | 2.40 | 4.91  | 3.40 | 1.65  |
| .50  | 1.63  | 1.50 | 5.77  | 2.50 | 4.06  | 3.50 | 1.55  |
| .60  | 1.75  | 1.60 | 7.86  | 2.60 | 3.47  | 3.60 | 1.46  |
| .70  | 1.89  | 1.70 | 12.27 | 2.70 | 3.03  | 3.70 | 1.39  |
| .80  | 2.06  | 1.80 | 26.17 | 2.80 | 2.70  | 3.80 | 1.32  |
| .90  | 2.26  | 1.90 | 72.58 | 2.90 | 2.43  | 3.90 | 1.26  |
| 1.00 | 2.50  | 2.00 | 26.96 | 3.00 | 2.22  | 4.00 | 1.20  |

```
-----
| CALIB | |
| NASHYD (0103) | | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
| | | U.H. Tp(hrs)= .36
-----
```

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

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 1.29 | 1.083 2.81 | 2.083 13.05 | 3.08 2.04
.167 1.35 | 1.167 3.14 | 2.167 9.36 | 3.17 1.92
.250 1.41 | 1.250 3.55 | 2.250 7.10 | 3.25 1.81
.333 1.48 | 1.333 4.08 | 2.333 5.69 | 3.33 1.72
.417 1.55 | 1.417 4.79 | 2.417 4.74 | 3.42 1.63
.500 1.63 | 1.500 5.77 | 2.500 4.06 | 3.50 1.55
.583 1.75 | 1.583 7.86 | 2.583 3.47 | 3.58 1.46
.667 1.86 | 1.667 11.39 | 2.667 3.12 | 3.67 1.40
.750 1.99 | 1.750 20.61 | 2.750 2.83 | 3.75 1.35
.833 2.14 | 1.833 44.73 | 2.833 2.59 | 3.83 1.30
.917 2.31 | 1.917 63.46 | 2.917 2.39 | 3.92 1.25
```

1.000 2.50 | 2.000 26.96 | 3.000 2.22 | 4.00 1.20

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .005 (i)  
TIME TO PEAK (hrs)= 2.417  
RUNOFF VOLUME (mm)= 1.215  
TOTAL RAINFALL (mm)= 24.971  
RUNOFF COEFFICIENT = .049

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

-----  
| CALIB |  
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0  
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00  
-----  
U.H. Tp(hrs)= .53

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .004 (i)  
TIME TO PEAK (hrs)= 2.667  
RUNOFF VOLUME (mm)= 1.215  
TOTAL RAINFALL (mm)= 24.971  
RUNOFF COEFFICIENT = .049

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

-----  
| CALIB |  
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0  
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00  
-----  
U.H. Tp(hrs)= .31

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .004 (i)  
TIME TO PEAK (hrs)= 2.333  
RUNOFF VOLUME (mm)= 1.215  
TOTAL RAINFALL (mm)= 24.971  
RUNOFF COEFFICIENT = .049

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

-----  
| ADD HYD (0901) |  
| 1 + 2 = 3 |  
-----  
ID1= 1 (0102): AREA QPEAK TPEAK R.V.  
(ha) (cms) (hrs) (mm)  
+ ID2= 2 (0101): 1.77 .004 2.67 1.22  
1.29 .004 2.33 1.22  
=====

ID = 3 (0901): 3.06 .007 2.50 1.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

-----  
| READ STORM | Filename: I:\2015 Projects\l15  
| | 185 - Monterra Phase 2 Natural Hazard Assessm  
| | \Design\Hydrology\l15185 vo2\STORMS\OSCHI2.4H  
| Ptotal= 33.75 mm | Comments: OWEN SOUND 2 YEAR 4 HOUR DURATION CHICAG  
-----

| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|-------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 1.75  | 1.10 | 3.80  | 2.10 | 17.64 | 3.10 | 2.75  |
| .20  | 1.84  | 1.20 | 4.35  | 2.20 | 11.41 | 3.20 | 2.55  |
| .30  | 1.95  | 1.30 | 5.09  | 2.30 | 8.39  | 3.30 | 2.38  |
| .40  | 2.07  | 1.40 | 6.16  | 2.40 | 6.63  | 3.40 | 2.23  |
| .50  | 2.21  | 1.50 | 7.80  | 2.50 | 5.49  | 3.50 | 2.09  |
| .60  | 2.37  | 1.60 | 10.63 | 2.60 | 4.69  | 3.60 | 1.98  |
| .70  | 2.56  | 1.70 | 16.59 | 2.70 | 4.10  | 3.70 | 1.88  |
| .80  | 2.78  | 1.80 | 35.38 | 2.80 | 3.65  | 3.80 | 1.78  |
| .90  | 3.05  | 1.90 | 98.09 | 2.90 | 3.29  | 3.90 | 1.70  |
| 1.00 | 3.38  | 2.00 | 36.45 | 3.00 | 2.99  | 4.00 | 1.63  |

```

-----
| CALIB |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .36

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 1.75 | 1.083 3.80 | 2.083 17.64 | 3.08 2.75
.167 1.82 | 1.167 4.24 | 2.167 12.66 | 3.17 2.59
.250 1.91 | 1.250 4.79 | 2.250 9.60 | 3.25 2.45
.333 2.00 | 1.333 5.52 | 2.333 7.69 | 3.33 2.32
.417 2.10 | 1.417 6.49 | 2.417 6.40 | 3.42 2.20
.500 2.21 | 1.500 7.80 | 2.500 5.49 | 3.50 2.09
.583 2.37 | 1.583 10.63 | 2.583 4.69 | 3.58 1.98
.667 2.52 | 1.667 15.40 | 2.667 4.22 | 3.67 1.90
.750 2.69 | 1.750 27.86 | 2.750 3.83 | 3.75 1.82
.833 2.89 | 1.833 60.46 | 2.833 3.51 | 3.83 1.75
.917 3.12 | 1.917 85.76 | 2.917 3.23 | 3.92 1.69
1.000 3.38 | 2.000 36.45 | 3.000 2.99 | 4.00 1.63

```

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .012 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 2.922  
 TOTAL RAINFALL (mm)= 33.755  
 RUNOFF COEFFICIENT = .087

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

```

-----
| CALIB |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .53

```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .009 (i)  
 TIME TO PEAK (hrs)= 2.583  
 RUNOFF VOLUME (mm)= 2.922  
 TOTAL RAINFALL (mm)= 33.755  
 RUNOFF COEFFICIENT = .087

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

```

-----
| CALIB |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .009 (i)  
 TIME TO PEAK (hrs)= 2.250  
 RUNOFF VOLUME (mm)= 2.921  
 TOTAL RAINFALL (mm)= 33.755  
 RUNOFF COEFFICIENT = .087

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 1 (0102): 1.77 .009 2.58 2.92
+ ID2= 2 (0101): 1.29 .009 2.25 2.92
=====
ID = 3 (0901): 3.06 .018 2.42 2.92

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*

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

```

-----
| READ STORM |      Filename: I:\2015 Projects\l15
|            |      185 - Monterra Phase 2 Natural Hazard Assessm
|            |      \Design\Hydrology\l15185 vo2\STORMS\OSCHI5.4H
| Ptotal= 44.07 mm | Comments: OWEN SOUND 5 YEAR 4 HOUR DURATION CHICAG
-----
  
```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.16  | 1.10 | 4.86   | 2.10 | 23.63 | 3.10 | 3.47  |
| .20  | 2.29  | 1.20 | 5.59   | 2.20 | 15.14 | 3.20 | 3.21  |
| .30  | 2.42  | 1.30 | 6.58   | 2.30 | 11.03 | 3.30 | 2.98  |
| .40  | 2.58  | 1.40 | 8.01   | 2.40 | 8.65  | 3.40 | 2.78  |
| .50  | 2.76  | 1.50 | 10.23  | 2.50 | 7.11  | 3.50 | 2.61  |
| .60  | 2.97  | 1.60 | 14.08  | 2.60 | 6.04  | 3.60 | 2.46  |
| .70  | 3.22  | 1.70 | 22.20  | 2.70 | 5.25  | 3.70 | 2.33  |
| .80  | 3.51  | 1.80 | 47.44  | 2.80 | 4.65  | 3.80 | 2.21  |
| .90  | 3.86  | 1.90 | 127.12 | 2.90 | 4.17  | 3.90 | 2.11  |
| 1.00 | 4.30  | 2.00 | 48.87  | 3.00 | 3.79  | 4.00 | 2.01  |

```

-----
| CALIB      |
| NASHYD     |      Area      (ha)= 1.87      Curve Number  (CN)= 60.0
| ID= 1 DT= 5.0 min |      Ia        (mm)= 10.00    # of Linear Res.(N)= 3.00
|            |      U.H. Tp(hrs)= .36
-----
  
```

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME | RAIN  |
|-------|-------|-------|--------|-------|-------|------|-------|
| hrs   | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs  | mm/hr |
| .083  | 2.16  | 1.083 | 4.86   | 2.083 | 23.63 | 3.08 | 3.47  |
| .167  | 2.26  | 1.167 | 5.44   | 2.167 | 16.84 | 3.17 | 3.26  |
| .250  | 2.37  | 1.250 | 6.18   | 2.250 | 12.67 | 3.25 | 3.07  |
| .333  | 2.48  | 1.333 | 7.15   | 2.333 | 10.08 | 3.33 | 2.90  |
| .417  | 2.62  | 1.417 | 8.45   | 2.417 | 8.34  | 3.42 | 2.75  |
| .500  | 2.76  | 1.500 | 10.23  | 2.500 | 7.11  | 3.50 | 2.61  |
| .583  | 2.97  | 1.583 | 14.08  | 2.583 | 6.04  | 3.58 | 2.46  |
| .667  | 3.17  | 1.667 | 20.58  | 2.667 | 5.41  | 3.67 | 2.36  |
| .750  | 3.39  | 1.750 | 37.34  | 2.750 | 4.89  | 3.75 | 2.26  |
| .833  | 3.65  | 1.833 | 79.31  | 2.833 | 4.46  | 3.83 | 2.17  |
| .917  | 3.95  | 1.917 | 111.47 | 2.917 | 4.09  | 3.92 | 2.09  |
| 1.000 | 4.30  | 2.000 | 48.87  | 3.000 | 3.79  | 4.00 | 2.01  |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .026 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 5.705  
 TOTAL RAINFALL (mm)= 44.068  
 RUNOFF COEFFICIENT = .129

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

```

-----
| CALIB      |
| NASHYD     |      Area      (ha)= 1.77      Curve Number  (CN)= 60.0
| ID= 1 DT= 5.0 min |      Ia        (mm)= 10.00    # of Linear Res.(N)= 3.00
|            |      U.H. Tp(hrs)= .53
-----
  
```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .019 (i)  
 TIME TO PEAK (hrs)= 2.583  
 RUNOFF VOLUME (mm)= 5.705  
 TOTAL RAINFALL (mm)= 44.068  
 RUNOFF COEFFICIENT = .129

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

```

-----
| CALIB      |
| NASHYD     |      Area      (ha)= 1.29      Curve Number  (CN)= 60.0
| ID= 1 DT= 5.0 min |      Ia        (mm)= 10.00    # of Linear Res.(N)= 3.00
|            |      U.H. Tp(hrs)= .31
-----
  
```

Unit Hyd Qpeak (cms)= .159



PEAK FLOW (cms)= .020 (i)  
 TIME TO PEAK (hrs)= 2.250  
 RUNOFF VOLUME (mm)= 5.704  
 TOTAL RAINFALL (mm)= 44.068  
 RUNOFF COEFFICIENT = .129

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
      ID1= 1 (0102):  1.77      .019      2.58      5.71
      + ID2= 2 (0101):  1.29      .020      2.25      5.70
      =====
      ID = 3 (0901):  3.06      .036      2.42      5.70
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION NUMBER: 4 \*\*  
 \*\*\*\*\*

```

-----
| READ STORM |      Filename: I:\2015 Projects\l15
|            |      185 - Monterra Phase 2 Natural Hazard Assessm
|            |      \Design\Hydrology\l15185 vo2\STORMS\OSchil0.4
| Ptotal= 50.59 mm | Comments: OWEN SOUND 10 YEAR 4 HOUR DURATION CHICA
-----
  
```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.37  | 1.10 | 5.44   | 2.10 | 27.54 | 3.10 | 3.85  |
| .20  | 2.50  | 1.20 | 6.28   | 2.20 | 17.50 | 3.20 | 3.54  |
| .30  | 2.66  | 1.30 | 7.44   | 2.30 | 12.66 | 3.30 | 3.29  |
| .40  | 2.84  | 1.40 | 9.10   | 2.40 | 9.86  | 3.40 | 3.06  |
| .50  | 3.04  | 1.50 | 11.71  | 2.50 | 8.06  | 3.50 | 2.87  |
| .60  | 3.28  | 1.60 | 16.26  | 2.60 | 6.81  | 3.60 | 2.70  |
| .70  | 3.56  | 1.70 | 25.85  | 2.70 | 5.89  | 3.70 | 2.55  |
| .80  | 3.89  | 1.80 | 55.53  | 2.80 | 5.20  | 3.80 | 2.42  |
| .90  | 4.29  | 1.90 | 146.69 | 2.90 | 4.65  | 3.90 | 2.30  |
| 1.00 | 4.80  | 2.00 | 57.21  | 3.00 | 4.21  | 4.00 | 2.20  |

```

-----
| CALIB      |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|            | U.H. Tp(hrs)= .36
-----
  
```

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

```

-----
          ---- TRANSFORMED HYETOGRAPH ----
          TIME      RAIN | TIME      RAIN | TIME      RAIN | TIME      RAIN
          hrs      mm/hr | hrs      mm/hr | hrs      mm/hr | hrs      mm/hr
      .083      2.37 | 1.083      5.44 | 2.083      27.54 | 3.08      3.85
      .167      2.47 | 1.167      6.11 | 2.167      19.51 | 3.17      3.60
      .250      2.60 | 1.250      6.98 | 2.250      14.60 | 3.25      3.39
      .333      2.73 | 1.333      8.10 | 2.333      11.54 | 3.33      3.20
      .417      2.88 | 1.417      9.62 | 2.417      9.50 | 3.42      3.02
      .500      3.04 | 1.500     11.71 | 2.500      8.06 | 3.50      2.87
      .583      3.28 | 1.583     16.26 | 2.583      6.81 | 3.58      2.70
      .667      3.50 | 1.667     23.93 | 2.667      6.07 | 3.67      2.58
      .750      3.76 | 1.750     43.66 | 2.750      5.48 | 3.75      2.47
      .833      4.05 | 1.833     91.99 | 2.833      4.98 | 3.83      2.37
      .917      4.39 | 1.917    128.79 | 2.917      4.56 | 3.92      2.28
      1.000      4.80 | 2.000     57.21 | 3.000      4.21 | 4.00      2.20
  
```

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .037 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 7.846  
 TOTAL RAINFALL (mm)= 50.590  
 RUNOFF COEFFICIENT = .155

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

```

-----
| CALIB |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .53

```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .026 (i)  
 TIME TO PEAK (hrs)= 2.500  
 RUNOFF VOLUME (mm)= 7.847  
 TOTAL RAINFALL (mm)= 50.590  
 RUNOFF COEFFICIENT = .155

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

```

-----
| CALIB |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .028 (i)  
 TIME TO PEAK (hrs)= 2.250  
 RUNOFF VOLUME (mm)= 7.845  
 TOTAL RAINFALL (mm)= 50.590  
 RUNOFF COEFFICIENT = .155

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
| ID1= 1 (0102): | AREA QPEAK TPEAK R.V.
| + ID2= 2 (0101): | (ha) (cms) (hrs) (mm)
| ID = 3 (0901): | 1.77 .026 2.50 7.85
| 1.29 .028 2.25 7.85
| 3.06 .051 2.33 7.85

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| READ STORM |
| |
| |
| Ptotal= 59.08 mm |
-----
| Filename: I:\2015 Projects\115
| 185 - Monterra Phase 2 Natural Hazard Assessm
| \Design\Hydrology\115185 vo2\STORMS\OSCHI25.4
| Comments: OWEN SOUND 25 YEAR 4 HOUR DURATION CHICA

```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.69  | 1.10 | 6.28   | 2.10 | 32.51 | 3.10 | 4.41  |
| .20  | 2.85  | 1.20 | 7.27   | 2.20 | 20.58 | 3.20 | 4.06  |
| .30  | 3.03  | 1.30 | 8.63   | 2.30 | 14.82 | 3.30 | 3.76  |
| .40  | 3.24  | 1.40 | 10.61  | 2.40 | 11.50 | 3.40 | 3.50  |
| .50  | 3.47  | 1.50 | 13.69  | 2.50 | 9.37  | 3.50 | 3.28  |
| .60  | 3.75  | 1.60 | 19.10  | 2.60 | 7.89  | 3.60 | 3.08  |
| .70  | 4.07  | 1.70 | 30.50  | 2.70 | 6.82  | 3.70 | 2.91  |
| .80  | 4.46  | 1.80 | 65.56  | 2.80 | 6.00  | 3.80 | 2.76  |
| .90  | 4.94  | 1.90 | 170.99 | 2.90 | 5.35  | 3.90 | 2.62  |
| 1.00 | 5.53  | 2.00 | 67.54  | 3.00 | 4.84  | 4.00 | 2.50  |

```

-----
| CALIB |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .36

```

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

```

----- TRANSFORMED HYETOGRAPH -----
| TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN |
| hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr |

```

|       |      |       |        |       |       |      |      |
|-------|------|-------|--------|-------|-------|------|------|
| .083  | 2.69 | 1.083 | 6.28   | 2.083 | 32.51 | 3.08 | 4.41 |
| .167  | 2.82 | 1.167 | 7.07   | 2.167 | 22.97 | 3.17 | 4.13 |
| .250  | 2.96 | 1.250 | 8.09   | 2.250 | 17.12 | 3.25 | 3.88 |
| .333  | 3.11 | 1.333 | 9.42   | 2.333 | 13.49 | 3.33 | 3.66 |
| .417  | 3.29 | 1.417 | 11.23  | 2.417 | 11.07 | 3.42 | 3.46 |
| .500  | 3.47 | 1.500 | 13.69  | 2.500 | 9.37  | 3.50 | 3.28 |
| .583  | 3.75 | 1.583 | 19.10  | 2.583 | 7.89  | 3.58 | 3.08 |
| .667  | 4.01 | 1.667 | 28.22  | 2.667 | 7.03  | 3.67 | 2.94 |
| .750  | 4.30 | 1.750 | 51.54  | 2.750 | 6.33  | 3.75 | 2.82 |
| .833  | 4.65 | 1.833 | 107.73 | 2.833 | 5.74  | 3.83 | 2.70 |
| .917  | 5.06 | 1.917 | 150.30 | 2.917 | 5.25  | 3.92 | 2.60 |
| 1.000 | 5.53 | 2.000 | 67.54  | 3.000 | 4.84  | 4.00 | 2.50 |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .053 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 11.025  
 TOTAL RAINFALL (mm)= 59.076  
 RUNOFF COEFFICIENT = .187

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

|                   |  |                   |                            |
|-------------------|--|-------------------|----------------------------|
| -----             |  |                   |                            |
| CALIB             |  |                   |                            |
| NASHYD (0102)     |  | Area (ha)= 1.77   | Curve Number (CN)= 60.0    |
| ID= 1 DT= 5.0 min |  | Ia (mm)= 10.00    | # of Linear Res. (N)= 3.00 |
| -----             |  | U.H. Tp(hrs)= .53 |                            |

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .038 (i)  
 TIME TO PEAK (hrs)= 2.500  
 RUNOFF VOLUME (mm)= 11.026  
 TOTAL RAINFALL (mm)= 59.076  
 RUNOFF COEFFICIENT = .187

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

|                   |  |                   |                            |
|-------------------|--|-------------------|----------------------------|
| -----             |  |                   |                            |
| CALIB             |  |                   |                            |
| NASHYD (0101)     |  | Area (ha)= 1.29   | Curve Number (CN)= 60.0    |
| ID= 1 DT= 5.0 min |  | Ia (mm)= 10.00    | # of Linear Res. (N)= 3.00 |
| -----             |  | U.H. Tp(hrs)= .31 |                            |

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .040 (i)  
 TIME TO PEAK (hrs)= 2.250  
 RUNOFF VOLUME (mm)= 11.023  
 TOTAL RAINFALL (mm)= 59.076  
 RUNOFF COEFFICIENT = .187

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

|                  |  |      |       |       |
|------------------|--|------|-------|-------|
| -----            |  |      |       |       |
| ADD HYD (0901)   |  |      |       |       |
| 1 + 2 = 3        |  |      |       |       |
| -----            |  | AREA | QPEAK | TPEAK |
|                  |  | (ha) | (cms) | (hrs) |
| ID1= 1 (0102):   |  | 1.77 | .038  | 2.50  |
| + ID2= 2 (0101): |  | 1.29 | .040  | 2.25  |
| =====            |  |      |       |       |
| ID = 3 (0901):   |  | 3.06 | .073  | 2.33  |
|                  |  |      |       | 11.02 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION NUMBER: 6 \*\*  
 \*\*\*\*\*

|                  |  |
|------------------|--|
| -----            |  |
| READ STORM       |  |
|                  |  |
|                  |  |
| Ptotal= 65.65 mm |  |
| -----            |  |

Filename: I:\2015 Projects\l15  
 185 - Monterra Phase 2 Natural Hazard Assessm  
 \Design\Hydrology\l15185 vo2\STORMS\OSchi50.4  
 Comments: OWEN SOUND 50 YEAR 4 HOUR DURATION CHICA

| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|-------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.87  | 1.10 | 6.88  | 2.10 | 36.93 | 3.10 | 4.78  |

|      |      |      |        |      |       |      |      |
|------|------|------|--------|------|-------|------|------|
| .20  | 3.04 | 1.20 | 8.01   | 2.20 | 23.25 | 3.20 | 4.39 |
| .30  | 3.24 | 1.30 | 9.55   | 2.30 | 16.64 | 3.30 | 4.05 |
| .40  | 3.47 | 1.40 | 11.81  | 2.40 | 12.83 | 3.40 | 3.76 |
| .50  | 3.73 | 1.50 | 15.34  | 2.50 | 10.39 | 3.50 | 3.52 |
| .60  | 4.04 | 1.60 | 21.55  | 2.60 | 8.71  | 3.60 | 3.30 |
| .70  | 4.40 | 1.70 | 34.62  | 2.70 | 7.49  | 3.70 | 3.11 |
| .80  | 4.84 | 1.80 | 74.20  | 2.80 | 6.56  | 3.80 | 2.94 |
| .90  | 5.37 | 1.90 | 187.94 | 2.90 | 5.84  | 3.90 | 2.79 |
| 1.00 | 6.03 | 2.00 | 76.42  | 3.00 | 5.26  | 4.00 | 2.65 |

```

-----
| CALIB          |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .36

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 2.87 | 1.083 6.88 | 2.083 36.93 | 3.08 4.78
.167 3.01 | 1.167 7.78 | 2.167 25.99 | 3.17 4.47
.250 3.16 | 1.250 8.93 | 2.250 19.28 | 3.25 4.19
.333 3.33 | 1.333 10.45 | 2.333 15.12 | 3.33 3.93
.417 3.52 | 1.417 12.52 | 2.417 12.34 | 3.42 3.71
.500 3.73 | 1.500 15.34 | 2.500 10.39 | 3.50 3.52
.583 4.04 | 1.583 21.55 | 2.583 8.71 | 3.58 3.30
.667 4.33 | 1.667 32.01 | 2.667 7.73 | 3.67 3.15
.750 4.66 | 1.750 58.37 | 2.750 6.93 | 3.75 3.01
.833 5.05 | 1.833 119.70 | 2.833 6.27 | 3.83 2.88
.917 5.50 | 1.917 165.64 | 2.917 5.72 | 3.92 2.76
1.000 6.03 | 2.000 76.42 | 3.000 5.26 | 4.00 2.65

```

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .067 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 13.764  
 TOTAL RAINFALL (mm)= 65.654  
 RUNOFF COEFFICIENT = .210

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

```

-----
| CALIB          |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .53

```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .048 (i)  
 TIME TO PEAK (hrs)= 2.500  
 RUNOFF VOLUME (mm)= 13.766  
 TOTAL RAINFALL (mm)= 65.654  
 RUNOFF COEFFICIENT = .210

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

```

-----
| CALIB          |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .051 (i)  
 TIME TO PEAK (hrs)= 2.250  
 RUNOFF VOLUME (mm)= 13.762  
 TOTAL RAINFALL (mm)= 65.654  
 RUNOFF COEFFICIENT = .210

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

```

-----
| ADD HYD (0901) |

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0102):   | 1.77         | .048           | 2.50           | 13.77        |
| + ID2= 2 (0101): | 1.29         | .051           | 2.25           | 13.76        |
| ID = 3 (0901):   | 3.06         | .093           | 2.33           | 13.76        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

|                  |                                                    |
|------------------|----------------------------------------------------|
| READ STORM       | Filename: I:\2015 Projects\l15                     |
|                  | 185 - Monterra Phase 2 Natural Hazard Assessm      |
|                  | \Design\Hydrology\l15185 vo2\STORMS\OSCHI100.      |
| Ptotal= 71.77 mm | Comments: OWEN SOUND 100 YEAR 4 HOUR DURATION CHIC |

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .10         | 3.08          | 1.10        | 7.44          | 2.10        | 40.41         | 3.10        | 5.16          |
| .20         | 3.27          | 1.20        | 8.67          | 2.20        | 25.38         | 3.20        | 4.73          |
| .30         | 3.49          | 1.30        | 10.36         | 2.30        | 18.12         | 3.30        | 4.37          |
| .40         | 3.73          | 1.40        | 12.83         | 2.40        | 13.95         | 3.40        | 4.05          |
| .50         | 4.02          | 1.50        | 16.70         | 2.50        | 11.28         | 3.50        | 3.79          |
| .60         | 4.35          | 1.60        | 23.51         | 2.60        | 9.44          | 3.60        | 3.55          |
| .70         | 4.75          | 1.70        | 37.88         | 2.70        | 8.10          | 3.70        | 3.35          |
| .80         | 5.22          | 1.80        | 81.47         | 2.80        | 7.09          | 3.80        | 3.16          |
| .90         | 5.80          | 1.90        | 206.92        | 2.90        | 6.31          | 3.90        | 3.00          |
| 1.00        | 6.52          | 2.00        | 83.92         | 3.00        | 5.67          | 4.00        | 2.85          |

|                   |                   |                           |  |
|-------------------|-------------------|---------------------------|--|
| CALIB             |                   |                           |  |
| NASHYD (0103)     | Area (ha)= 1.87   | Curve Number (CN)= 60.0   |  |
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00    | # of Linear Res.(N)= 3.00 |  |
|                   | U.H. Tp(hrs)= .36 |                           |  |

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

| ---- TRANSFORMED HYETOGRAPH ---- |               |             |               |             |               |             |               |
|----------------------------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| TIME<br>hrs                      | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
| .083                             | 3.08          | 1.083       | 7.44          | 2.083       | 40.41         | 3.08        | 5.16          |
| .167                             | 3.23          | 1.167       | 8.42          | 2.167       | 28.39         | 3.17        | 4.82          |
| .250                             | 3.40          | 1.250       | 9.68          | 2.250       | 21.02         | 3.25        | 4.51          |
| .333                             | 3.59          | 1.333       | 11.35         | 2.333       | 16.45         | 3.33        | 4.24          |
| .417                             | 3.79          | 1.417       | 13.60         | 2.417       | 13.42         | 3.42        | 4.00          |
| .500                             | 4.02          | 1.500       | 16.70         | 2.500       | 11.28         | 3.50        | 3.79          |
| .583                             | 4.35          | 1.583       | 23.51         | 2.583       | 9.44          | 3.58        | 3.55          |
| .667                             | 4.67          | 1.667       | 35.01         | 2.667       | 8.37          | 3.67        | 3.39          |
| .750                             | 5.03          | 1.750       | 64.03         | 2.750       | 7.49          | 3.75        | 3.24          |
| .833                             | 5.45          | 1.833       | 131.65        | 2.833       | 6.78          | 3.83        | 3.10          |
| .917                             | 5.94          | 1.917       | 182.32        | 2.917       | 6.18          | 3.92        | 2.97          |
| 1.000                            | 6.52          | 2.000       | 83.92         | 3.000       | 5.67          | 4.00        | 2.85          |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .081 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 16.506  
 TOTAL RAINFALL (mm)= 71.769  
 RUNOFF COEFFICIENT = .230

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

|                   |                   |                           |  |
|-------------------|-------------------|---------------------------|--|
| CALIB             |                   |                           |  |
| NASHYD (0102)     | Area (ha)= 1.77   | Curve Number (CN)= 60.0   |  |
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00    | # of Linear Res.(N)= 3.00 |  |
|                   | U.H. Tp(hrs)= .53 |                           |  |

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .058 (i)  
 TIME TO PEAK (hrs)= 2.500  
 RUNOFF VOLUME (mm)= 16.508  
 TOTAL RAINFALL (mm)= 71.769  
 RUNOFF COEFFICIENT = .230

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

```
-----
| CALIB |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .31
```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .062 (i)  
TIME TO PEAK (hrs)= 2.250  
RUNOFF VOLUME (mm)= 16.503  
TOTAL RAINFALL (mm)= 71.769  
RUNOFF COEFFICIENT = .230

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

```
-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
|-----|
| ID1= 1 (0102): | AREA QPEAK TPEAK R.V.
| | (ha) (cms) (hrs) (mm)
| + ID2= 2 (0101): | 1.77 .058 2.50 16.51
| | 1.29 .062 2.25 16.50
|=====|
| ID = 3 (0901): | 3.06 .113 2.33 16.51
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
*****
** SIMULATION NUMBER: 8 **
*****
```

```
-----
| READ STORM | Filename: I:\2015 Projects\115
| | 185 - Monterra Phase 2 Natural Hazard Assessm
| | \Design\Hydrology\115185 vo2\STORMS\Timmins.s
| Ptotal=193.00 mm | Comments: REGIONAL STORM TIMMINS - 12 hour storm
```

| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME  | RAIN  |
|------|-------|------|-------|------|-------|-------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs   | mm/hr |
| 1.00 | 15.00 | 4.00 | 3.00  | 7.00 | 43.00 | 10.00 | 13.00 |
| 2.00 | 20.00 | 5.00 | 5.00  | 8.00 | 20.00 | 11.00 | 13.00 |
| 3.00 | 10.00 | 6.00 | 20.00 | 9.00 | 23.00 | 12.00 | 8.00  |

```
-----
| CALIB |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .36
```

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

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 15.00 | 3.083 3.00 | 6.083 43.00 | 9.08 13.00
.167 15.00 | 3.167 3.00 | 6.167 43.00 | 9.17 13.00
.250 15.00 | 3.250 3.00 | 6.250 43.00 | 9.25 13.00
.333 15.00 | 3.333 3.00 | 6.333 43.00 | 9.33 13.00
.417 15.00 | 3.417 3.00 | 6.417 43.00 | 9.42 13.00
.500 15.00 | 3.500 3.00 | 6.500 43.00 | 9.50 13.00
.583 15.00 | 3.583 3.00 | 6.583 43.00 | 9.58 13.00
.667 15.00 | 3.667 3.00 | 6.667 43.00 | 9.67 13.00
.750 15.00 | 3.750 3.00 | 6.750 43.00 | 9.75 13.00
.833 15.00 | 3.833 3.00 | 6.833 43.00 | 9.83 13.00
.917 15.00 | 3.917 3.00 | 6.917 43.00 | 9.92 13.00
1.000 15.00 | 4.000 3.00 | 7.000 43.00 | 10.00 13.00
1.083 20.00 | 4.083 5.00 | 7.083 20.00 | 10.08 13.00
1.167 20.00 | 4.167 5.00 | 7.167 20.00 | 10.17 13.00
1.250 20.00 | 4.250 5.00 | 7.250 20.00 | 10.25 13.00
1.333 20.00 | 4.333 5.00 | 7.333 20.00 | 10.33 13.00
1.417 20.00 | 4.417 5.00 | 7.417 20.00 | 10.42 13.00
1.500 20.00 | 4.500 5.00 | 7.500 20.00 | 10.50 13.00
1.583 20.00 | 4.583 5.00 | 7.583 20.00 | 10.58 13.00
1.667 20.00 | 4.667 5.00 | 7.667 20.00 | 10.67 13.00
```

|       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.750 | 20.00 | 4.750 | 5.00  | 7.750 | 20.00 | 10.75 | 13.00 |
| 1.833 | 20.00 | 4.833 | 5.00  | 7.833 | 20.00 | 10.83 | 13.00 |
| 1.917 | 20.00 | 4.917 | 5.00  | 7.917 | 20.00 | 10.92 | 13.00 |
| 2.000 | 20.00 | 5.000 | 5.00  | 8.000 | 20.00 | 11.00 | 13.00 |
| 2.083 | 10.00 | 5.083 | 20.00 | 8.083 | 23.00 | 11.08 | 8.00  |
| 2.167 | 10.00 | 5.167 | 20.00 | 8.167 | 23.00 | 11.17 | 8.00  |
| 2.250 | 10.00 | 5.250 | 20.00 | 8.250 | 23.00 | 11.25 | 8.00  |
| 2.333 | 10.00 | 5.333 | 20.00 | 8.333 | 23.00 | 11.33 | 8.00  |
| 2.417 | 10.00 | 5.417 | 20.00 | 8.417 | 23.00 | 11.42 | 8.00  |
| 2.500 | 10.00 | 5.500 | 20.00 | 8.500 | 23.00 | 11.50 | 8.00  |
| 2.583 | 10.00 | 5.583 | 20.00 | 8.583 | 23.00 | 11.58 | 8.00  |
| 2.667 | 10.00 | 5.667 | 20.00 | 8.667 | 23.00 | 11.67 | 8.00  |
| 2.750 | 10.00 | 5.750 | 20.00 | 8.750 | 23.00 | 11.75 | 8.00  |
| 2.833 | 10.00 | 5.833 | 20.00 | 8.833 | 23.00 | 11.83 | 8.00  |
| 2.917 | 10.00 | 5.917 | 20.00 | 8.917 | 23.00 | 11.92 | 8.00  |
| 3.000 | 10.00 | 6.000 | 20.00 | 9.000 | 23.00 | 12.00 | 8.00  |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .121 (i)  
 TIME TO PEAK (hrs)= 7.083  
 RUNOFF VOLUME (mm)= 95.031  
 TOTAL RAINFALL (mm)= 193.000  
 RUNOFF COEFFICIENT = .492

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

|                   |  |                   |                            |
|-------------------|--|-------------------|----------------------------|
| -----             |  |                   |                            |
| CALIB             |  |                   |                            |
| NASHYD (0102)     |  | Area (ha)= 1.77   | Curve Number (CN)= 60.0    |
| ID= 1 DT= 5.0 min |  | Ia (mm)= 10.00    | # of Linear Res. (N)= 3.00 |
| -----             |  | U.H. Tp(hrs)= .53 |                            |

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .103 (i)  
 TIME TO PEAK (hrs)= 7.250  
 RUNOFF VOLUME (mm)= 95.045  
 TOTAL RAINFALL (mm)= 193.000  
 RUNOFF COEFFICIENT = .492

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

|                   |  |                   |                            |
|-------------------|--|-------------------|----------------------------|
| -----             |  |                   |                            |
| CALIB             |  |                   |                            |
| NASHYD (0101)     |  | Area (ha)= 1.29   | Curve Number (CN)= 60.0    |
| ID= 1 DT= 5.0 min |  | Ia (mm)= 10.00    | # of Linear Res. (N)= 3.00 |
| -----             |  | U.H. Tp(hrs)= .31 |                            |

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .086 (i)  
 TIME TO PEAK (hrs)= 7.000  
 RUNOFF VOLUME (mm)= 95.016  
 TOTAL RAINFALL (mm)= 193.000  
 RUNOFF COEFFICIENT = .492

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

|                  |  |      |       |       |
|------------------|--|------|-------|-------|
| -----            |  |      |       |       |
| ADD HYD (0901)   |  |      |       |       |
| 1 + 2 = 3        |  |      |       |       |
| -----            |  | AREA | QPEAK | TPEAK |
|                  |  | (ha) | (cms) | (hrs) |
| ID1= 1 (0102):   |  | 1.77 | .103  | 7.25  |
| + ID2= 2 (0101): |  | 1.29 | .086  | 7.00  |
| =====            |  |      |       |       |
| ID = 3 (0901):   |  | 3.06 | .186  | 7.08  |
|                  |  |      |       | 95.03 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

```

V   V   I   SSSSS U   U   A   L
V   V   I   SS    U   U   A A  L
V   V   I   SS    U   U   A A A L
V   V   I   SS    U   U   A   A L
VV    I   SSSSS UUUUU A   A  LLLL

```

SCS - Pre

```

OOO   TTTT   TTTT   H   H   Y   Y   M   M   OOO
O   O   T   T   H   H   Y   Y   MM  MM  O   O
O   O   T   T   H   H   Y   M   M   O   O
OOO   T   T   H   H   Y   M   M   OOO

```

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.2\voin.dat  
Output filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Pre-development SCS.out  
Summary filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Pre-development SCS.sum

DATE: 9/19/2017

TIME: 11:23:03 AM

USER:

COMMENTS:

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

```

-----
| MASS STORM |      Filename: I:\2015 Projects\115
|             |      185 - Monterra Phase 2 Natural Hazard Assessm
|             |      \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
| Ptotal= 48.70 mm | Comments: SCS Type II 24 HR MASS CURVE
-----

```

Duration of storm = 23.75 hrs  
Mass curve time step = 15.00 min

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | .58           | 6.25        | .97           | 12.25       | 7.01          | 18.25       | .78           |
| .50         | .39           | 6.50        | .78           | 12.50       | 3.70          | 18.50       | .97           |
| .75         | .58           | 6.75        | .97           | 12.75       | 3.51          | 18.75       | .78           |
| 1.00        | .58           | 7.00        | .97           | 13.00       | 2.73          | 19.00       | .97           |
| 1.25        | .58           | 7.25        | 1.17          | 13.25       | 2.53          | 19.25       | .78           |
| 1.50        | .39           | 7.50        | .97           | 13.50       | 2.14          | 19.50       | .97           |
| 1.75        | .58           | 7.75        | 1.17          | 13.75       | 1.95          | 19.75       | .78           |
| 2.00        | .58           | 8.00        | 1.17          | 14.00       | 1.56          | 20.00       | .58           |
| 2.25        | .78           | 8.25        | 1.36          | 14.25       | 1.36          | 20.25       | .58           |
| 2.50        | .58           | 8.50        | 1.36          | 14.50       | 1.56          | 20.50       | .58           |
| 2.75        | .58           | 8.75        | 1.36          | 14.75       | 1.36          | 20.75       | .58           |
| 3.00        | .58           | 9.00        | 1.56          | 15.00       | 1.56          | 21.00       | .58           |
| 3.25        | .78           | 9.25        | 1.56          | 15.25       | 1.36          | 21.25       | .58           |
| 3.50        | .58           | 9.50        | 1.75          | 15.50       | 1.56          | 21.50       | .58           |
| 3.75        | .58           | 9.75        | 1.75          | 15.75       | 1.36          | 21.75       | .58           |
| 4.00        | .78           | 10.00       | 2.14          | 16.00       | .97           | 22.00       | .58           |
| 4.25        | .78           | 10.25       | 2.34          | 16.25       | .78           | 22.25       | .58           |
| 4.50        | .78           | 10.50       | 2.92          | 16.50       | .97           | 22.50       | .58           |
| 4.75        | .78           | 10.75       | 3.12          | 16.75       | .78           | 22.75       | .58           |
| 5.00        | .78           | 11.00       | 4.68          | 17.00       | .97           | 23.00       | .58           |
| 5.25        | .78           | 11.25       | 4.68          | 17.25       | .78           | 23.25       | .58           |
| 5.50        | .78           | 11.50       | 14.42         | 17.50       | .97           | 23.50       | .58           |
| 5.75        | .78           | 11.75       | 59.61         | 17.75       | .78           | 23.75       | .58           |
| 6.00        | .78           | 12.00       | 7.01          | 18.00       | .97           |             |               |

```

-----
| CALIB |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res. (N)= 3.00
|-----| U.H. Tp(hrs)= .36

```

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



----- TRANSFORMED HYETOGRAPH -----

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .083        | .58           | 6.083       | .97           | 12.083      | 7.01          | 18.08       | .78           |
| .167        | .58           | 6.167       | .97           | 12.167      | 7.01          | 18.17       | .78           |
| .250        | .58           | 6.250       | .97           | 12.250      | 7.01          | 18.25       | .78           |
| .333        | .39           | 6.333       | .78           | 12.333      | 3.70          | 18.33       | .97           |
| .417        | .39           | 6.417       | .78           | 12.417      | 3.70          | 18.42       | .97           |
| .500        | .39           | 6.500       | .78           | 12.500      | 3.70          | 18.50       | .97           |
| .583        | .58           | 6.583       | .97           | 12.583      | 3.51          | 18.58       | .78           |
| .667        | .58           | 6.667       | .97           | 12.667      | 3.51          | 18.67       | .78           |
| .750        | .58           | 6.750       | .97           | 12.750      | 3.51          | 18.75       | .78           |
| .833        | .58           | 6.833       | .97           | 12.833      | 2.73          | 18.83       | .97           |
| .917        | .58           | 6.917       | .97           | 12.917      | 2.73          | 18.92       | .97           |
| 1.000       | .58           | 7.000       | .97           | 13.000      | 2.73          | 19.00       | .97           |
| 1.083       | .58           | 7.083       | 1.17          | 13.083      | 2.53          | 19.08       | .78           |
| 1.167       | .58           | 7.167       | 1.17          | 13.167      | 2.53          | 19.17       | .78           |
| 1.250       | .58           | 7.250       | 1.17          | 13.250      | 2.53          | 19.25       | .78           |
| 1.333       | .39           | 7.333       | .97           | 13.333      | 2.14          | 19.33       | .97           |
| 1.417       | .39           | 7.417       | .97           | 13.417      | 2.14          | 19.42       | .97           |
| 1.500       | .39           | 7.500       | .97           | 13.500      | 2.14          | 19.50       | .97           |
| 1.583       | .58           | 7.583       | 1.17          | 13.583      | 1.95          | 19.58       | .78           |
| 1.667       | .58           | 7.667       | 1.17          | 13.667      | 1.95          | 19.67       | .78           |
| 1.750       | .58           | 7.750       | 1.17          | 13.750      | 1.95          | 19.75       | .78           |
| 1.833       | .58           | 7.833       | 1.17          | 13.833      | 1.56          | 19.83       | .58           |
| 1.917       | .58           | 7.917       | 1.17          | 13.917      | 1.56          | 19.92       | .58           |
| 2.000       | .58           | 8.000       | 1.17          | 14.000      | 1.56          | 20.00       | .58           |
| 2.083       | .78           | 8.083       | 1.36          | 14.083      | 1.36          | 20.08       | .58           |
| 2.167       | .78           | 8.167       | 1.36          | 14.167      | 1.36          | 20.17       | .58           |
| 2.250       | .78           | 8.250       | 1.36          | 14.250      | 1.36          | 20.25       | .58           |
| 2.333       | .58           | 8.333       | 1.36          | 14.333      | 1.56          | 20.33       | .58           |
| 2.417       | .58           | 8.417       | 1.36          | 14.417      | 1.56          | 20.42       | .58           |
| 2.500       | .58           | 8.500       | 1.36          | 14.500      | 1.56          | 20.50       | .58           |
| 2.583       | .58           | 8.583       | 1.36          | 14.583      | 1.36          | 20.58       | .58           |
| 2.667       | .58           | 8.667       | 1.36          | 14.667      | 1.36          | 20.67       | .58           |
| 2.750       | .58           | 8.750       | 1.36          | 14.750      | 1.36          | 20.75       | .58           |
| 2.833       | .58           | 8.833       | 1.56          | 14.833      | 1.56          | 20.83       | .58           |
| 2.917       | .58           | 8.917       | 1.56          | 14.917      | 1.56          | 20.92       | .58           |
| 3.000       | .58           | 9.000       | 1.56          | 15.000      | 1.56          | 21.00       | .58           |
| 3.083       | .78           | 9.083       | 1.56          | 15.083      | 1.36          | 21.08       | .58           |
| 3.167       | .78           | 9.167       | 1.56          | 15.167      | 1.36          | 21.17       | .58           |
| 3.250       | .78           | 9.250       | 1.56          | 15.250      | 1.36          | 21.25       | .58           |
| 3.333       | .58           | 9.333       | 1.75          | 15.333      | 1.56          | 21.33       | .58           |
| 3.417       | .58           | 9.417       | 1.75          | 15.417      | 1.56          | 21.42       | .58           |
| 3.500       | .58           | 9.500       | 1.75          | 15.500      | 1.56          | 21.50       | .58           |
| 3.583       | .58           | 9.583       | 1.75          | 15.583      | 1.36          | 21.58       | .58           |
| 3.667       | .58           | 9.667       | 1.75          | 15.667      | 1.36          | 21.67       | .58           |
| 3.750       | .58           | 9.750       | 1.75          | 15.750      | 1.36          | 21.75       | .58           |
| 3.833       | .78           | 9.833       | 2.14          | 15.833      | .97           | 21.83       | .58           |
| 3.917       | .78           | 9.917       | 2.14          | 15.917      | .97           | 21.92       | .58           |
| 4.000       | .78           | 10.000      | 2.14          | 16.000      | .97           | 22.00       | .58           |
| 4.083       | .78           | 10.083      | 2.34          | 16.083      | .78           | 22.08       | .58           |
| 4.167       | .78           | 10.167      | 2.34          | 16.167      | .78           | 22.17       | .58           |
| 4.250       | .78           | 10.250      | 2.34          | 16.250      | .78           | 22.25       | .58           |
| 4.333       | .78           | 10.333      | 2.92          | 16.333      | .97           | 22.33       | .58           |
| 4.417       | .78           | 10.417      | 2.92          | 16.417      | .97           | 22.42       | .58           |
| 4.500       | .78           | 10.500      | 2.92          | 16.500      | .97           | 22.50       | .58           |
| 4.583       | .78           | 10.583      | 3.12          | 16.583      | .78           | 22.58       | .58           |
| 4.667       | .78           | 10.667      | 3.12          | 16.667      | .78           | 22.67       | .58           |
| 4.750       | .78           | 10.750      | 3.12          | 16.750      | .78           | 22.75       | .58           |
| 4.833       | .78           | 10.833      | 4.68          | 16.833      | .97           | 22.83       | .58           |
| 4.917       | .78           | 10.917      | 4.68          | 16.917      | .97           | 22.92       | .58           |
| 5.000       | .78           | 11.000      | 4.68          | 17.000      | .97           | 23.00       | .58           |
| 5.083       | .78           | 11.083      | 4.68          | 17.083      | .78           | 23.08       | .58           |
| 5.167       | .78           | 11.167      | 4.68          | 17.167      | .78           | 23.17       | .58           |
| 5.250       | .78           | 11.250      | 4.68          | 17.250      | .78           | 23.25       | .58           |
| 5.333       | .78           | 11.333      | 14.41         | 17.333      | .97           | 23.33       | .58           |
| 5.417       | .78           | 11.417      | 14.42         | 17.417      | .97           | 23.42       | .58           |
| 5.500       | .78           | 11.500      | 14.42         | 17.500      | .97           | 23.50       | .58           |
| 5.583       | .78           | 11.583      | 59.60         | 17.583      | .78           | 23.58       | .58           |
| 5.667       | .78           | 11.667      | 59.61         | 17.667      | .78           | 23.67       | .58           |
| 5.750       | .78           | 11.750      | 59.61         | 17.750      | .78           | 23.75       | .58           |
| 5.833       | .78           | 11.833      | 7.02          | 17.833      | .97           |             |               |
| 5.917       | .78           | 11.917      | 7.01          | 17.917      | .97           |             |               |
| 6.000       | .78           | 12.000      | 7.01          | 18.000      | .97           |             |               |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .020 (i)

TIME TO PEAK (hrs)= 12.000

RUNOFF VOLUME (mm)= 7.148

TOTAL RAINFALL (mm)= 48.554

RUNOFF COEFFICIENT = .147

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

```
-----
| CALIB          |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res. (N)= 3.00
|-----|
| U.H. Tp(hrs)= .31
```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .015 (i)  
TIME TO PEAK (hrs)= 11.917  
RUNOFF VOLUME (mm)= 7.147  
TOTAL RAINFALL (mm)= 48.554  
RUNOFF COEFFICIENT = .147

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

```
-----
| CALIB          |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res. (N)= 3.00
|-----|
| U.H. Tp(hrs)= .53
```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .014 (i)  
TIME TO PEAK (hrs)= 12.250  
RUNOFF VOLUME (mm)= 7.149  
TOTAL RAINFALL (mm)= 48.554  
RUNOFF COEFFICIENT = .147

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

```
-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
|-----|
| ID1= 1 (0101): | AREA QPEAK TPEAK R.V.
|                  | (ha) (cms) (hrs) (mm)
| + ID2= 2 (0102): | 1.29 .015 11.92 7.15
|                  | 1.77 .014 12.25 7.15
|=====|
| ID = 3 (0901): | 3.06 .028 12.08 7.15
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
*****
** SIMULATION NUMBER: 2 **
*****
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-----
| MASS STORM      |
|-----|
| Ptotal= 62.00 mm |
|-----|
| Filename: I:\2015 Projects\115
| 185 - Monterra Phase 2 Natural Hazard Assessm
| \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
| Comments: SCS Type II 24 HR MASS CURVE
|
| Duration of storm = 23.75 hrs
| Mass curve time step = 15.00 min
```

| TIME | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|-------|-------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs   | mm/hr |
| .25  | .74   | 6.25  | 1.24  | 12.25 | 8.93  | 18.25 | .99   |
| .50  | .50   | 6.50  | .99   | 12.50 | 4.71  | 18:50 | 1.24  |
| .75  | .74   | 6.75  | 1.24  | 12.75 | 4.46  | 18.75 | .99   |
| 1.00 | .74   | 7.00  | 1.24  | 13.00 | 3.47  | 19.00 | 1.24  |
| 1.25 | .74   | 7.25  | 1.49  | 13.25 | 3.22  | 19.25 | .99   |
| 1.50 | .50   | 7.50  | 1.24  | 13.50 | 2.73  | 19.50 | 1.24  |
| 1.75 | .74   | 7.75  | 1.49  | 13.75 | 2.48  | 19.75 | .99   |
| 2.00 | .74   | 8.00  | 1.49  | 14.00 | 1.98  | 20.00 | .74   |
| 2.25 | .99   | 8.25  | 1.74  | 14.25 | 1.74  | 20.25 | .74   |
| 2.50 | .74   | 8.50  | 1.74  | 14.50 | 1.98  | 20.50 | .74   |
| 2.75 | .74   | 8.75  | 1.74  | 14.75 | 1.74  | 20.75 | .74   |
| 3.00 | .74   | 9.00  | 1.98  | 15.00 | 1.98  | 21.00 | .74   |
| 3.25 | .99   | 9.25  | 1.98  | 15.25 | 1.74  | 21.25 | .74   |
| 3.50 | .74   | 9.50  | 2.23  | 15.50 | 1.98  | 21.50 | .74   |
| 3.75 | .74   | 9.75  | 2.23  | 15.75 | 1.74  | 21.75 | .74   |
| 4.00 | .99   | 10.00 | 2.73  | 16.00 | 1.24  | 22.00 | .74   |
| 4.25 | .99   | 10.25 | 2.98  | 16.25 | .99   | 22.25 | .74   |
| 4.50 | .99   | 10.50 | 3.72  | 16.50 | 1.24  | 22.50 | .74   |
| 4.75 | .99   | 10.75 | 3.97  | 16.75 | .99   | 22.75 | .74   |
| 5.00 | .99   | 11.00 | 5.95  | 17.00 | 1.24  | 23.00 | .74   |

|      |     |       |       |       |      |       |     |
|------|-----|-------|-------|-------|------|-------|-----|
| 5.25 | .99 | 11.25 | 5.95  | 17.25 | .99  | 23.25 | .74 |
| 5.50 | .99 | 11.50 | 18.35 | 17.50 | 1.24 | 23.50 | .74 |
| 5.75 | .99 | 11.75 | 75.89 | 17.75 | .99  | 23.75 | .74 |
| 6.00 | .99 | 12.00 | 8.93  | 18.00 | 1.24 |       |     |

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| CALIB          |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .36

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

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----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|--------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .74   | 6.083  | 1.24  | 12.083 | 8.93  | 18.08 | .99   |
| .167  | .74   | 6.167  | 1.24  | 12.167 | 8.93  | 18.17 | .99   |
| .250  | .74   | 6.250  | 1.24  | 12.250 | 8.93  | 18.25 | .99   |
| .333  | .50   | 6.333  | .99   | 12.333 | 4.71  | 18.33 | 1.24  |
| .417  | .50   | 6.417  | .99   | 12.417 | 4.71  | 18.42 | 1.24  |
| .500  | .50   | 6.500  | .99   | 12.500 | 4.71  | 18.50 | 1.24  |
| .583  | .74   | 6.583  | 1.24  | 12.583 | 4.46  | 18.58 | .99   |
| .667  | .74   | 6.667  | 1.24  | 12.667 | 4.46  | 18.67 | .99   |
| .750  | .74   | 6.750  | 1.24  | 12.750 | 4.46  | 18.75 | .99   |
| .833  | .74   | 6.833  | 1.24  | 12.833 | 3.47  | 18.83 | 1.24  |
| .917  | .74   | 6.917  | 1.24  | 12.917 | 3.47  | 18.92 | 1.24  |
| 1.000 | .74   | 7.000  | 1.24  | 13.000 | 3.47  | 19.00 | 1.24  |
| 1.083 | .74   | 7.083  | 1.49  | 13.083 | 3.22  | 19.08 | .99   |
| 1.167 | .74   | 7.167  | 1.49  | 13.167 | 3.22  | 19.17 | .99   |
| 1.250 | .74   | 7.250  | 1.49  | 13.250 | 3.22  | 19.25 | .99   |
| 1.333 | .50   | 7.333  | 1.24  | 13.333 | 2.73  | 19.33 | 1.24  |
| 1.417 | .50   | 7.417  | 1.24  | 13.417 | 2.73  | 19.42 | 1.24  |
| 1.500 | .50   | 7.500  | 1.24  | 13.500 | 2.73  | 19.50 | 1.24  |
| 1.583 | .74   | 7.583  | 1.49  | 13.583 | 2.48  | 19.58 | .99   |
| 1.667 | .74   | 7.667  | 1.49  | 13.667 | 2.48  | 19.67 | .99   |
| 1.750 | .74   | 7.750  | 1.49  | 13.750 | 2.48  | 19.75 | .99   |
| 1.833 | .74   | 7.833  | 1.49  | 13.833 | 1.98  | 19.83 | .74   |
| 1.917 | .74   | 7.917  | 1.49  | 13.917 | 1.98  | 19.92 | .74   |
| 2.000 | .74   | 8.000  | 1.49  | 14.000 | 1.98  | 20.00 | .74   |
| 2.083 | .99   | 8.083  | 1.74  | 14.083 | 1.74  | 20.08 | .74   |
| 2.167 | .99   | 8.167  | 1.74  | 14.167 | 1.74  | 20.17 | .74   |
| 2.250 | .99   | 8.250  | 1.74  | 14.250 | 1.74  | 20.25 | .74   |
| 2.333 | .74   | 8.333  | 1.74  | 14.333 | 1.98  | 20.33 | .74   |
| 2.417 | .74   | 8.417  | 1.74  | 14.417 | 1.98  | 20.42 | .74   |
| 2.500 | .74   | 8.500  | 1.74  | 14.500 | 1.98  | 20.50 | .74   |
| 2.583 | .74   | 8.583  | 1.74  | 14.583 | 1.74  | 20.58 | .74   |
| 2.667 | .74   | 8.667  | 1.74  | 14.667 | 1.74  | 20.67 | .74   |
| 2.750 | .74   | 8.750  | 1.74  | 14.750 | 1.74  | 20.75 | .74   |
| 2.833 | .74   | 8.833  | 1.98  | 14.833 | 1.98  | 20.83 | .74   |
| 2.917 | .74   | 8.917  | 1.98  | 14.917 | 1.98  | 20.92 | .74   |
| 3.000 | .74   | 9.000  | 1.98  | 15.000 | 1.98  | 21.00 | .74   |
| 3.083 | .99   | 9.083  | 1.98  | 15.083 | 1.74  | 21.08 | .74   |
| 3.167 | .99   | 9.167  | 1.98  | 15.167 | 1.74  | 21.17 | .74   |
| 3.250 | .99   | 9.250  | 1.98  | 15.250 | 1.74  | 21.25 | .74   |
| 3.333 | .74   | 9.333  | 2.23  | 15.333 | 1.98  | 21.33 | .74   |
| 3.417 | .74   | 9.417  | 2.23  | 15.417 | 1.98  | 21.42 | .74   |
| 3.500 | .74   | 9.500  | 2.23  | 15.500 | 1.98  | 21.50 | .74   |
| 3.583 | .74   | 9.583  | 2.23  | 15.583 | 1.74  | 21.58 | .74   |
| 3.667 | .74   | 9.667  | 2.23  | 15.667 | 1.74  | 21.67 | .74   |
| 3.750 | .74   | 9.750  | 2.23  | 15.750 | 1.74  | 21.75 | .74   |
| 3.833 | .99   | 9.833  | 2.73  | 15.833 | 1.24  | 21.83 | .74   |
| 3.917 | .99   | 9.917  | 2.73  | 15.917 | 1.24  | 21.92 | .74   |
| 4.000 | .99   | 10.000 | 2.73  | 16.000 | 1.24  | 22.00 | .74   |
| 4.083 | .99   | 10.083 | 2.98  | 16.083 | .99   | 22.08 | .74   |
| 4.167 | .99   | 10.167 | 2.98  | 16.167 | .99   | 22.17 | .74   |
| 4.250 | .99   | 10.250 | 2.98  | 16.250 | .99   | 22.25 | .74   |
| 4.333 | .99   | 10.333 | 3.72  | 16.333 | 1.24  | 22.33 | .74   |
| 4.417 | .99   | 10.417 | 3.72  | 16.417 | 1.24  | 22.42 | .74   |
| 4.500 | .99   | 10.500 | 3.72  | 16.500 | 1.24  | 22.50 | .74   |
| 4.583 | .99   | 10.583 | 3.97  | 16.583 | .99   | 22.58 | .74   |
| 4.667 | .99   | 10.667 | 3.97  | 16.667 | .99   | 22.67 | .74   |
| 4.750 | .99   | 10.750 | 3.97  | 16.750 | .99   | 22.75 | .74   |
| 4.833 | .99   | 10.833 | 5.95  | 16.833 | 1.24  | 22.83 | .74   |
| 4.917 | .99   | 10.917 | 5.95  | 16.917 | 1.24  | 22.92 | .74   |
| 5.000 | .99   | 11.000 | 5.95  | 17.000 | 1.24  | 23.00 | .74   |
| 5.083 | .99   | 11.083 | 5.95  | 17.083 | .99   | 23.08 | .74   |
| 5.167 | .99   | 11.167 | 5.95  | 17.167 | .99   | 23.17 | .74   |
| 5.250 | .99   | 11.250 | 5.95  | 17.250 | .99   | 23.25 | .74   |
| 5.333 | .99   | 11.333 | 18.35 | 17.333 | 1.24  | 23.33 | .74   |
| 5.417 | .99   | 11.417 | 18.35 | 17.417 | 1.24  | 23.42 | .74   |
| 5.500 | .99   | 11.500 | 18.35 | 17.500 | 1.24  | 23.50 | .74   |
| 5.583 | .99   | 11.583 | 75.88 | 17.583 | .99   | 23.58 | .74   |

|       |     |        |       |        |      |       |     |
|-------|-----|--------|-------|--------|------|-------|-----|
| 5.667 | .99 | 11.667 | 75.89 | 17.667 | .99  | 23.67 | .74 |
| 5.750 | .99 | 11.750 | 75.89 | 17.750 | .99  | 23.75 | .74 |
| 5.833 | .99 | 11.833 | 8.94  | 17.833 | 1.24 |       |     |
| 5.917 | .99 | 11.917 | 8.93  | 17.917 | 1.24 |       |     |
| 6.000 | .99 | 12.000 | 8.93  | 18.000 | 1.24 |       |     |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .036 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 12.137  
 TOTAL RAINFALL (mm)= 61.814  
 RUNOFF COEFFICIENT = .196

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

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-----
| CALIB |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .31
  
```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .027 (i)  
 TIME TO PEAK (hrs)= 11.917  
 RUNOFF VOLUME (mm)= 12.135  
 TOTAL RAINFALL (mm)= 61.814  
 RUNOFF COEFFICIENT = .196

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

```

-----
| CALIB |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .53
  
```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .025 (i)  
 TIME TO PEAK (hrs)= 12.250  
 RUNOFF VOLUME (mm)= 12.139  
 TOTAL RAINFALL (mm)= 61.814  
 RUNOFF COEFFICIENT = .196

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
|-----|
| ID1= 1 (0101): | AREA QPEAK TPEAK R.V.
|                  | (ha) (cms) (hrs) (mm)
| + ID2= 2 (0102): | 1.29 .027 11.92 12.14
|                  | 1.77 .025 12.25 12.14
|=====|
| ID = 3 (0901): | 3.06 .049 12.00 12.14
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

-----
| MASS STORM |
|           |
|           |
| Ptotal= 70.90 mm |
|-----|
|           |
|           |
|           |
  
```

Filename: I:\2015 Projects\115  
 185 - Monterra Phase 2 Natural Hazard Assessm  
 \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS  
 Comments: SCS Type II 24 HR MASS CURVE

Duration of storm = 23.75 hrs  
 Mass curve time step = 15.00 min

| TIME | RAIN  | TIME | RAIN  | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|------|-------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs   | mm/hr | hrs   | mm/hr |
| .25  | .85   | 6.25 | 1.42  | 12.25 | 10.21 | 18.25 | 1.13  |
| .50  | .57   | 6.50 | 1.13  | 12.50 | 5.39  | 18.50 | 1.42  |
| .75  | .85   | 6.75 | 1.42  | 12.75 | 5.10  | 18.75 | 1.13  |
| 1.00 | .85   | 7.00 | 1.42  | 13.00 | 3.97  | 19.00 | 1.42  |
| 1.25 | .85   | 7.25 | 1.70  | 13.25 | 3.69  | 19.25 | 1.13  |
| 1.50 | .57   | 7.50 | 1.42  | 13.50 | 3.12  | 19.50 | 1.42  |

|      |      |       |       |       |      |       |      |
|------|------|-------|-------|-------|------|-------|------|
| 1.75 | .85  | 7.75  | 1.70  | 13.75 | 2.84 | 19.75 | 1.13 |
| 2.00 | .85  | 8.00  | 1.70  | 14.00 | 2.27 | 20.00 | .85  |
| 2.25 | 1.13 | 8.25  | 1.99  | 14.25 | 1.99 | 20.25 | .85  |
| 2.50 | .85  | 8.50  | 1.99  | 14.50 | 2.27 | 20.50 | .85  |
| 2.75 | .85  | 8.75  | 1.99  | 14.75 | 1.99 | 20.75 | .85  |
| 3.00 | .85  | 9.00  | 2.27  | 15.00 | 2.27 | 21.00 | .85  |
| 3.25 | 1.13 | 9.25  | 2.27  | 15.25 | 1.99 | 21.25 | .85  |
| 3.50 | .85  | 9.50  | 2.55  | 15.50 | 2.27 | 21.50 | .85  |
| 3.75 | .85  | 9.75  | 2.55  | 15.75 | 1.99 | 21.75 | .85  |
| 4.00 | 1.13 | 10.00 | 3.12  | 16.00 | 1.42 | 22.00 | .85  |
| 4.25 | 1.13 | 10.25 | 3.40  | 16.25 | 1.13 | 22.25 | .85  |
| 4.50 | 1.13 | 10.50 | 4.25  | 16.50 | 1.42 | 22.50 | .85  |
| 4.75 | 1.13 | 10.75 | 4.54  | 16.75 | 1.13 | 22.75 | .85  |
| 5.00 | 1.13 | 11.00 | 6.81  | 17.00 | 1.42 | 23.00 | .85  |
| 5.25 | 1.13 | 11.25 | 6.81  | 17.25 | 1.13 | 23.25 | .85  |
| 5.50 | 1.13 | 11.50 | 20.99 | 17.50 | 1.42 | 23.50 | .85  |
| 5.75 | 1.13 | 11.75 | 86.78 | 17.75 | 1.13 | 23.75 | .85  |
| 6.00 | 1.13 | 12.00 | 10.21 | 18.00 | 1.42 |       |      |

```

-----
| CALIB |
| NASHYD (0103) | Area (ha)= 1.87 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .36

```

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|--------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .85   | 6.083  | 1.42  | 12.083 | 10.21 | 18.08 | 1.13  |
| .167  | .85   | 6.167  | 1.42  | 12.167 | 10.21 | 18.17 | 1.13  |
| .250  | .85   | 6.250  | 1.42  | 12.250 | 10.21 | 18.25 | 1.13  |
| .333  | .57   | 6.333  | 1.13  | 12.333 | 5.39  | 18.33 | 1.42  |
| .417  | .57   | 6.417  | 1.13  | 12.417 | 5.39  | 18.42 | 1.42  |
| .500  | .57   | 6.500  | 1.13  | 12.500 | 5.39  | 18.50 | 1.42  |
| .583  | .85   | 6.583  | 1.42  | 12.583 | 5.10  | 18.58 | 1.13  |
| .667  | .85   | 6.667  | 1.42  | 12.667 | 5.10  | 18.67 | 1.13  |
| .750  | .85   | 6.750  | 1.42  | 12.750 | 5.10  | 18.75 | 1.13  |
| .833  | .85   | 6.833  | 1.42  | 12.833 | 3.97  | 18.83 | 1.42  |
| .917  | .85   | 6.917  | 1.42  | 12.917 | 3.97  | 18.92 | 1.42  |
| 1.000 | .85   | 7.000  | 1.42  | 13.000 | 3.97  | 19.00 | 1.42  |
| 1.083 | .85   | 7.083  | 1.70  | 13.083 | 3.69  | 19.08 | 1.13  |
| 1.167 | .85   | 7.167  | 1.70  | 13.167 | 3.69  | 19.17 | 1.13  |
| 1.250 | .85   | 7.250  | 1.70  | 13.250 | 3.69  | 19.25 | 1.13  |
| 1.333 | .57   | 7.333  | 1.42  | 13.333 | 3.12  | 19.33 | 1.42  |
| 1.417 | .57   | 7.417  | 1.42  | 13.417 | 3.12  | 19.42 | 1.42  |
| 1.500 | .57   | 7.500  | 1.42  | 13.500 | 3.12  | 19.50 | 1.42  |
| 1.583 | .85   | 7.583  | 1.70  | 13.583 | 2.84  | 19.58 | 1.13  |
| 1.667 | .85   | 7.667  | 1.70  | 13.667 | 2.84  | 19.67 | 1.13  |
| 1.750 | .85   | 7.750  | 1.70  | 13.750 | 2.84  | 19.75 | 1.13  |
| 1.833 | .85   | 7.833  | 1.70  | 13.833 | 2.27  | 19.83 | .85   |
| 1.917 | .85   | 7.917  | 1.70  | 13.917 | 2.27  | 19.92 | .85   |
| 2.000 | .85   | 8.000  | 1.70  | 14.000 | 2.27  | 20.00 | .85   |
| 2.083 | 1.13  | 8.083  | 1.99  | 14.083 | 1.99  | 20.08 | .85   |
| 2.167 | 1.13  | 8.167  | 1.99  | 14.167 | 1.99  | 20.17 | .85   |
| 2.250 | 1.13  | 8.250  | 1.99  | 14.250 | 1.99  | 20.25 | .85   |
| 2.333 | .85   | 8.333  | 1.99  | 14.333 | 2.27  | 20.33 | .85   |
| 2.417 | .85   | 8.417  | 1.99  | 14.417 | 2.27  | 20.42 | .85   |
| 2.500 | .85   | 8.500  | 1.99  | 14.500 | 2.27  | 20.50 | .85   |
| 2.583 | .85   | 8.583  | 1.99  | 14.583 | 1.99  | 20.58 | .85   |
| 2.667 | .85   | 8.667  | 1.99  | 14.667 | 1.99  | 20.67 | .85   |
| 2.750 | .85   | 8.750  | 1.99  | 14.750 | 1.99  | 20.75 | .85   |
| 2.833 | .85   | 8.833  | 2.27  | 14.833 | 2.27  | 20.83 | .85   |
| 2.917 | .85   | 8.917  | 2.27  | 14.917 | 2.27  | 20.92 | .85   |
| 3.000 | .85   | 9.000  | 2.27  | 15.000 | 2.27  | 21.00 | .85   |
| 3.083 | 1.13  | 9.083  | 2.27  | 15.083 | 1.99  | 21.08 | .85   |
| 3.167 | 1.13  | 9.167  | 2.27  | 15.167 | 1.99  | 21.17 | .85   |
| 3.250 | 1.13  | 9.250  | 2.27  | 15.250 | 1.99  | 21.25 | .85   |
| 3.333 | .85   | 9.333  | 2.55  | 15.333 | 2.27  | 21.33 | .85   |
| 3.417 | .85   | 9.417  | 2.55  | 15.417 | 2.27  | 21.42 | .85   |
| 3.500 | .85   | 9.500  | 2.55  | 15.500 | 2.27  | 21.50 | .85   |
| 3.583 | .85   | 9.583  | 2.55  | 15.583 | 1.99  | 21.58 | .85   |
| 3.667 | .85   | 9.667  | 2.55  | 15.667 | 1.99  | 21.67 | .85   |
| 3.750 | .85   | 9.750  | 2.55  | 15.750 | 1.99  | 21.75 | .85   |
| 3.833 | 1.13  | 9.833  | 3.12  | 15.833 | 1.42  | 21.83 | .85   |
| 3.917 | 1.13  | 9.917  | 3.12  | 15.917 | 1.42  | 21.92 | .85   |
| 4.000 | 1.13  | 10.000 | 3.12  | 16.000 | 1.42  | 22.00 | .85   |
| 4.083 | 1.13  | 10.083 | 3.40  | 16.083 | 1.13  | 22.08 | .85   |
| 4.167 | 1.13  | 10.167 | 3.40  | 16.167 | 1.13  | 22.17 | .85   |
| 4.250 | 1.13  | 10.250 | 3.40  | 16.250 | 1.13  | 22.25 | .85   |
| 4.333 | 1.13  | 10.333 | 4.25  | 16.333 | 1.42  | 22.33 | .85   |
| 4.417 | 1.13  | 10.417 | 4.25  | 16.417 | 1.42  | 22.42 | .85   |

|       |      |        |       |        |      |       |     |
|-------|------|--------|-------|--------|------|-------|-----|
| 4.500 | 1.13 | 10.500 | 4.25  | 16.500 | 1.42 | 22.50 | .85 |
| 4.583 | 1.13 | 10.583 | 4.54  | 16.583 | 1.13 | 22.58 | .85 |
| 4.667 | 1.13 | 10.667 | 4.54  | 16.667 | 1.13 | 22.67 | .85 |
| 4.750 | 1.13 | 10.750 | 4.54  | 16.750 | 1.13 | 22.75 | .85 |
| 4.833 | 1.13 | 10.833 | 6.81  | 16.833 | 1.42 | 22.83 | .85 |
| 4.917 | 1.13 | 10.917 | 6.81  | 16.917 | 1.42 | 22.92 | .85 |
| 5.000 | 1.13 | 11.000 | 6.81  | 17.000 | 1.42 | 23.00 | .85 |
| 5.083 | 1.13 | 11.083 | 6.81  | 17.083 | 1.13 | 23.08 | .85 |
| 5.167 | 1.13 | 11.167 | 6.81  | 17.167 | 1.13 | 23.17 | .85 |
| 5.250 | 1.13 | 11.250 | 6.81  | 17.250 | 1.13 | 23.25 | .85 |
| 5.333 | 1.13 | 11.333 | 20.99 | 17.333 | 1.42 | 23.33 | .85 |
| 5.417 | 1.13 | 11.417 | 20.99 | 17.417 | 1.42 | 23.42 | .85 |
| 5.500 | 1.13 | 11.500 | 20.99 | 17.500 | 1.42 | 23.50 | .85 |
| 5.583 | 1.13 | 11.583 | 86.78 | 17.583 | 1.13 | 23.58 | .85 |
| 5.667 | 1.13 | 11.667 | 86.78 | 17.667 | 1.13 | 23.67 | .85 |
| 5.750 | 1.13 | 11.750 | 86.78 | 17.750 | 1.13 | 23.75 | .85 |
| 5.833 | 1.13 | 11.833 | 10.22 | 17.833 | 1.42 |       |     |
| 5.917 | 1.13 | 11.917 | 10.21 | 17.917 | 1.42 |       |     |
| 6.000 | 1.13 | 12.000 | 10.21 | 18.000 | 1.42 |       |     |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .048 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 16.008  
 TOTAL RAINFALL (mm)= 70.687  
 RUNOFF COEFFICIENT = .226

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

```

-----
| CALIB          |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .037 (i)  
 TIME TO PEAK (hrs)= 11.917  
 RUNOFF VOLUME (mm)= 16.005  
 TOTAL RAINFALL (mm)= 70.687  
 RUNOFF COEFFICIENT = .226

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

```

-----
| CALIB          |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .53

```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .034 (i)  
 TIME TO PEAK (hrs)= 12.250  
 RUNOFF VOLUME (mm)= 16.010  
 TOTAL RAINFALL (mm)= 70.687  
 RUNOFF COEFFICIENT = .226

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3      |
-----
| ID1= 1 (0101): | AREA QPEAK TPEAK R.V.
| + ID2= 2 (0102): | (ha) (cms) (hrs) (mm)
| ID = 3 (0901): | 1.29 .037 11.92 16.01
|                  | 1.77 .034 12.25 16.01
|                  | =====
|                  | 3.06 .067 12.00 16.01

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| MASS STORM      | Filename: I:\2015 Projects\115
|                  | 185 - Monterra Phase 2 Natural Hazard Assessm

```

|  
| Ptotal= 82.00 mm |  
-----

\Design\Hydrology\115185 vo2\STORMS\SCS24H.MS  
Comments: SCS Type II 24 HR MASS CURVE

Duration of storm = 23.75 hrs  
Mass curve time step = 15.00 min

| TIME | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|-------|--------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs   | mm/hr |
| .25  | .98   | 6.25  | 1.64   | 12.25 | 11.81 | 18.25 | 1.31  |
| .50  | .66   | 6.50  | 1.31   | 12.50 | 6.23  | 18.50 | 1.64  |
| .75  | .98   | 6.75  | 1.64   | 12.75 | 5.90  | 18.75 | 1.31  |
| 1.00 | .98   | 7.00  | 1.64   | 13.00 | 4.59  | 19.00 | 1.64  |
| 1.25 | .98   | 7.25  | 1.97   | 13.25 | 4.26  | 19.25 | 1.31  |
| 1.50 | .66   | 7.50  | 1.64   | 13.50 | 3.61  | 19.50 | 1.64  |
| 1.75 | .98   | 7.75  | 1.97   | 13.75 | 3.28  | 19.75 | 1.31  |
| 2.00 | .98   | 8.00  | 1.97   | 14.00 | 2.62  | 20.00 | .98   |
| 2.25 | 1.31  | 8.25  | 2.30   | 14.25 | 2.30  | 20.25 | .98   |
| 2.50 | .98   | 8.50  | 2.30   | 14.50 | 2.62  | 20.50 | .98   |
| 2.75 | .98   | 8.75  | 2.30   | 14.75 | 2.30  | 20.75 | .98   |
| 3.00 | .98   | 9.00  | 2.62   | 15.00 | 2.62  | 21.00 | .98   |
| 3.25 | 1.31  | 9.25  | 2.62   | 15.25 | 2.30  | 21.25 | .98   |
| 3.50 | .98   | 9.50  | 2.95   | 15.50 | 2.62  | 21.50 | .98   |
| 3.75 | .98   | 9.75  | 2.95   | 15.75 | 2.30  | 21.75 | .98   |
| 4.00 | 1.31  | 10.00 | 3.61   | 16.00 | 1.64  | 22.00 | .98   |
| 4.25 | 1.31  | 10.25 | 3.94   | 16.25 | 1.31  | 22.25 | .98   |
| 4.50 | 1.31  | 10.50 | 4.92   | 16.50 | 1.64  | 22.50 | .98   |
| 4.75 | 1.31  | 10.75 | 5.25   | 16.75 | 1.31  | 22.75 | .98   |
| 5.00 | 1.31  | 11.00 | 7.87   | 17.00 | 1.64  | 23.00 | .98   |
| 5.25 | 1.31  | 11.25 | 7.87   | 17.25 | 1.31  | 23.25 | .98   |
| 5.50 | 1.31  | 11.50 | 24.27  | 17.50 | 1.64  | 23.50 | .98   |
| 5.75 | 1.31  | 11.75 | 100.37 | 17.75 | 1.31  | 23.75 | .98   |
| 6.00 | 1.31  | 12.00 | 11.81  | 18.00 | 1.64  |       |       |

-----  
| CALIB  
| NASHYD (0103)  
| ID= 1 DT= 5.0 min |  
-----

Area (ha)= 1.87 Curve Number (CN)= 60.0  
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00  
U.H. Tp(hrs)= .36

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|-------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .98   | 6.083 | 1.64  | 12.083 | 11.81 | 18.08 | 1.31  |
| .167  | .98   | 6.167 | 1.64  | 12.167 | 11.81 | 18.17 | 1.31  |
| .250  | .98   | 6.250 | 1.64  | 12.250 | 11.81 | 18.25 | 1.31  |
| .333  | .66   | 6.333 | 1.31  | 12.333 | 6.23  | 18.33 | 1.64  |
| .417  | .66   | 6.417 | 1.31  | 12.417 | 6.23  | 18.42 | 1.64  |
| .500  | .66   | 6.500 | 1.31  | 12.500 | 6.23  | 18.50 | 1.64  |
| .583  | .98   | 6.583 | 1.64  | 12.583 | 5.90  | 18.58 | 1.31  |
| .667  | .98   | 6.667 | 1.64  | 12.667 | 5.90  | 18.67 | 1.31  |
| .750  | .98   | 6.750 | 1.64  | 12.750 | 5.90  | 18.75 | 1.31  |
| .833  | .98   | 6.833 | 1.64  | 12.833 | 4.59  | 18.83 | 1.64  |
| .917  | .98   | 6.917 | 1.64  | 12.917 | 4.59  | 18.92 | 1.64  |
| 1.000 | .98   | 7.000 | 1.64  | 13.000 | 4.59  | 19.00 | 1.64  |
| 1.083 | .98   | 7.083 | 1.97  | 13.083 | 4.26  | 19.08 | 1.31  |
| 1.167 | .98   | 7.167 | 1.97  | 13.167 | 4.26  | 19.17 | 1.31  |
| 1.250 | .98   | 7.250 | 1.97  | 13.250 | 4.26  | 19.25 | 1.31  |
| 1.333 | .66   | 7.333 | 1.64  | 13.333 | 3.61  | 19.33 | 1.64  |
| 1.417 | .66   | 7.417 | 1.64  | 13.417 | 3.61  | 19.42 | 1.64  |
| 1.500 | .66   | 7.500 | 1.64  | 13.500 | 3.61  | 19.50 | 1.64  |
| 1.583 | .98   | 7.583 | 1.97  | 13.583 | 3.28  | 19.58 | 1.31  |
| 1.667 | .98   | 7.667 | 1.97  | 13.667 | 3.28  | 19.67 | 1.31  |
| 1.750 | .98   | 7.750 | 1.97  | 13.750 | 3.28  | 19.75 | 1.31  |
| 1.833 | .98   | 7.833 | 1.97  | 13.833 | 2.62  | 19.83 | .98   |
| 1.917 | .98   | 7.917 | 1.97  | 13.917 | 2.62  | 19.92 | .98   |
| 2.000 | .98   | 8.000 | 1.97  | 14.000 | 2.62  | 20.00 | .98   |
| 2.083 | 1.31  | 8.083 | 2.30  | 14.083 | 2.30  | 20.08 | .98   |
| 2.167 | 1.31  | 8.167 | 2.30  | 14.167 | 2.30  | 20.17 | .98   |
| 2.250 | 1.31  | 8.250 | 2.30  | 14.250 | 2.30  | 20.25 | .98   |
| 2.333 | .98   | 8.333 | 2.30  | 14.333 | 2.62  | 20.33 | .98   |
| 2.417 | .98   | 8.417 | 2.30  | 14.417 | 2.62  | 20.42 | .98   |
| 2.500 | .98   | 8.500 | 2.30  | 14.500 | 2.62  | 20.50 | .98   |
| 2.583 | .98   | 8.583 | 2.30  | 14.583 | 2.30  | 20.58 | .98   |
| 2.667 | .98   | 8.667 | 2.30  | 14.667 | 2.30  | 20.67 | .98   |
| 2.750 | .98   | 8.750 | 2.30  | 14.750 | 2.30  | 20.75 | .98   |
| 2.833 | .98   | 8.833 | 2.62  | 14.833 | 2.62  | 20.83 | .98   |
| 2.917 | .98   | 8.917 | 2.62  | 14.917 | 2.62  | 20.92 | .98   |
| 3.000 | .98   | 9.000 | 2.62  | 15.000 | 2.62  | 21.00 | .98   |
| 3.083 | 1.31  | 9.083 | 2.62  | 15.083 | 2.30  | 21.08 | .98   |
| 3.167 | 1.31  | 9.167 | 2.62  | 15.167 | 2.30  | 21.17 | .98   |
| 3.250 | 1.31  | 9.250 | 2.62  | 15.250 | 2.30  | 21.25 | .98   |

|       |      |        |        |        |      |       |     |
|-------|------|--------|--------|--------|------|-------|-----|
| 3.333 | .98  | 9.333  | 2.95   | 15.333 | 2.62 | 21.33 | .98 |
| 3.417 | .98  | 9.417  | 2.95   | 15.417 | 2.62 | 21.42 | .98 |
| 3.500 | .98  | 9.500  | 2.95   | 15.500 | 2.62 | 21.50 | .98 |
| 3.583 | .98  | 9.583  | 2.95   | 15.583 | 2.30 | 21.58 | .98 |
| 3.667 | .98  | 9.667  | 2.95   | 15.667 | 2.30 | 21.67 | .98 |
| 3.750 | .98  | 9.750  | 2.95   | 15.750 | 2.30 | 21.75 | .98 |
| 3.833 | 1.31 | 9.833  | 3.61   | 15.833 | 1.64 | 21.83 | .98 |
| 3.917 | 1.31 | 9.917  | 3.61   | 15.917 | 1.64 | 21.92 | .98 |
| 4.000 | 1.31 | 10.000 | 3.61   | 16.000 | 1.64 | 22.00 | .98 |
| 4.083 | 1.31 | 10.083 | 3.94   | 16.083 | 1.31 | 22.08 | .98 |
| 4.167 | 1.31 | 10.167 | 3.94   | 16.167 | 1.31 | 22.17 | .98 |
| 4.250 | 1.31 | 10.250 | 3.94   | 16.250 | 1.31 | 22.25 | .98 |
| 4.333 | 1.31 | 10.333 | 4.92   | 16.333 | 1.64 | 22.33 | .98 |
| 4.417 | 1.31 | 10.417 | 4.92   | 16.417 | 1.64 | 22.42 | .98 |
| 4.500 | 1.31 | 10.500 | 4.92   | 16.500 | 1.64 | 22.50 | .98 |
| 4.583 | 1.31 | 10.583 | 5.25   | 16.583 | 1.31 | 22.58 | .98 |
| 4.667 | 1.31 | 10.667 | 5.25   | 16.667 | 1.31 | 22.67 | .98 |
| 4.750 | 1.31 | 10.750 | 5.25   | 16.750 | 1.31 | 22.75 | .98 |
| 4.833 | 1.31 | 10.833 | 7.87   | 16.833 | 1.64 | 22.83 | .98 |
| 4.917 | 1.31 | 10.917 | 7.87   | 16.917 | 1.64 | 22.92 | .98 |
| 5.000 | 1.31 | 11.000 | 7.87   | 17.000 | 1.64 | 23.00 | .98 |
| 5.083 | 1.31 | 11.083 | 7.87   | 17.083 | 1.31 | 23.08 | .98 |
| 5.167 | 1.31 | 11.167 | 7.87   | 17.167 | 1.31 | 23.17 | .98 |
| 5.250 | 1.31 | 11.250 | 7.87   | 17.250 | 1.31 | 23.25 | .98 |
| 5.333 | 1.31 | 11.333 | 24.27  | 17.333 | 1.64 | 23.33 | .98 |
| 5.417 | 1.31 | 11.417 | 24.27  | 17.417 | 1.64 | 23.42 | .98 |
| 5.500 | 1.31 | 11.500 | 24.27  | 17.500 | 1.64 | 23.50 | .98 |
| 5.583 | 1.31 | 11.583 | 100.36 | 17.583 | 1.31 | 23.58 | .98 |
| 5.667 | 1.31 | 11.667 | 100.37 | 17.667 | 1.31 | 23.67 | .98 |
| 5.750 | 1.31 | 11.750 | 100.37 | 17.750 | 1.31 | 23.75 | .98 |
| 5.833 | 1.31 | 11.833 | 11.82  | 17.833 | 1.64 |       |     |
| 5.917 | 1.31 | 11.917 | 11.81  | 17.917 | 1.64 |       |     |
| 6.000 | 1.31 | 12.000 | 11.81  | 18.000 | 1.64 |       |     |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .065 (i)

TIME TO PEAK (hrs)= 12.000

RUNOFF VOLUME (mm)= 21.352

TOTAL RAINFALL (mm)= 81.754

RUNOFF COEFFICIENT = .261

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

```

-----
| CALIB |
| NASHYD (0101) | Area (ha)= 1.29 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .050 (i)

TIME TO PEAK (hrs)= 11.917

RUNOFF VOLUME (mm)= 21.348

TOTAL RAINFALL (mm)= 81.754

RUNOFF COEFFICIENT = .261

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

```

-----
| CALIB |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .53

```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .046 (i)

TIME TO PEAK (hrs)= 12.167

RUNOFF VOLUME (mm)= 21.354

TOTAL RAINFALL (mm)= 81.754

RUNOFF COEFFICIENT = .261

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
|-----| (ha) (cms) (hrs) (mm)
ID1= 1 (0101): 1.29 .050 11.92 21.35

```



```

+ ID2= 2 (0102):      1.77      .046      12.17      21.35
=====
ID = 3 (0901):      3.06      .090      12.00      21.35

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| MASS STORM          |      Filename: I:\2015 Projects\115
|                     |      185 - Monterra Phase 2 Natural Hazard Assessm
|                     |      \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
| Ptotal= 90.30 mm   |      Comments: SCS Type II 24 HR MASS CURVE
-----

Duration of storm      = 23.75 hrs
Mass curve time step   = 15.00 min

```

| TIME | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|-------|--------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs   | mm/hr |
| .25  | 1.08  | 6.25  | 1.81   | 12.25 | 13.00 | 18.25 | 1.44  |
| .50  | .72   | 6.50  | 1.44   | 12.50 | 6.86  | 18.50 | 1.81  |
| .75  | 1.08  | 6.75  | 1.81   | 12.75 | 6.50  | 18.75 | 1.44  |
| 1.00 | 1.08  | 7.00  | 1.81   | 13.00 | 5.06  | 19.00 | 1.81  |
| 1.25 | 1.08  | 7.25  | 2.17   | 13.25 | 4.70  | 19.25 | 1.44  |
| 1.50 | .72   | 7.50  | 1.81   | 13.50 | 3.97  | 19.50 | 1.81  |
| 1.75 | 1.08  | 7.75  | 2.17   | 13.75 | 3.61  | 19.75 | 1.44  |
| 2.00 | 1.08  | 8.00  | 2.17   | 14.00 | 2.89  | 20.00 | 1.08  |
| 2.25 | 1.44  | 8.25  | 2.53   | 14.25 | 2.53  | 20.25 | 1.08  |
| 2.50 | 1.08  | 8.50  | 2.53   | 14.50 | 2.89  | 20.50 | 1.08  |
| 2.75 | 1.08  | 8.75  | 2.53   | 14.75 | 2.53  | 20.75 | 1.08  |
| 3.00 | 1.08  | 9.00  | 2.89   | 15.00 | 2.89  | 21.00 | 1.08  |
| 3.25 | 1.44  | 9.25  | 2.89   | 15.25 | 2.53  | 21.25 | 1.08  |
| 3.50 | 1.08  | 9.50  | 3.25   | 15.50 | 2.89  | 21.50 | 1.08  |
| 3.75 | 1.08  | 9.75  | 3.25   | 15.75 | 2.53  | 21.75 | 1.08  |
| 4.00 | 1.44  | 10.00 | 3.97   | 16.00 | 1.81  | 22.00 | 1.08  |
| 4.25 | 1.44  | 10.25 | 4.33   | 16.25 | 1.44  | 22.25 | 1.08  |
| 4.50 | 1.44  | 10.50 | 5.42   | 16.50 | 1.81  | 22.50 | 1.08  |
| 4.75 | 1.44  | 10.75 | 5.78   | 16.75 | 1.44  | 22.75 | 1.08  |
| 5.00 | 1.44  | 11.00 | 8.67   | 17.00 | 1.81  | 23.00 | 1.08  |
| 5.25 | 1.44  | 11.25 | 8.67   | 17.25 | 1.44  | 23.25 | 1.08  |
| 5.50 | 1.44  | 11.50 | 26.73  | 17.50 | 1.81  | 23.50 | 1.08  |
| 5.75 | 1.44  | 11.75 | 110.53 | 17.75 | 1.44  | 23.75 | 1.08  |
| 6.00 | 1.44  | 12.00 | 13.00  | 18.00 | 1.81  |       |       |

```

-----
| CALIB              |
| NASHYD (0103)     |      Area (ha)= 1.87      Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min |      Ia (mm)= 10.00      # of Linear Res.(N)= 3.00
-----
|                     |      U.H. Tp(hrs)= .36

```

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|-------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | 1.08  | 6.083 | 1.81  | 12.083 | 13.00 | 18.08 | 1.44  |
| .167  | 1.08  | 6.167 | 1.81  | 12.167 | 13.00 | 18.17 | 1.44  |
| .250  | 1.08  | 6.250 | 1.81  | 12.250 | 13.00 | 18.25 | 1.44  |
| .333  | .72   | 6.333 | 1.44  | 12.333 | 6.86  | 18.33 | 1.81  |
| .417  | .72   | 6.417 | 1.44  | 12.417 | 6.86  | 18.42 | 1.81  |
| .500  | .72   | 6.500 | 1.44  | 12.500 | 6.86  | 18.50 | 1.81  |
| .583  | 1.08  | 6.583 | 1.81  | 12.583 | 6.50  | 18.58 | 1.44  |
| .667  | 1.08  | 6.667 | 1.81  | 12.667 | 6.50  | 18.67 | 1.44  |
| .750  | 1.08  | 6.750 | 1.81  | 12.750 | 6.50  | 18.75 | 1.44  |
| .833  | 1.08  | 6.833 | 1.81  | 12.833 | 5.06  | 18.83 | 1.81  |
| .917  | 1.08  | 6.917 | 1.81  | 12.917 | 5.06  | 18.92 | 1.81  |
| 1.000 | 1.08  | 7.000 | 1.81  | 13.000 | 5.06  | 19.00 | 1.81  |
| 1.083 | 1.08  | 7.083 | 2.17  | 13.083 | 4.70  | 19.08 | 1.44  |
| 1.167 | 1.08  | 7.167 | 2.17  | 13.167 | 4.70  | 19.17 | 1.44  |
| 1.250 | 1.08  | 7.250 | 2.17  | 13.250 | 4.70  | 19.25 | 1.44  |
| 1.333 | .72   | 7.333 | 1.81  | 13.333 | 3.97  | 19.33 | 1.81  |
| 1.417 | .72   | 7.417 | 1.81  | 13.417 | 3.97  | 19.42 | 1.81  |
| 1.500 | .72   | 7.500 | 1.81  | 13.500 | 3.97  | 19.50 | 1.81  |
| 1.583 | 1.08  | 7.583 | 2.17  | 13.583 | 3.61  | 19.58 | 1.44  |
| 1.667 | 1.08  | 7.667 | 2.17  | 13.667 | 3.61  | 19.67 | 1.44  |
| 1.750 | 1.08  | 7.750 | 2.17  | 13.750 | 3.61  | 19.75 | 1.44  |
| 1.833 | 1.08  | 7.833 | 2.17  | 13.833 | 2.89  | 19.83 | 1.08  |
| 1.917 | 1.08  | 7.917 | 2.17  | 13.917 | 2.89  | 19.92 | 1.08  |
| 2.000 | 1.08  | 8.000 | 2.17  | 14.000 | 2.89  | 20.00 | 1.08  |
| 2.083 | 1.44  | 8.083 | 2.53  | 14.083 | 2.53  | 20.08 | 1.08  |

|       |      |        |        |        |      |       |      |
|-------|------|--------|--------|--------|------|-------|------|
| 2.167 | 1.44 | 8.167  | 2.53   | 14.167 | 2.53 | 20.17 | 1.08 |
| 2.250 | 1.44 | 8.250  | 2.53   | 14.250 | 2.53 | 20.25 | 1.08 |
| 2.333 | 1.08 | 8.333  | 2.53   | 14.333 | 2.89 | 20.33 | 1.08 |
| 2.417 | 1.08 | 8.417  | 2.53   | 14.417 | 2.89 | 20.42 | 1.08 |
| 2.500 | 1.08 | 8.500  | 2.53   | 14.500 | 2.89 | 20.50 | 1.08 |
| 2.583 | 1.08 | 8.583  | 2.53   | 14.583 | 2.53 | 20.58 | 1.08 |
| 2.667 | 1.08 | 8.667  | 2.53   | 14.667 | 2.53 | 20.67 | 1.08 |
| 2.750 | 1.08 | 8.750  | 2.53   | 14.750 | 2.53 | 20.75 | 1.08 |
| 2.833 | 1.08 | 8.833  | 2.89   | 14.833 | 2.89 | 20.83 | 1.08 |
| 2.917 | 1.08 | 8.917  | 2.89   | 14.917 | 2.89 | 20.92 | 1.08 |
| 3.000 | 1.08 | 9.000  | 2.89   | 15.000 | 2.89 | 21.00 | 1.08 |
| 3.083 | 1.44 | 9.083  | 2.89   | 15.083 | 2.53 | 21.08 | 1.08 |
| 3.167 | 1.44 | 9.167  | 2.89   | 15.167 | 2.53 | 21.17 | 1.08 |
| 3.250 | 1.44 | 9.250  | 2.89   | 15.250 | 2.53 | 21.25 | 1.08 |
| 3.333 | 1.08 | 9.333  | 3.25   | 15.333 | 2.89 | 21.33 | 1.08 |
| 3.417 | 1.08 | 9.417  | 3.25   | 15.417 | 2.89 | 21.42 | 1.08 |
| 3.500 | 1.08 | 9.500  | 3.25   | 15.500 | 2.89 | 21.50 | 1.08 |
| 3.583 | 1.08 | 9.583  | 3.25   | 15.583 | 2.53 | 21.58 | 1.08 |
| 3.667 | 1.08 | 9.667  | 3.25   | 15.667 | 2.53 | 21.67 | 1.08 |
| 3.750 | 1.08 | 9.750  | 3.25   | 15.750 | 2.53 | 21.75 | 1.08 |
| 3.833 | 1.44 | 9.833  | 3.97   | 15.833 | 1.81 | 21.83 | 1.08 |
| 3.917 | 1.44 | 9.917  | 3.97   | 15.917 | 1.81 | 21.92 | 1.08 |
| 4.000 | 1.44 | 10.000 | 3.97   | 16.000 | 1.81 | 22.00 | 1.08 |
| 4.083 | 1.44 | 10.083 | 4.33   | 16.083 | 1.44 | 22.08 | 1.08 |
| 4.167 | 1.44 | 10.167 | 4.33   | 16.167 | 1.44 | 22.17 | 1.08 |
| 4.250 | 1.44 | 10.250 | 4.33   | 16.250 | 1.44 | 22.25 | 1.08 |
| 4.333 | 1.44 | 10.333 | 5.42   | 16.333 | 1.81 | 22.33 | 1.08 |
| 4.417 | 1.44 | 10.417 | 5.42   | 16.417 | 1.81 | 22.42 | 1.08 |
| 4.500 | 1.44 | 10.500 | 5.42   | 16.500 | 1.81 | 22.50 | 1.08 |
| 4.583 | 1.44 | 10.583 | 5.78   | 16.583 | 1.44 | 22.58 | 1.08 |
| 4.667 | 1.44 | 10.667 | 5.78   | 16.667 | 1.44 | 22.67 | 1.08 |
| 4.750 | 1.44 | 10.750 | 5.78   | 16.750 | 1.44 | 22.75 | 1.08 |
| 4.833 | 1.44 | 10.833 | 8.67   | 16.833 | 1.81 | 22.83 | 1.08 |
| 4.917 | 1.44 | 10.917 | 8.67   | 16.917 | 1.81 | 22.92 | 1.08 |
| 5.000 | 1.44 | 11.000 | 8.67   | 17.000 | 1.81 | 23.00 | 1.08 |
| 5.083 | 1.44 | 11.083 | 8.67   | 17.083 | 1.44 | 23.08 | 1.08 |
| 5.167 | 1.44 | 11.167 | 8.67   | 17.167 | 1.44 | 23.17 | 1.08 |
| 5.250 | 1.44 | 11.250 | 8.67   | 17.250 | 1.44 | 23.25 | 1.08 |
| 5.333 | 1.44 | 11.333 | 26.73  | 17.333 | 1.81 | 23.33 | 1.08 |
| 5.417 | 1.44 | 11.417 | 26.73  | 17.417 | 1.81 | 23.42 | 1.08 |
| 5.500 | 1.44 | 11.500 | 26.73  | 17.500 | 1.81 | 23.50 | 1.08 |
| 5.583 | 1.44 | 11.583 | 110.52 | 17.583 | 1.44 | 23.58 | 1.08 |
| 5.667 | 1.44 | 11.667 | 110.53 | 17.667 | 1.44 | 23.67 | 1.08 |
| 5.750 | 1.44 | 11.750 | 110.53 | 17.750 | 1.44 | 23.75 | 1.08 |
| 5.833 | 1.44 | 11.833 | 13.01  | 17.833 | 1.81 |       |      |
| 5.917 | 1.44 | 11.917 | 13.00  | 17.917 | 1.81 |       |      |
| 6.000 | 1.44 | 12.000 | 13.00  | 18.000 | 1.81 |       |      |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .079 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 25.679  
 TOTAL RAINFALL (mm)= 90.029  
 RUNOFF COEFFICIENT = .285

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

---

|                   |            |       |                           |
|-------------------|------------|-------|---------------------------|
| CALIB             |            |       |                           |
| NASHYD (0101)     | Area (ha)= | 1.29  | Curve Number (CN)= 60.0   |
| ID= 1 DT= 5.0 min | Ia (mm)=   | 10.00 | # of Linear Res.(N)= 3.00 |
| U.H. Tp(hrs)=     |            | .31   |                           |

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .061 (i)  
 TIME TO PEAK (hrs)= 11.917  
 RUNOFF VOLUME (mm)= 25.675  
 TOTAL RAINFALL (mm)= 90.029  
 RUNOFF COEFFICIENT = .285

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

---

|                   |            |       |                           |
|-------------------|------------|-------|---------------------------|
| CALIB             |            |       |                           |
| NASHYD (0102)     | Area (ha)= | 1.77  | Curve Number (CN)= 60.0   |
| ID= 1 DT= 5.0 min | Ia (mm)=   | 10.00 | # of Linear Res.(N)= 3.00 |
| U.H. Tp(hrs)=     |            | .53   |                           |

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .056 (i)

TIME TO PEAK (hrs)= 12.167  
 RUNOFF VOLUME (mm)= 25.683  
 TOTAL RAINFALL (mm)= 90.029  
 RUNOFF COEFFICIENT = .285

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

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0101):  1.29      .061      11.92      25.67
+ ID2= 2 (0102):  1.77      .056      12.17      25.68
=====
ID = 3 (0901):  3.06      .110      12.00      25.68
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION NUMBER: 6 \*\*  
 \*\*\*\*\*

```

-----
| MASS STORM |      Filename: I:\2015 Projects\l15
|            |      185 - Monterra Phase 2 Natural Hazard Assessm
|            |      \Design\Hydrology\l15185 vo2\STORMS\SCS24H.MS
| Ptotal= 98.50 mm |      Comments: SCS Type II 24 HR MASS CURVE
-----

      Duration of storm = 23.75 hrs
      Mass curve time step = 15.00 min
  
```

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | 1.18          | 6.25        | 1.97          | 12.25       | 14.18         | 18.25       | 1.58          |
| .50         | .79           | 6.50        | 1.58          | 12.50       | 7.49          | 18.50       | 1.97          |
| .75         | 1.18          | 6.75        | 1.97          | 12.75       | 7.09          | 18.75       | 1.58          |
| 1.00        | 1.18          | 7.00        | 1.97          | 13.00       | 5.52          | 19.00       | 1.97          |
| 1.25        | 1.18          | 7.25        | 2.36          | 13.25       | 5.12          | 19.25       | 1.58          |
| 1.50        | .79           | 7.50        | 1.97          | 13.50       | 4.33          | 19.50       | 1.97          |
| 1.75        | 1.18          | 7.75        | 2.36          | 13.75       | 3.94          | 19.75       | 1.58          |
| 2.00        | 1.18          | 8.00        | 2.36          | 14.00       | 3.15          | 20.00       | 1.18          |
| 2.25        | 1.58          | 8.25        | 2.76          | 14.25       | 2.76          | 20.25       | 1.18          |
| 2.50        | 1.18          | 8.50        | 2.76          | 14.50       | 3.15          | 20.50       | 1.18          |
| 2.75        | 1.18          | 8.75        | 2.76          | 14.75       | 2.76          | 20.75       | 1.18          |
| 3.00        | 1.18          | 9.00        | 3.15          | 15.00       | 3.15          | 21.00       | 1.18          |
| 3.25        | 1.58          | 9.25        | 3.15          | 15.25       | 2.76          | 21.25       | 1.18          |
| 3.50        | 1.18          | 9.50        | 3.55          | 15.50       | 3.15          | 21.50       | 1.18          |
| 3.75        | 1.18          | 9.75        | 3.55          | 15.75       | 2.76          | 21.75       | 1.18          |
| 4.00        | 1.58          | 10.00       | 4.33          | 16.00       | 1.97          | 22.00       | 1.18          |
| 4.25        | 1.58          | 10.25       | 4.73          | 16.25       | 1.58          | 22.25       | 1.18          |
| 4.50        | 1.58          | 10.50       | 5.91          | 16.50       | 1.97          | 22.50       | 1.18          |
| 4.75        | 1.58          | 10.75       | 6.30          | 16.75       | 1.58          | 22.75       | 1.18          |
| 5.00        | 1.58          | 11.00       | 9.46          | 17.00       | 1.97          | 23.00       | 1.18          |
| 5.25        | 1.58          | 11.25       | 9.46          | 17.25       | 1.58          | 23.25       | 1.18          |
| 5.50        | 1.58          | 11.50       | 29.16         | 17.50       | 1.97          | 23.50       | 1.18          |
| 5.75        | 1.58          | 11.75       | 120.56        | 17.75       | 1.58          | 23.75       | 1.18          |
| 6.00        | 1.58          | 12.00       | 14.18         | 18.00       | 1.97          |             |               |

```

-----
| CALIB |
| NASHYD (0103) |      Area (ha)= 1.87      Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min |      Ia (mm)= 10.00      # of Linear Res. (N)= 3.00
-----
      U.H. Tp(hrs)= .36
  
```

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .083        | 1.18          | 6.083       | 1.97          | 12.083      | 14.18         | 18.08       | 1.58          |
| .167        | 1.18          | 6.167       | 1.97          | 12.167      | 14.18         | 18.17       | 1.58          |
| .250        | 1.18          | 6.250       | 1.97          | 12.250      | 14.18         | 18.25       | 1.58          |
| .333        | .79           | 6.333       | 1.58          | 12.333      | 7.49          | 18.33       | 1.97          |
| .417        | .79           | 6.417       | 1.58          | 12.417      | 7.49          | 18.42       | 1.97          |
| .500        | .79           | 6.500       | 1.58          | 12.500      | 7.49          | 18.50       | 1.97          |
| .583        | 1.18          | 6.583       | 1.97          | 12.583      | 7.09          | 18.58       | 1.58          |
| .667        | 1.18          | 6.667       | 1.97          | 12.667      | 7.09          | 18.67       | 1.58          |
| .750        | 1.18          | 6.750       | 1.97          | 12.750      | 7.09          | 18.75       | 1.58          |
| .833        | 1.18          | 6.833       | 1.97          | 12.833      | 5.52          | 18.83       | 1.97          |
| .917        | 1.18          | 6.917       | 1.97          | 12.917      | 5.52          | 18.92       | 1.97          |

|       |      |        |        |        |      |       |      |
|-------|------|--------|--------|--------|------|-------|------|
| 1.000 | 1.18 | 7.000  | 1.97   | 13.000 | 5.52 | 19.00 | 1.97 |
| 1.083 | 1.18 | 7.083  | 2.36   | 13.083 | 5.12 | 19.08 | 1.58 |
| 1.167 | 1.18 | 7.167  | 2.36   | 13.167 | 5.12 | 19.17 | 1.58 |
| 1.250 | 1.18 | 7.250  | 2.36   | 13.250 | 5.12 | 19.25 | 1.58 |
| 1.333 | .79  | 7.333  | 1.97   | 13.333 | 4.33 | 19.33 | 1.97 |
| 1.417 | .79  | 7.417  | 1.97   | 13.417 | 4.33 | 19.42 | 1.97 |
| 1.500 | .79  | 7.500  | 1.97   | 13.500 | 4.33 | 19.50 | 1.97 |
| 1.583 | 1.18 | 7.583  | 2.36   | 13.583 | 3.94 | 19.58 | 1.58 |
| 1.667 | 1.18 | 7.667  | 2.36   | 13.667 | 3.94 | 19.67 | 1.58 |
| 1.750 | 1.18 | 7.750  | 2.36   | 13.750 | 3.94 | 19.75 | 1.58 |
| 1.833 | 1.18 | 7.833  | 2.36   | 13.833 | 3.15 | 19.83 | 1.18 |
| 1.917 | 1.18 | 7.917  | 2.36   | 13.917 | 3.15 | 19.92 | 1.18 |
| 2.000 | 1.18 | 8.000  | 2.36   | 14.000 | 3.15 | 20.00 | 1.18 |
| 2.083 | 1.58 | 8.083  | 2.76   | 14.083 | 2.76 | 20.08 | 1.18 |
| 2.167 | 1.58 | 8.167  | 2.76   | 14.167 | 2.76 | 20.17 | 1.18 |
| 2.250 | 1.58 | 8.250  | 2.76   | 14.250 | 2.76 | 20.25 | 1.18 |
| 2.333 | 1.18 | 8.333  | 2.76   | 14.333 | 3.15 | 20.33 | 1.18 |
| 2.417 | 1.18 | 8.417  | 2.76   | 14.417 | 3.15 | 20.42 | 1.18 |
| 2.500 | 1.18 | 8.500  | 2.76   | 14.500 | 3.15 | 20.50 | 1.18 |
| 2.583 | 1.18 | 8.583  | 2.76   | 14.583 | 2.76 | 20.58 | 1.18 |
| 2.667 | 1.18 | 8.667  | 2.76   | 14.667 | 2.76 | 20.67 | 1.18 |
| 2.750 | 1.18 | 8.750  | 2.76   | 14.750 | 2.76 | 20.75 | 1.18 |
| 2.833 | 1.18 | 8.833  | 3.15   | 14.833 | 3.15 | 20.83 | 1.18 |
| 2.917 | 1.18 | 8.917  | 3.15   | 14.917 | 3.15 | 20.92 | 1.18 |
| 3.000 | 1.18 | 9.000  | 3.15   | 15.000 | 3.15 | 21.00 | 1.18 |
| 3.083 | 1.58 | 9.083  | 3.15   | 15.083 | 2.76 | 21.08 | 1.18 |
| 3.167 | 1.58 | 9.167  | 3.15   | 15.167 | 2.76 | 21.17 | 1.18 |
| 3.250 | 1.58 | 9.250  | 3.15   | 15.250 | 2.76 | 21.25 | 1.18 |
| 3.333 | 1.18 | 9.333  | 3.55   | 15.333 | 3.15 | 21.33 | 1.18 |
| 3.417 | 1.18 | 9.417  | 3.55   | 15.417 | 3.15 | 21.42 | 1.18 |
| 3.500 | 1.18 | 9.500  | 3.55   | 15.500 | 3.15 | 21.50 | 1.18 |
| 3.583 | 1.18 | 9.583  | 3.55   | 15.583 | 2.76 | 21.58 | 1.18 |
| 3.667 | 1.18 | 9.667  | 3.55   | 15.667 | 2.76 | 21.67 | 1.18 |
| 3.750 | 1.18 | 9.750  | 3.55   | 15.750 | 2.76 | 21.75 | 1.18 |
| 3.833 | 1.58 | 9.833  | 4.33   | 15.833 | 1.97 | 21.83 | 1.18 |
| 3.917 | 1.58 | 9.917  | 4.33   | 15.917 | 1.97 | 21.92 | 1.18 |
| 4.000 | 1.58 | 10.000 | 4.33   | 16.000 | 1.97 | 22.00 | 1.18 |
| 4.083 | 1.58 | 10.083 | 4.73   | 16.083 | 1.58 | 22.08 | 1.18 |
| 4.167 | 1.58 | 10.167 | 4.73   | 16.167 | 1.58 | 22.17 | 1.18 |
| 4.250 | 1.58 | 10.250 | 4.73   | 16.250 | 1.58 | 22.25 | 1.18 |
| 4.333 | 1.58 | 10.333 | 5.91   | 16.333 | 1.97 | 22.33 | 1.18 |
| 4.417 | 1.58 | 10.417 | 5.91   | 16.417 | 1.97 | 22.42 | 1.18 |
| 4.500 | 1.58 | 10.500 | 5.91   | 16.500 | 1.97 | 22.50 | 1.18 |
| 4.583 | 1.58 | 10.583 | 6.30   | 16.583 | 1.58 | 22.58 | 1.18 |
| 4.667 | 1.58 | 10.667 | 6.30   | 16.667 | 1.58 | 22.67 | 1.18 |
| 4.750 | 1.58 | 10.750 | 6.30   | 16.750 | 1.58 | 22.75 | 1.18 |
| 4.833 | 1.58 | 10.833 | 9.46   | 16.833 | 1.97 | 22.83 | 1.18 |
| 4.917 | 1.58 | 10.917 | 9.46   | 16.917 | 1.97 | 22.92 | 1.18 |
| 5.000 | 1.58 | 11.000 | 9.46   | 17.000 | 1.97 | 23.00 | 1.18 |
| 5.083 | 1.58 | 11.083 | 9.46   | 17.083 | 1.58 | 23.08 | 1.18 |
| 5.167 | 1.58 | 11.167 | 9.46   | 17.167 | 1.58 | 23.17 | 1.18 |
| 5.250 | 1.58 | 11.250 | 9.46   | 17.250 | 1.58 | 23.25 | 1.18 |
| 5.333 | 1.58 | 11.333 | 29.15  | 17.333 | 1.97 | 23.33 | 1.18 |
| 5.417 | 1.58 | 11.417 | 29.16  | 17.417 | 1.97 | 23.42 | 1.18 |
| 5.500 | 1.58 | 11.500 | 29.16  | 17.500 | 1.97 | 23.50 | 1.18 |
| 5.583 | 1.58 | 11.583 | 120.56 | 17.583 | 1.58 | 23.58 | 1.18 |
| 5.667 | 1.58 | 11.667 | 120.56 | 17.667 | 1.58 | 23.67 | 1.18 |
| 5.750 | 1.58 | 11.750 | 120.56 | 17.750 | 1.58 | 23.75 | 1.18 |
| 5.833 | 1.58 | 11.833 | 14.20  | 17.833 | 1.97 |       |      |
| 5.917 | 1.58 | 11.917 | 14.18  | 17.917 | 1.97 |       |      |
| 6.000 | 1.58 | 12.000 | 14.18  | 18.000 | 1.97 |       |      |

Unit Hyd Qpeak (cms)= .198

PEAK FLOW (cms)= .093 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 30.203  
 TOTAL RAINFALL (mm)= 98.205  
 RUNOFF COEFFICIENT = .308

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

|                   |  |                   |                           |
|-------------------|--|-------------------|---------------------------|
| -----             |  |                   |                           |
| CALIB             |  |                   |                           |
| NASHYD (0101)     |  | Area (ha)= 1.29   | Curve Number (CN)= 60.0   |
| ID= 1 DT= 5.0 min |  | Ia (mm)= 10.00    | # of Linear Res.(N)= 3.00 |
| -----             |  | U.H. Tp(hrs)= .31 |                           |

Unit Hyd Qpeak (cms)= .159

PEAK FLOW (cms)= .072 (i)  
 TIME TO PEAK (hrs)= 11.917  
 RUNOFF VOLUME (mm)= 30.199  
 TOTAL RAINFALL (mm)= 98.205

RUNOFF COEFFICIENT = .308

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

```
-----
| CALIB |
| NASHYD (0102) | Area (ha)= 1.77 Curve Number (CN)= 60.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res. (N)= 3.00
-----
U.H. Tp(hrs)= .53
```

Unit Hyd Qpeak (cms)= .128

PEAK FLOW (cms)= .066 (i)

TIME TO PEAK (hrs)= 12.167

RUNOFF VOLUME (mm)= 30.207

TOTAL RAINFALL (mm)= 98.205

RUNOFF COEFFICIENT = .308

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

```
-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 (0101):  1.29    .072    11.92    30.20
+ ID2= 2 (0102):  1.77    .066    12.17    30.21
=====
ID = 3 (0901):  3.06    .130    12.00    30.20
```

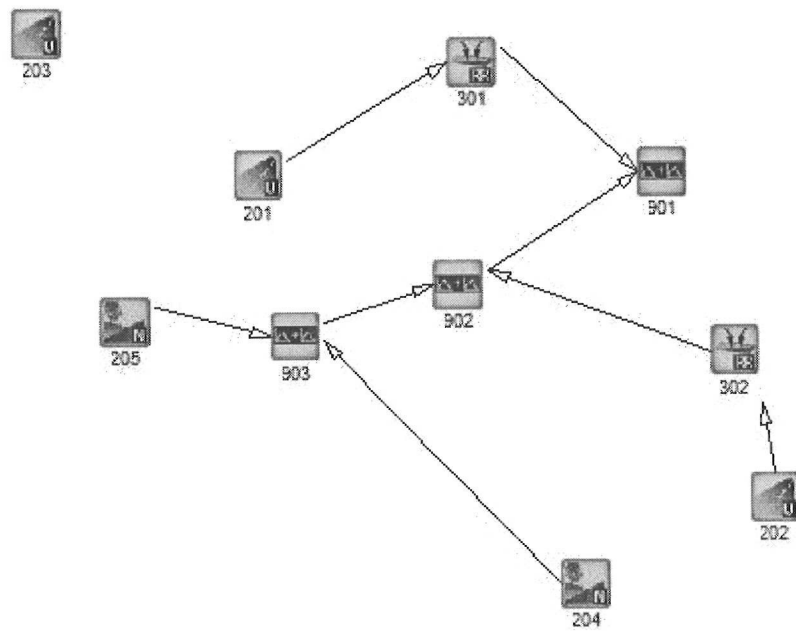
NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

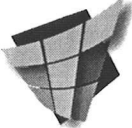
FINISH

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=====
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## **Appendix C: Proposed Conditions Hydrologic Analysis**

# Proposed Conditions OTTHYMO Model Schematic

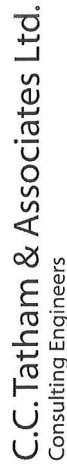


|                                                                                                                                                                                                                      |                                  |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------|
|  <b>C.C. Tatham &amp; Associates Ltd.</b><br>Consulting Engineers<br><small>Collingwood    Bracebridge    Orillia    Barrie</small> | Project: Monterra Phase 2        | Date: Sept 11, 2017 |
|                                                                                                                                                                                                                      | File No.: 115185                 | Designed: AO        |
|                                                                                                                                                                                                                      | Subject: % Impervious Calculator | Checked             |

Approximate House Footprint                      250 m<sup>2</sup>  
 Approximate Impervious Area per lot            330 m<sup>2</sup>

| Catchment    | Area (m <sup>2</sup> ) | No. Houses/<br>Driveways/Patio | Road Area (m <sup>2</sup> ) | Total Impervious<br>Area (m <sup>2</sup> ) | % Impervious | % Directly<br>Connected |
|--------------|------------------------|--------------------------------|-----------------------------|--------------------------------------------|--------------|-------------------------|
| 201          | 19,250                 | 19.5                           | 1890                        | 8,325                                      | 43           | 18                      |
| 202          | 11,360                 | 10                             | 1080                        | 4,380                                      | 39           | 17                      |
| 203          | 5,000                  | 2.5                            | 270                         | 1,095                                      | 22           | 5                       |
| 204          | 1,620                  | 0                              | 0                           | -                                          | 0            | 0                       |
| 205          | 4,460                  | 0                              | 0                           | -                                          | 0            | 0                       |
| SWMF         | 6,300                  |                                |                             |                                            |              |                         |
| <b>Total</b> | <b>47,990</b>          |                                |                             |                                            |              |                         |





Collingwood  
Bracebridge  
Orillia  
Barrie

## EXISTING CONDITIONS

1.925 ha

### Time of Concentration Calculations

### Bransby-Williams Formula

### Airport Method

|                             |          |                             |
|-----------------------------|----------|-----------------------------|
| Maximum Catchment Elevation | 190 m    | Maximum Catchment Elevation |
| Minimum Catchment Elevation | 188 m    | Minimum Catchment Elevation |
| Catchment length            | 200 m    | Catchment length            |
| Catchment Slope             | 1%       | Catchment Slope             |
| Catchment Area              | 1 925 ha | Catchment Area              |

Time of Concentration (Hours)

Time of Concentration (Hours)

Time to Peak (2/3 x Time of Concentration)

|  |          |
|--|----------|
|  | 0.12 hrs |
|--|----------|

hrs

|  |      |
|--|------|
|  | 0.12 |
|--|------|

Time to Peak

|                     |        |
|---------------------|--------|
| Initial Abstraction | 3.7 mm |
|---------------------|--------|

|            |    |
|------------|----|
| Woods      | 10 |
| Meadows    | 8  |
| Cultivated | 7  |
| Lawns      | 5  |
| Impervious | 2  |
| Wetlands   | 16 |

|                    |      |
|--------------------|------|
| Runoff Coefficient | 0.57 |
|--------------------|------|

| Landuse Type      | Soil Series |      |      |      |
|-------------------|-------------|------|------|------|
|                   | Gf          | 0    | 0    | 0    |
| Forest/Woodland   | 2           | #N/A | #N/A | #N/A |
| Cultivated        | 0.25        | #N/A | #N/A | #N/A |
| Pasture/Lawn      | 0.35        | #N/A | #N/A | #N/A |
| Impervious        | 0.28        | #N/A | #N/A | #N/A |
| Wetland/Lake/SWMP | 0.95        | #N/A | #N/A | #N/A |
| Meadows           | 0.05        | #N/A | #N/A | #N/A |
| Soil Series Total | 0.27        | #N/A | #N/A | #N/A |
|                   | 0.568       | #N/A | #N/A | #N/A |



|             |             |         |        |
|-------------|-------------|---------|--------|
| Collingwood | Bracebridge | Orillia | Barrie |
|-------------|-------------|---------|--------|

## POST-DEVELOPMENT CONDITIONS

1.136 haWEIGHTED CN VALUE

**For Runoff Coefficients greater than 0.4**

### Bransby-Williams Formula

188.65 m  
188 m  
65 m  
1%  
1.136 ha

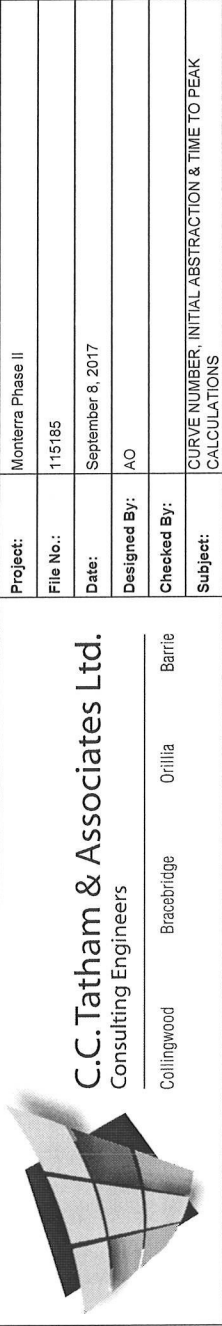
Time of Concentration (Minutes)  
Time of Concentration (Hours)  
Time to Peak (2/3 x Time of Concentration)

hrs

|                     |        |
|---------------------|--------|
| Initial Abstraction | 3.8 mm |
|---------------------|--------|

0.54

|  | Landuse Type      | Soil Series |     |     |     |
|--|-------------------|-------------|-----|-----|-----|
|  |                   | Gf          | 0   | 0   | 0   |
|  | 2                 | #/A         | #/A | #/A | #/A |
|  | Fores/Woodland    | 0.25        | #/A | #/A | #/A |
|  | Cultivated        | 0.35        | #/A | #/A | #/A |
|  | Pasture/Lawn      | 0.28        | #/A | #/A | #/A |
|  | Impervious        | 0.95        | #/A | #/A | #/A |
|  | Wetland/Lake/SWMI | 0.05        | #/A | #/A | #/A |
|  | Meadows           | 0.27        | #/A | #/A | #/A |
|  | Soil Series Total | 0.541       | #/A | #/A | #/A |



| Catchment | Area | ha  |
|-----------|------|-----|
| 203       |      | 0.5 |

### CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

|                                            |         |                                            |         |        |  |
|--------------------------------------------|---------|--------------------------------------------|---------|--------|--|
| Time of Concentration Calculations         |         | Initial Abstraction                        |         | 4.3 mm |  |
| For Runoff Coefficients greater than 0.4   |         |                                            |         |        |  |
| Bransby-Williams Formula                   |         |                                            |         |        |  |
| Maximum Catchment Elevation                | 188.6 m | Maximum Catchment Elevation                | 188.6 m |        |  |
| Minimum Catchment Elevation                | 188 m   | Minimum Catchment Elevation                | 188 m   |        |  |
| Catchment length                           | 30 m    | Catchment length                           | 30 m    |        |  |
| Catchment Slope                            | 2%      | Catchment Slope                            | 2%      |        |  |
| Catchment Area                             | 0.5 ha  | Catchment Area                             | 0.5 ha  |        |  |
| Time of Concentration (Minutes)            |         |                                            |         |        |  |
| Time of Concentration (Hours)              | 1.60    | Time of Concentration (Minutes)            | 9.65    |        |  |
| Time to Peak (2/3 x Time of Concentration) | 0.03    | Time of Concentration (Hours)              | 0.16    |        |  |
|                                            | 0.02    | Time to Peak (2/3 x Time of Concentration) | 0.11    |        |  |
| Time to Peak                               |         | 0.02 hrs                                   |         |        |  |
| For Runoff Coefficients less than 0.4      |         |                                            |         |        |  |
| Airport Method                             |         |                                            |         |        |  |
| Maximum Catchment Elevation                | 188.6 m | Maximum Catchment Elevation                | 188.6 m |        |  |
| Minimum Catchment Elevation                | 188 m   | Minimum Catchment Elevation                | 188 m   |        |  |
| Catchment length                           | 30 m    | Catchment length                           | 30 m    |        |  |
| Catchment Slope                            | 2%      | Catchment Slope                            | 2%      |        |  |
| Catchment Area                             | 0.5 ha  | Catchment Area                             | 0.5 ha  |        |  |
| Time of Concentration (Minutes)            |         |                                            |         |        |  |
| Time of Concentration (Hours)              | 1.60    | Time of Concentration (Minutes)            | 9.65    |        |  |
| Time to Peak (2/3 x Time of Concentration) | 0.03    | Time of Concentration (Hours)              | 0.16    |        |  |
|                                            | 0.02    | Time to Peak (2/3 x Time of Concentration) | 0.11    |        |  |
| Time to Peak                               |         | 0.02 hrs                                   |         |        |  |



Collingwood  
Bracebridge  
Orillia  
Barrie

**CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS**

0.162 haWEIGHTED CN VALUE

|                     |        |
|---------------------|--------|
| Initial Abstraction | 5.0 mm |
|---------------------|--------|

For Runoff Coefficients less than 0.4

### Airport Method

|                             |          |
|-----------------------------|----------|
| Maximum Catchment Elevation | 189.1 m  |
| Minimum Catchment Elevation | 188 m    |
| Catchment length            | 110 m    |
| Catchment Slope             | 1%       |
| Catchment Area              | 0.162 ha |

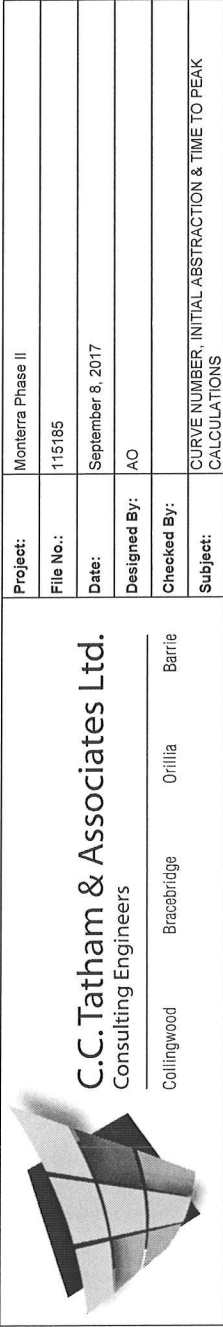
Time of Concentration (Minutes)  
Time of Concentration (Hours)  
Time to Peak ( $2/3 \times$  Time of Concentration)

hrs

|                     |        |
|---------------------|--------|
| Initial Abstraction | 5.0 mm |
|---------------------|--------|

|                    |      |
|--------------------|------|
| Runoff Coefficient | 0.28 |
|--------------------|------|

| Landuse Type      | Soil Series |      |      |      |
|-------------------|-------------|------|------|------|
|                   | Gr          | 0    | 0    | 0    |
| Forest/Woodland   | 2           | #N/A | #N/A | #N/A |
| Cultivated        | 0.25        | #N/A | #N/A | #N/A |
| Pasture/Lawn      | 0.35        | #N/A | #N/A | #N/A |
| Impervious        | 0.28        | #N/A | #N/A | #N/A |
| Wetland/Lake/SWMP | 0.95        | #N/A | #N/A | #N/A |
| Meadows           | 0.05        | #N/A | #N/A | #N/A |
| Soil Series Total | 0.27        | #N/A | #N/A | #N/A |
|                   | 0.28        | #N/A | #N/A | #N/A |



| Catchment | Area  | ha |
|-----------|-------|----|
| 205       | 0.446 | ha |

0.446 ha

|                                            |          |
|--------------------------------------------|----------|
| Time of Concentration Calculations         |          |
| For Runoff Coefficients greater than 0.4   |          |
| Bransby-Williams Formula                   |          |
| Maximum Catchment Elevation                | 189.48 m |
| Minimum Catchment Elevation                | 188 m    |
| Catchment length                           | 148 m    |
| Catchment Slope                            | 1%       |
| Catchment Area                             | 0.446 ha |
| Time of Concentration (Minutes)            | 9.15     |
| Time of Concentration (Hours)              | 0.15     |
| Time to Peak (2/3 x Time of Concentration) | 0.10     |
| Time to Peak                               | 0.36 hrs |

|                                            |          |
|--------------------------------------------|----------|
| For Runoff Coefficients less than 0.4      |          |
| Airport Method                             |          |
| Maximum Catchment Elevation                | 189.48 m |
| Minimum Catchment Elevation                | 188 m    |
| Catchment length                           | 148 m    |
| Catchment Slope                            | 1%       |
| Catchment Area                             | 0.446 ha |
| Time of Concentration (Minutes)            | 32.62    |
| Time of Concentration (Hours)              | 0.54     |
| Time to Peak (2/3 x Time of Concentration) | 0.36     |

|                     |  |        |  |
|---------------------|--|--------|--|
| Initial Abstraction |  | 5.0 mm |  |
| Runoff Coefficient  |  | 0.38   |  |
| Woods               |  | 1      |  |
| Meadows             |  | 8      |  |
| Cultivated          |  | 7      |  |
| Lawns               |  | 5      |  |
| Impervious          |  | 2      |  |
| Wetlands            |  | 16     |  |

|                   |  |      |  |             |  |
|-------------------|--|------|--|-------------|--|
| Landuse Type      |  | Gf   |  | Soil Series |  |
| Forest/Woodland   |  | 2    |  | 0           |  |
| Cultivated        |  | 0.25 |  | #N/A        |  |
| Pasture/Lawn      |  | 0.35 |  | #N/A        |  |
| Impervious        |  | 0.28 |  | #N/A        |  |
| Wetland/Lake/SWMP |  | 0.95 |  | #N/A        |  |
| Meadows           |  | 0.05 |  | #N/A        |  |
| Soil Series Total |  | 0.27 |  | #N/A        |  |
|                   |  | 0.28 |  | #N/A        |  |

```

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

```

Chicago - Post

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O   O   T   T   H   H   Y   Y   MM  MM   O   O
O   O   T   T   H   H   Y   M   M   O   O
OOO   T   T   H   H   Y   M   M   OOO

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

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USER:

COMMENTS: \_\_\_\_\_

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\*\* SIMULATION NUMBER: 1 \*\*  
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| READ STORM | Filename: I:\2015 Projects\115
|             | 185 - Monterra Phase 2 Natural Hazard Assessm
|             | \Design\Hydrology\115185 vo2\STORMS\CHIC25MM.
| Ptotal= 24.97 mm | Comments: OWEN SOUND 25 mm (from a 2 year-4hr stor

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| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|-------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 1.29  | 1.10 | 2.81  | 2.10 | 13.05 | 3.10 | 2.04  |
| .20  | 1.36  | 1.20 | 3.22  | 2.20 | 8.44  | 3.20 | 1.89  |
| .30  | 1.44  | 1.30 | 3.77  | 2.30 | 6.21  | 3.30 | 1.76  |
| .40  | 1.53  | 1.40 | 4.55  | 2.40 | 4.91  | 3.40 | 1.65  |
| .50  | 1.63  | 1.50 | 5.77  | 2.50 | 4.06  | 3.50 | 1.55  |
| .60  | 1.75  | 1.60 | 7.86  | 2.60 | 3.47  | 3.60 | 1.46  |
| .70  | 1.89  | 1.70 | 12.27 | 2.70 | 3.03  | 3.70 | 1.39  |
| .80  | 2.06  | 1.80 | 26.17 | 2.80 | 2.70  | 3.80 | 1.32  |
| .90  | 2.26  | 1.90 | 72.58 | 2.90 | 2.43  | 3.90 | 1.26  |
| 1.00 | 2.50  | 2.00 | 26.96 | 3.00 | 2.22  | 4.00 | 1.20  |

```

| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00

```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n         | .013       | .250         |

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

```

---- TRANSFORMED HYETOGRAPH ----
TIME  RAIN | TIME  RAIN | TIME  RAIN | TIME  RAIN
hrs   mm/hr | hrs   mm/hr | hrs   mm/hr | hrs   mm/hr
.083  1.29 | 1.083  2.81 | 2.083 13.05 | 3.08  2.04
.167  1.35 | 1.167  3.14 | 2.167  9.36 | 3.17  1.92
.250  1.41 | 1.250  3.55 | 2.250  7.10 | 3.25  1.81
.333  1.48 | 1.333  4.08 | 2.333  5.69 | 3.33  1.72
.417  1.55 | 1.417  4.79 | 2.417  4.74 | 3.42  1.63

```

|       |      |       |       |       |      |      |      |
|-------|------|-------|-------|-------|------|------|------|
| .500  | 1.63 | 1.500 | 5.77  | 2.500 | 4.06 | 3.50 | 1.55 |
| .583  | 1.75 | 1.583 | 7.86  | 2.583 | 3.47 | 3.58 | 1.46 |
| .667  | 1.86 | 1.667 | 11.39 | 2.667 | 3.12 | 3.67 | 1.40 |
| .750  | 1.99 | 1.750 | 20.61 | 2.750 | 2.83 | 3.75 | 1.35 |
| .833  | 2.14 | 1.833 | 44.73 | 2.833 | 2.59 | 3.83 | 1.30 |
| .917  | 2.31 | 1.917 | 63.46 | 2.917 | 2.39 | 3.92 | 1.25 |
| 1.000 | 2.50 | 2.000 | 26.96 | 3.000 | 2.22 | 4.00 | 1.20 |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 63.46     | 10.66      |
| over (min)              | 5.00      | 20.00      |
| Storage Coeff. (min)=   | 1.49 (ii) | 18.77 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 20.00      |
| Unit Hyd. peak (cms)=   | .33       | .06        |

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .00   | .01   | .008 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.17  | 2.17       |
| RUNOFF VOLUME (mm)=  | 23.97 | 5.27  | 6.18       |
| TOTAL RAINFALL (mm)= | 24.97 | 24.97 | 24.97      |
| RUNOFF COEFFICIENT   | .96   | .21   | .25        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |                                          |
|-------------------|------------------------------------------|
| CALIB             |                                          |
| STANDHYD (0202)   | Area (ha)= 1.14                          |
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00 |

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .44        | .69          |
| Dep. Storage (mm)= | 1.00       | 3.80         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 65.00      | 40.00        |
| Mannings n         | .013       | .250         |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 63.46     | 20.14      |
| over (min)              | 5.00      | 20.00      |
| Storage Coeff. (min)=   | 2.37 (ii) | 15.77 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 20.00      |
| Unit Hyd. peak (cms)=   | .30       | .07        |

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .03   | .02   | .040 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.17  | 1.92       |
| RUNOFF VOLUME (mm)=  | 23.97 | 7.46  | 10.26      |
| TOTAL RAINFALL (mm)= | 24.97 | 24.97 | 24.97      |
| RUNOFF COEFFICIENT   | .96   | .30   | .41        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

|                   |                                         |
|-------------------|-----------------------------------------|
| CALIB             |                                         |
| NASHYD (0205)     | Area (ha)= .45 Curve Number (CN)= 69.0  |
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 |
|                   | U.H. Tp(hrs)= .36                       |

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | 1.32  | 1.167 | 2.97  | 2.167 | 11.21 | 3.17 | 1.98  |
| .333                             | 1.44  | 1.333 | 3.82  | 2.333 | 6.40  | 3.33 | 1.76  |
| .500                             | 1.59  | 1.500 | 5.28  | 2.500 | 4.40  | 3.50 | 1.59  |
| .667                             | 1.81  | 1.667 | 9.62  | 2.667 | 3.29  | 3.67 | 1.43  |
| .833                             | 2.07  | 1.833 | 32.67 | 2.833 | 2.71  | 3.83 | 1.32  |
| 1.000                            | 2.40  | 2.000 | 45.21 | 3.000 | 2.30  | 4.00 | 1.22  |



Unit Hyd Qpeak (cms)= .047  
 PEAK FLOW (cms)= .003 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 2.964  
 TOTAL RAINFALL (mm)= 24.971  
 RUNOFF COEFFICIENT = .119

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

-----  
 | CALIB |  
 | NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0  
 | ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 -----  
 U.H. Tp(hrs)= .31

Unit Hyd Qpeak (cms)= .020  
 PEAK FLOW (cms)= .001 (i)  
 TIME TO PEAK (hrs)= 2.167  
 RUNOFF VOLUME (mm)= 2.956  
 TOTAL RAINFALL (mm)= 24.971  
 RUNOFF COEFFICIENT = .118

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

-----  
 | CALIB |  
 | STANDHYD (0201) | Area (ha)= 1.92  
 | ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00  
 -----

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

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

| ---- TRANSFORMED HYETOGRAPH ---- |       |       |       |       |       |      |       |
|----------------------------------|-------|-------|-------|-------|-------|------|-------|
| TIME                             | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME | RAIN  |
| hrs                              | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs  | mm/hr |
| .083                             | 1.29  | 1.083 | 2.81  | 2.083 | 13.05 | 3.08 | 2.04  |
| .167                             | 1.35  | 1.167 | 3.14  | 2.167 | 9.36  | 3.17 | 1.92  |
| .250                             | 1.41  | 1.250 | 3.55  | 2.250 | 7.10  | 3.25 | 1.81  |
| .333                             | 1.48  | 1.333 | 4.08  | 2.333 | 5.69  | 3.33 | 1.72  |
| .417                             | 1.55  | 1.417 | 4.79  | 2.417 | 4.74  | 3.42 | 1.63  |
| .500                             | 1.63  | 1.500 | 5.77  | 2.500 | 4.06  | 3.50 | 1.55  |
| .583                             | 1.75  | 1.583 | 7.86  | 2.583 | 3.47  | 3.58 | 1.46  |
| .667                             | 1.86  | 1.667 | 11.39 | 2.667 | 3.12  | 3.67 | 1.40  |
| .750                             | 1.99  | 1.750 | 20.61 | 2.750 | 2.83  | 3.75 | 1.35  |
| .833                             | 2.14  | 1.833 | 44.73 | 2.833 | 2.59  | 3.83 | 1.30  |
| .917                             | 2.31  | 1.917 | 63.46 | 2.917 | 2.39  | 3.92 | 1.25  |
| 1.000                            | 2.50  | 2.000 | 26.96 | 3.000 | 2.22  | 4.00 | 1.20  |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 63.46     | 23.59      |
| over (min)             | 5.00      | 20.00      |
| Storage Coeff. (min)=  | 4.64 (ii) | 17.22 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 20.00      |
| Unit Hyd. peak (cms)=  | .22       | .06        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .05   | .04   | .065 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.17  | 1.92       |
| RUNOFF VOLUME (mm)=  | 23.97 | 8.20  | 11.04      |
| TOTAL RAINFALL (mm)= | 24.97 | 24.97 | 24.97      |
| RUNOFF COEFFICIENT = | .96   | .33   | .44        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
 | RESERVOIR (0302) |  
 | IN= 2---> OUT= 1 |



| DT= 5.0 min | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|-------------|------------------|--------------------|------------------|--------------------|
|             | .0000            | .0000              | .0054            | .0654              |
|             | .0011            | .0049              | .0393            | .0739              |
|             | .0021            | .0102              | .1153            | .0828              |
|             | .0027            | .0158              | .2258            | .0921              |
|             | .0033            | .0218              | .3706            | .1017              |
|             | .0037            | .0281              | .5506            | .1117              |
|             | .0041            | .0349              | .7671            | .1220              |
|             | .0045            | .0420              | 1.0214           | .1327              |
|             | .0048            | .0494              | 1.3149           | .1438              |
|             | .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .040           | 1.92           | 10.26        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .002           | 4.08           | 9.27         |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.18  
 TIME SHIFT OF PEAK FLOW (min) = 130.00  
 MAXIMUM STORAGE USED (ha.m.) = .0100

| ADD HYD (0903)   | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| 1 + 2 = 3        |              |                |                |              |
| ID1= 1 (0205):   | .45          | .003           | 2.33           | 2.96         |
| + ID2= 2 (0204): | .16          | .001           | 2.17           | 2.96         |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .004           | 2.33           | 2.96         |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| RESERVOIR (0301) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|------------------|--------------------|------------------|--------------------|
| IN= 2---> OUT= 1 |                  |                    |                  |                    |
| DT= 5.0 min      |                  |                    |                  |                    |
|                  | .0000            | .0000              | .0707            | .0775              |
|                  | .0010            | .0052              | .1232            | .0859              |
|                  | .0020            | .0108              | .2290            | .0944              |
|                  | .0030            | .0233              | .3811            | .1031              |
|                  | .0040            | .0302              | .5760            | .1120              |
|                  | .0164            | .0376              | .8126            | .1210              |
|                  | .0392            | .0453              | 1.0915           | .1301              |
|                  | .0602            | .0531              | 1.4134           | .1394              |
|                  | .0639            | .0611              | 1.7793           | .1488              |
|                  | .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .065           | 1.92           | 11.04        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .003           | 4.25           | 10.35        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 4.08  
 TIME SHIFT OF PEAK FLOW (min) = 140.00  
 MAXIMUM STORAGE USED (ha.m.) = .0190

| ADD HYD (0902)   | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| 1 + 2 = 3        |              |                |                |              |
| ID1= 1 (0302):   | 1.14         | .002           | 4.08           | 9.27         |
| + ID2= 2 (0903): | .61          | .004           | 2.33           | 2.96         |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .006           | 2.33           | 7.07         |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0901)   | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| 1 + 2 = 3        |              |                |                |              |
| ID1= 1 (0902):   | 1.74         | .006           | 2.33           | 7.07         |
| + ID2= 2 (0301): | 1.92         | .003           | 4.25           | 10.35        |
| =====            |              |                |                |              |
| ID = 3 (0901):   | 3.67         | .008           | 2.33           | 8.79         |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

-----  
| READ STORM | Filename: I:\2015 Projects\115  
| | 185 - Monterra Phase 2 Natural Hazard Assessm  
| | \Design\Hydrology\115185 vo2\STORMS\OSCHI2.4H  
| Ptotal= 33.75 mm | Comments: OWEN SOUND 2 YEAR 4 HOUR DURATION CHICAG  
-----

| TIME | RAIN  | TIME | RAIN  | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|-------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 1.75  | 1.10 | 3.80  | 2.10 | 17.64 | 3.10 | 2.75  |
| .20  | 1.84  | 1.20 | 4.35  | 2.20 | 11.41 | 3.20 | 2.55  |
| .30  | 1.95  | 1.30 | 5.09  | 2.30 | 8.39  | 3.30 | 2.38  |
| .40  | 2.07  | 1.40 | 6.16  | 2.40 | 6.63  | 3.40 | 2.23  |
| .50  | 2.21  | 1.50 | 7.80  | 2.50 | 5.49  | 3.50 | 2.09  |
| .60  | 2.37  | 1.60 | 10.63 | 2.60 | 4.69  | 3.60 | 1.98  |
| .70  | 2.56  | 1.70 | 16.59 | 2.70 | 4.10  | 3.70 | 1.88  |
| .80  | 2.78  | 1.80 | 35.38 | 2.80 | 3.65  | 3.80 | 1.78  |
| .90  | 3.05  | 1.90 | 98.09 | 2.90 | 3.29  | 3.90 | 1.70  |
| 1.00 | 3.38  | 2.00 | 36.45 | 3.00 | 2.99  | 4.00 | 1.63  |

-----  
| CALIB |  
| STANDHYD (0203) | Area (ha)= .50  
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00  
-----

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME | RAIN  |
|-------|-------|-------|-------|-------|-------|------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs  | mm/hr |
| .083  | 1.75  | 1.083 | 3.80  | 2.083 | 17.64 | 3.08 | 2.75  |
| .167  | 1.82  | 1.167 | 4.24  | 2.167 | 12.66 | 3.17 | 2.59  |
| .250  | 1.91  | 1.250 | 4.79  | 2.250 | 9.60  | 3.25 | 2.45  |
| .333  | 2.00  | 1.333 | 5.52  | 2.333 | 7.69  | 3.33 | 2.32  |
| .417  | 2.10  | 1.417 | 6.49  | 2.417 | 6.40  | 3.42 | 2.20  |
| .500  | 2.21  | 1.500 | 7.80  | 2.500 | 5.49  | 3.50 | 2.09  |
| .583  | 2.37  | 1.583 | 10.63 | 2.583 | 4.69  | 3.58 | 1.98  |
| .667  | 2.52  | 1.667 | 15.40 | 2.667 | 4.22  | 3.67 | 1.90  |
| .750  | 2.69  | 1.750 | 27.86 | 2.750 | 3.83  | 3.75 | 1.82  |
| .833  | 2.89  | 1.833 | 60.46 | 2.833 | 3.51  | 3.83 | 1.75  |
| .917  | 3.12  | 1.917 | 85.76 | 2.917 | 3.23  | 3.92 | 1.69  |
| 1.000 | 3.38  | 2.000 | 36.45 | 3.000 | 2.99  | 4.00 | 1.63  |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 85.76     | 22.86      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 1.32 (ii) | 14.06 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .33       | .08        |

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .02   | .017 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 2.08       |
| RUNOFF VOLUME (mm)=  | 32.76 | 9.51  | 10.65      |
| TOTAL RAINFALL (mm)= | 33.76 | 33.76 | 33.76      |
| RUNOFF COEFFICIENT = | .97   | .28   | .32        |

\*TOTALS\*

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
| CALIB |

| STANDHYD (0202) | Area (ha)= 1.14  
|ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00  
-----

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .44        | .69          |
| Dep. Storage (mm)= | 1.00       | 3.80         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 65.00      | 40.00        |
| Mannings n =       | .013       | .250         |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 85.76     | 35.16      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 2.10 (ii) | 12.82 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .31       | .08        |

|                      |       |       | *TOTALS*   |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .04   | .05   | .067 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 1.92       |
| RUNOFF VOLUME (mm)=  | 32.75 | 12.82 | 16.21      |
| TOTAL RAINFALL (mm)= | 33.76 | 33.76 | 33.76      |
| RUNOFF COEFFICIENT = | .97   | .38   | .48        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
| CALIB |  
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0  
|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
-----  
U.H. Tp(hrs)= .36

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | 1.79  | 1.167 | 4.02  | 2.167 | 15.15 | 3.17 | 2.67  |
| .333                             | 1.95  | 1.333 | 5.16  | 2.333 | 8.64  | 3.33 | 2.38  |
| .500                             | 2.15  | 1.500 | 7.14  | 2.500 | 5.95  | 3.50 | 2.15  |
| .667                             | 2.45  | 1.667 | 13.01 | 2.667 | 4.45  | 3.67 | 1.94  |
| .833                             | 2.79  | 1.833 | 44.16 | 2.833 | 3.67  | 3.83 | 1.78  |
| 1.000                            | 3.25  | 2.000 | 61.11 | 3.000 | 3.11  | 4.00 | 1.66  |

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .006 (i)  
TIME TO PEAK (hrs)= 2.333  
RUNOFF VOLUME (mm)= 5.769  
TOTAL RAINFALL (mm)= 33.755  
RUNOFF COEFFICIENT = .171

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

-----  
| CALIB |  
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0  
|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
-----  
U.H. Tp(hrs)= .31

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .003 (i)  
TIME TO PEAK (hrs)= 2.167  
RUNOFF VOLUME (mm)= 5.752  
TOTAL RAINFALL (mm)= 33.755  
RUNOFF COEFFICIENT = .170

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

-----  
| CALIB |  
| STANDHYD (0201) | Area (ha)= 1.92  
|ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00  
-----

|               |       |            |              |
|---------------|-------|------------|--------------|
|               |       | IMPERVIOUS | PERVIOUS (i) |
| Surface Area  | (ha)= | .83        | 1.10         |
| Dep. Storage  | (mm)= | 1.00       | 3.70         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 200.00     | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME | RAIN  |
|-------|-------|-------|-------|-------|-------|------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs  | mm/hr |
| .083  | 1.75  | 1.083 | 3.80  | 2.083 | 17.64 | 3.08 | 2.75  |
| .167  | 1.82  | 1.167 | 4.24  | 2.167 | 12.66 | 3.17 | 2.59  |
| .250  | 1.91  | 1.250 | 4.79  | 2.250 | 9.60  | 3.25 | 2.45  |
| .333  | 2.00  | 1.333 | 5.52  | 2.333 | 7.69  | 3.33 | 2.32  |
| .417  | 2.10  | 1.417 | 6.49  | 2.417 | 6.40  | 3.42 | 2.20  |
| .500  | 2.21  | 1.500 | 7.80  | 2.500 | 5.49  | 3.50 | 2.09  |
| .583  | 2.37  | 1.583 | 10.63 | 2.583 | 4.69  | 3.58 | 1.98  |
| .667  | 2.52  | 1.667 | 15.40 | 2.667 | 4.22  | 3.67 | 1.90  |
| .750  | 2.69  | 1.750 | 27.86 | 2.750 | 3.83  | 3.75 | 1.82  |
| .833  | 2.89  | 1.833 | 60.46 | 2.833 | 3.51  | 3.83 | 1.75  |
| .917  | 3.12  | 1.917 | 85.76 | 2.917 | 3.23  | 3.92 | 1.69  |
| 1.000 | 3.38  | 2.000 | 36.45 | 3.000 | 2.99  | 4.00 | 1.63  |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 85.76     | 45.67      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 4.12 (ii) | 13.77 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .24       | .08        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .07   | .08   | .111 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 1.92       |
| RUNOFF VOLUME (mm)=  | 32.75 | 13.90 | 17.29      |
| TOTAL RAINFALL (mm)= | 33.76 | 33.76 | 33.76      |
| RUNOFF COEFFICIENT = | .97   | .41   | .51        |

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

\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
| RESERVOIR (0302) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW | STORAGE | OUTFLOW | STORAGE |
|---------|---------|---------|---------|
| (cms)   | (ha.m.) | (cms)   | (ha.m.) |
| .0000   | .0000   | .0054   | .0654   |
| .0011   | .0049   | .0393   | .0739   |
| .0021   | .0102   | .1153   | .0828   |
| .0027   | .0158   | .2258   | .0921   |
| .0033   | .0218   | .3706   | .1017   |
| .0037   | .0281   | .5506   | .1117   |
| .0041   | .0349   | .7671   | .1220   |
| .0045   | .0420   | 1.0214  | .1327   |
| .0048   | .0494   | 1.3149  | .1438   |
| .0051   | .0572   | .0000   | .0000   |

|                       | AREA  | QPEAK | TPEAK | R.V.  |
|-----------------------|-------|-------|-------|-------|
|                       | (ha)  | (cms) | (hrs) | (mm)  |
| INFLOW : ID= 2 (0202) | 1.136 | .067  | 1.92  | 16.21 |
| OUTFLOW: ID= 1 (0302) | 1.136 | .003  | 4.08  | 15.22 |

PEAK FLOW REDUCTION [Qout/Qin] (%)= 4.12  
TIME SHIFT OF PEAK FLOW (min)=130.00  
MAXIMUM STORAGE USED (ha.m.)= .0162

-----  
| ADD HYD (0903) |  
| 1 + 2 = 3 |  
-----

|                  | AREA | QPEAK | TPEAK | R.V. |
|------------------|------|-------|-------|------|
|                  | (ha) | (cms) | (hrs) | (mm) |
| ID1= 1 (0205):   | .45  | .006  | 2.33  | 5.77 |
| + ID2= 2 (0204): | .16  | .003  | 2.17  | 5.75 |
| =====            |      |       |       |      |
| ID = 3 (0903):   | .61  | .009  | 2.33  | 5.76 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
|-----|
| OUTFLOW          | STORAGE          | OUTFLOW          | STORAGE          |
| (cms)            | (ha.m.)          | (cms)            | (ha.m.)          |
| .0000            | .0000            | .0707            | .0775            |
| .0010            | .0052            | .1232            | .0859            |
| .0020            | .0108            | .2290            | .0944            |
| .0030            | .0233            | .3811            | .1031            |
| .0040            | .0302            | .5760            | .1120            |
| .0164            | .0376            | .8126            | .1210            |
| .0392            | .0453            | 1.0915           | .1301            |
| .0602            | .0531            | 1.4134           | .1394            |
| .0639            | .0611            | 1.7793           | .1488            |
| .0674            | .0692            | .0000            | .0000            |
|-----|
| AREA             | QPEAK            | TPEAK            | R.V.             |
| (ha)             | (cms)            | (hrs)            | (mm)             |
| INFLOW : ID= 2 (0201) | 1.925           | .111             | 1.92             | 17.29            |
| OUTFLOW: ID= 1 (0301) | 1.925           | .004             | 4.17             | 16.61            |
|-----|
| PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.58
| TIME SHIFT OF PEAK FLOW (min) = 135.00
| MAXIMUM STORAGE USED (ha.m.) = .0301
|-----
```

```
-----
| ADD HYD (0902) |
| 1 + 2 = 3      |
|-----|
| AREA             | QPEAK            | TPEAK            | R.V.             |
| (ha)             | (cms)            | (hrs)            | (mm)             |
| ID1= 1 (0302):   | 1.14             | .003             | 4.08             | 15.22            |
| + ID2= 2 (0903): | .61              | .009             | 2.33             | 5.76             |
|=====|
| ID = 3 (0902):   | 1.74             | .011             | 2.33             | 11.92            |
|-----
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
| ADD HYD (0901) |
| 1 + 2 = 3      |
|-----|
| AREA             | QPEAK            | TPEAK            | R.V.             |
| (ha)             | (cms)            | (hrs)            | (mm)             |
| ID1= 1 (0902):   | 1.74             | .011             | 2.33             | 11.92            |
| + ID2= 2 (0301): | 1.92             | .004             | 4.17             | 16.61            |
|=====|
| ID = 3 (0901):   | 3.67             | .014             | 2.33             | 14.38            |
|-----
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```
-----
| READ STORM      |
|-----|
| Ptotal= 44.07 mm |
|-----|
| Filename: I:\2015 Projects\l15
| 185 - Monterra Phase 2 Natural Hazard Assessm
| \Design\Hydrology\l15185 vo2\STORMS\OSCHI5.4H
| Comments: OWEN SOUND 5 YEAR 4 HOUR DURATION CHICAG
```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.16  | 1.10 | 4.86   | 2.10 | 23.63 | 3.10 | 3.47  |
| .20  | 2.29  | 1.20 | 5.59   | 2.20 | 15.14 | 3.20 | 3.21  |
| .30  | 2.42  | 1.30 | 6.58   | 2.30 | 11.03 | 3.30 | 2.98  |
| .40  | 2.58  | 1.40 | 8.01   | 2.40 | 8.65  | 3.40 | 2.78  |
| .50  | 2.76  | 1.50 | 10.23  | 2.50 | 7.11  | 3.50 | 2.61  |
| .60  | 2.97  | 1.60 | 14.08  | 2.60 | 6.04  | 3.60 | 2.46  |
| .70  | 3.22  | 1.70 | 22.20  | 2.70 | 5.25  | 3.70 | 2.33  |
| .80  | 3.51  | 1.80 | 47.44  | 2.80 | 4.65  | 3.80 | 2.21  |
| .90  | 3.86  | 1.90 | 127.12 | 2.90 | 4.17  | 3.90 | 2.11  |
| 1.00 | 4.30  | 2.00 | 48.87  | 3.00 | 3.79  | 4.00 | 2.01  |

```
-----
| CALIB          |
| STANDHYD (0203) |
| ID= 1 DT= 5.0 min |
|-----|
| Area (ha)= .50
| Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
|-----
```

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .11        | .39          |
| Dep. Storage  | (mm)= | 1.00       | 4.30         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 30.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

| ---- TRANSFORMED HYETOGRAPH ---- |       |       |        |       |       |      |       |
|----------------------------------|-------|-------|--------|-------|-------|------|-------|
| TIME                             | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME | RAIN  |
| hrs                              | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs  | mm/hr |
| .083                             | 2.16  | 1.083 | 4.86   | 2.083 | 23.63 | 3.08 | 3.47  |
| .167                             | 2.26  | 1.167 | 5.44   | 2.167 | 16.84 | 3.17 | 3.26  |
| .250                             | 2.37  | 1.250 | 6.18   | 2.250 | 12.67 | 3.25 | 3.07  |
| .333                             | 2.48  | 1.333 | 7.15   | 2.333 | 10.08 | 3.33 | 2.90  |
| .417                             | 2.62  | 1.417 | 8.45   | 2.417 | 8.34  | 3.42 | 2.75  |
| .500                             | 2.76  | 1.500 | 10.23  | 2.500 | 7.11  | 3.50 | 2.61  |
| .583                             | 2.97  | 1.583 | 14.08  | 2.583 | 6.04  | 3.58 | 2.46  |
| .667                             | 3.17  | 1.667 | 20.58  | 2.667 | 5.41  | 3.67 | 2.36  |
| .750                             | 3.39  | 1.750 | 37.34  | 2.750 | 4.89  | 3.75 | 2.26  |
| .833                             | 3.65  | 1.833 | 79.31  | 2.833 | 4.46  | 3.83 | 2.17  |
| .917                             | 3.95  | 1.917 | 111.47 | 2.917 | 4.09  | 3.92 | 2.09  |
| 1.000                            | 4.30  | 2.000 | 48.87  | 3.000 | 3.79  | 4.00 | 2.01  |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 111.47    | 42.83      |
| over (min)              | 5.00      | 15.00      |
| Storage Coeff. (min)=   | 1.19 (ii) | 11.10 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=   | .33       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .03   | .032 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 2.08       |
| RUNOFF VOLUME (mm)=  | 43.07 | 15.45 | 16.81      |
| TOTAL RAINFALL (mm)= | 44.07 | 44.07 | 44.07      |
| RUNOFF COEFFICIENT   | .98   | .35   | .38        |

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

\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN\* = 76.0 Ia = Dep. Storage (Above)

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

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

|                   |                                          |
|-------------------|------------------------------------------|
| ! CALIB           |                                          |
| STANDHYD (0202)   | Area (ha)= 1.14                          |
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00 |

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 111.47    | 62.83      |
| over (min)              | 5.00      | 15.00      |
| Storage Coeff. (min)=   | 1.89 (ii) | 10.39 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=   | .32       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .06   | .08   | .099 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 1.92       |
| RUNOFF VOLUME (mm)=  | 43.07 | 20.03 | 23.94      |
| TOTAL RAINFALL (mm)= | 44.07 | 44.07 | 44.07      |
| RUNOFF COEFFICIENT   | .98   | .45   | .54        |

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

\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

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

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

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

```

-----
| CALIB |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .36

```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
.167 2.21 | 1.167 5.15 | 2.167 20.23 | 3.17 3.37
.333 2.43 | 1.333 6.67 | 2.333 11.38 | 3.33 2.99
.500 2.69 | 1.500 9.34 | 2.500 7.73 | 3.50 2.68
.667 3.07 | 1.667 17.33 | 2.667 5.72 | 3.67 2.41
.833 3.52 | 1.833 58.33 | 2.833 4.67 | 3.83 2.21
1.000 4.12 | 2.000 80.17 | 3.000 3.94 | 4.00 2.05

```

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .011 (i)  
 TIME TO PEAK (hrs)= 2.333  
 RUNOFF VOLUME (mm)= 9.933  
 TOTAL RAINFALL (mm)= 44.068  
 RUNOFF COEFFICIENT = .225

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

```

-----
| CALIB |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .31

```

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .005 (i)  
 TIME TO PEAK (hrs)= 2.167  
 RUNOFF VOLUME (mm)= 9.909  
 TOTAL RAINFALL (mm)= 44.068  
 RUNOFF COEFFICIENT = .225

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

```

-----
| CALIB |
| STANDHYD (0201) | Area (ha)= 1.92
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
-----

```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 2.16 | 1.083 4.86 | 2.083 23.63 | 3.08 3.47
.167 2.26 | 1.167 5.44 | 2.167 16.84 | 3.17 3.26
.250 2.37 | 1.250 6.18 | 2.250 12.67 | 3.25 3.07
.333 2.48 | 1.333 7.15 | 2.333 10.08 | 3.33 2.90
.417 2.62 | 1.417 8.45 | 2.417 8.34 | 3.42 2.75
.500 2.76 | 1.500 10.23 | 2.500 7.11 | 3.50 2.61
.583 2.97 | 1.583 14.08 | 2.583 6.04 | 3.58 2.46
.667 3.17 | 1.667 20.58 | 2.667 5.41 | 3.67 2.36
.750 3.39 | 1.750 37.34 | 2.750 4.89 | 3.75 2.26
.833 3.65 | 1.833 79.31 | 2.833 4.46 | 3.83 2.17
.917 3.95 | 1.917 111.47 | 2.917 4.09 | 3.92 2.09
1.000 4.30 | 2.000 48.87 | 3.000 3.79 | 4.00 2.01

```

Max.Eff.Inten.(mm/hr)= 111.47 71.75  
 over (min) 5.00 15.00  
 Storage Coeff. (min)= 3.71 (ii) 11.77 (ii)  
 Unit Hyd. Tpeak (min)= 5.00 15.00  
 Unit Hyd. peak (cms)= .25 .09

\*TOTALS\*

PEAK FLOW (cms)= .10 .14 .173 (iii)

|                      |       |       |       |
|----------------------|-------|-------|-------|
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 2.00  |
| RUNOFF VOLUME (mm)=  | 43.07 | 21.46 | 25.34 |
| TOTAL RAINFALL (mm)= | 44.07 | 44.07 | 44.07 |
| RUNOFF COEFFICIENT = | .98   | .49   | .58   |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
 | RESERVOIR (0302) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .099           | 1.92           | 23.94        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .003           | 4.08           | 22.95        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.48  
 TIME SHIFT OF PEAK FLOW (min) = 130.00  
 MAXIMUM STORAGE USED (ha.m.) = .0244

-----  
 | ADD HYD (0903) |  
 | 1 + 2 = 3 |  
 -----

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0205):   | .45          | .011           | 2.33           | 9.93         |
| + ID2= 2 (0204): | .16          | .005           | 2.17           | 9.91         |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .015           | 2.17           | 9.93         |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----  
 | RESERVOIR (0301) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .173           | 2.00           | 25.34        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .020           | 3.08           | 24.66        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 11.36  
 TIME SHIFT OF PEAK FLOW (min) = 65.00  
 MAXIMUM STORAGE USED (ha.m.) = .0387

-----  
 | ADD HYD (0902) |  
 | 1 + 2 = 3 |  
 -----

| AREA | QPEAK | TPEAK | R.V. |
|------|-------|-------|------|
|------|-------|-------|------|



```

-----
              (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0302):  1.14    .003    4.08    22.95
+ ID2= 2 (0903):  .61     .015    2.17     9.93
=====
ID = 3 (0902):  1.74    .018    2.33    18.40

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD      (0901) |
| 1 + 2 = 3 |
-----
              AREA      QPEAK      TPEAK      R.V.
              (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0902):  1.74    .018    2.33    18.40
+ ID2= 2 (0301):  1.92    .020    3.08    24.66
=====
ID = 3 (0901):  3.67    .029    2.75    21.69

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| READ STORM |      Filename: I:\2015 Projects\115
|            |      185 - Monterra Phase 2 Natural Hazard Assessm
|            |      \Design\Hydrology\115185 vo2\STORMS\OSchil0.4
| Ptotal= 50.59 mm |      Comments: OWEN SOUND 10 YEAR 4 HOUR DURATION CHICA
-----

```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.37  | 1.10 | 5.44   | 2.10 | 27.54 | 3.10 | 3.85  |
| .20  | 2.50  | 1.20 | 6.28   | 2.20 | 17.50 | 3.20 | 3.54  |
| .30  | 2.66  | 1.30 | 7.44   | 2.30 | 12.66 | 3.30 | 3.29  |
| .40  | 2.84  | 1.40 | 9.10   | 2.40 | 9.86  | 3.40 | 3.06  |
| .50  | 3.04  | 1.50 | 11.71  | 2.50 | 8.06  | 3.50 | 2.87  |
| .60  | 3.28  | 1.60 | 16.26  | 2.60 | 6.81  | 3.60 | 2.70  |
| .70  | 3.56  | 1.70 | 25.85  | 2.70 | 5.89  | 3.70 | 2.55  |
| .80  | 3.89  | 1.80 | 55.53  | 2.80 | 5.20  | 3.80 | 2.42  |
| .90  | 4.29  | 1.90 | 146.69 | 2.90 | 4.65  | 3.90 | 2.30  |
| 1.00 | 4.80  | 2.00 | 57.21  | 3.00 | 4.21  | 4.00 | 2.20  |

```

-----
| CALIB      |
| STANDHYD (0203) |      Area (ha)= .50
| DT= 1 DT= 5.0 min |      Total Imp(%)= 22.00      Dir. Conn.(%)= 5.00
-----

```

|               | IMPERVIOUS | PERVIOUS (i) |
|---------------|------------|--------------|
| Surface Area  | (ha)= .11  | .39          |
| Dep. Storage  | (mm)= 1.00 | 4.30         |
| Average Slope | (%)= 1.00  | 2.00         |
| Length        | (m)= 30.00 | 40.00        |
| Mannings n    | = .013     | .250         |

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

```

-----
              ---- TRANSFORMED HYETOGRAPH ----
TIME      RAIN | TIME      RAIN | TIME      RAIN | TIME      RAIN
hrs      mm/hr | hrs      mm/hr | hrs      mm/hr | hrs      mm/hr
.083     2.37 | 1.083     5.44 | 2.083     27.54 | 3.08     3.85
.167     2.47 | 1.167     6.11 | 2.167     19.51 | 3.17     3.60
.250     2.60 | 1.250     6.98 | 2.250     14.60 | 3.25     3.39
.333     2.73 | 1.333     8.10 | 2.333     11.54 | 3.33     3.20
.417     2.88 | 1.417     9.62 | 2.417     9.50 | 3.42     3.02
.500     3.04 | 1.500    11.71 | 2.500     8.06 | 3.50     2.87
.583     3.28 | 1.583    16.26 | 2.583     6.81 | 3.58     2.70
.667     3.50 | 1.667    23.93 | 2.667     6.07 | 3.67     2.58
.750     3.76 | 1.750    43.66 | 2.750     5.48 | 3.75     2.47
.833     4.05 | 1.833    91.99 | 2.833     4.98 | 3.83     2.37
.917     4.39 | 1.917   128.79 | 2.917     4.56 | 3.92     2.28
1.000     4.80 | 2.000    57.21 | 3.000     4.21 | 4.00     2.20

```

```

Max.Eff.Inten.(mm/hr)= 128.79      54.88
over (min)           5.00      15.00
Storage Coeff. (min)= 1.12 (ii)  10.09 (ii)
Unit Hyd. Tpeak (min)= 5.00      15.00
Unit Hyd. peak (cms)= .34        .10

```

\*TOTALS\*

|                    |        |       |       |            |
|--------------------|--------|-------|-------|------------|
| PEAK FLOW          | (cms)= | .01   | .04   | .042 (iii) |
| TIME TO PEAK       | (hrs)= | 1.92  | 2.08  | 2.08       |
| RUNOFF VOLUME      | (mm)=  | 49.59 | 19.61 | 21.10      |
| TOTAL RAINFALL     | (mm)=  | 50.59 | 50.59 | 50.59      |
| RUNOFF COEFFICIENT | =      | .98   | .39   | .42        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB          |
| STANDHYD (0202) | Area (ha)= 1.14
|ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
-----
  
```

|               |       |            |              |
|---------------|-------|------------|--------------|
|               |       | IMPERVIOUS | PERVIOUS (i) |
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 128.79    | 79.55     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.78 (ii) | 9.52 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .32       | .12       |

\*TOTALS\*

|                    |        |       |       |            |
|--------------------|--------|-------|-------|------------|
| PEAK FLOW          | (cms)= | .07   | .11   | .148 (iii) |
| TIME TO PEAK       | (hrs)= | 1.92  | 2.00  | 1.92       |
| RUNOFF VOLUME      | (mm)=  | 49.59 | 24.94 | 29.13      |
| TOTAL RAINFALL     | (mm)=  | 50.59 | 50.59 | 50.59      |
| RUNOFF COEFFICIENT | =      | .98   | .49   | .58        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

```

-----
| CALIB          |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .36
  
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
.167    2.42 | 1.167    5.78 | 2.167   23.52 | 3.17     3.73
.333    2.66 | 1.333    7.54 | 2.333   13.07 | 3.33     3.29
.500    2.96 | 1.500   10.67 | 2.500    8.78 | 3.50     2.95
.667    3.39 | 1.667   20.10 | 2.667    6.44 | 3.67     2.64
.833    3.90 | 1.833   67.83 | 2.833    5.23 | 3.83     2.42
1.000    4.60 | 2.000   93.00 | 3.000    4.39 | 4.00     2.24
  
```

Unit Hyd Qpeak (cms)= .047

|                    |        |          |
|--------------------|--------|----------|
| PEAK FLOW          | (cms)= | .015 (i) |
| TIME TO PEAK       | (hrs)= | 2.333    |
| RUNOFF VOLUME      | (mm)=  | 12.976   |
| TOTAL RAINFALL     | (mm)=  | 50.590   |
| RUNOFF COEFFICIENT | =      | .256     |

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

```

-----
| CALIB          |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
  
```

ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
----- U.H. Tp(hrs)= .31

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .006 (i)  
TIME TO PEAK (hrs)= 2.167  
RUNOFF VOLUME (mm)= 12.944  
TOTAL RAINFALL (mm)= 50.590  
RUNOFF COEFFICIENT = .256

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

-----  
| CALIB |  
| STANDHYD (0201) | Area (ha)= 1.92  
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00  
-----

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME | RAIN  |
|-------|-------|-------|--------|-------|-------|------|-------|
| hrs   | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs  | mm/hr |
| .083  | 2.37  | 1.083 | 5.44   | 2.083 | 27.54 | 3.08 | 3.85  |
| .167  | 2.47  | 1.167 | 6.11   | 2.167 | 19.51 | 3.17 | 3.60  |
| .250  | 2.60  | 1.250 | 6.98   | 2.250 | 14.60 | 3.25 | 3.39  |
| .333  | 2.73  | 1.333 | 8.10   | 2.333 | 11.54 | 3.33 | 3.20  |
| .417  | 2.88  | 1.417 | 9.62   | 2.417 | 9.50  | 3.42 | 3.02  |
| .500  | 3.04  | 1.500 | 11.71  | 2.500 | 8.06  | 3.50 | 2.87  |
| .583  | 3.28  | 1.583 | 16.26  | 2.583 | 6.81  | 3.58 | 2.70  |
| .667  | 3.50  | 1.667 | 23.93  | 2.667 | 6.07  | 3.67 | 2.58  |
| .750  | 3.76  | 1.750 | 43.66  | 2.750 | 5.48  | 3.75 | 2.47  |
| .833  | 4.05  | 1.833 | 91.99  | 2.833 | 4.98  | 3.83 | 2.37  |
| .917  | 4.39  | 1.917 | 128.79 | 2.917 | 4.56  | 3.92 | 2.28  |
| 1.000 | 4.80  | 2.000 | 57.21  | 3.000 | 4.21  | 4.00 | 2.20  |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 128.79    | 90.23      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 3.50 (ii) | 10.85 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .26       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .11   | .18   | .218 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.08  | 2.00       |
| RUNOFF VOLUME (mm)=  | 49.59 | 26.57 | 30.71      |
| TOTAL RAINFALL (mm)= | 50.59 | 50.59 | 50.59      |
| RUNOFF COEFFICIENT = | .98   | .53   | .61        |

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

\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 82.0 Ia = Dep. Storage (Above)  
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.  
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
| RESERVOIR (0302) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW | STORAGE | OUTFLOW | STORAGE |
|---------|---------|---------|---------|
| (cms)   | (ha.m.) | (cms)   | (ha.m.) |
| .0000   | .0000   | .0054   | .0654   |
| .0011   | .0049   | .0393   | .0739   |
| .0021   | .0102   | .1153   | .0828   |
| .0027   | .0158   | .2258   | .0921   |
| .0033   | .0218   | .3706   | .1017   |
| .0037   | .0281   | .5506   | .1117   |
| .0041   | .0349   | .7671   | .1220   |
| .0045   | .0420   | 1.0214  | .1327   |
| .0048   | .0494   | 1.3149  | .1438   |
| .0051   | .0572   | .0000   | .0000   |

AREA QPEAK TPEAK R.V.

|          |              |       |       |       |       |
|----------|--------------|-------|-------|-------|-------|
|          |              | (ha)  | (cms) | (hrs) | (mm)  |
| INFLOW : | ID= 2 (0202) | 1.136 | .148  | 1.92  | 29.13 |
| OUTFLOW: | ID= 1 (0302) | 1.136 | .004  | 4.08  | 28.14 |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.57  
 TIME SHIFT OF PEAK FLOW (min) = 130.00  
 MAXIMUM STORAGE USED (ha.m.) = .0300

```

-----
| ADD HYD (0903) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0205):    .45      .015      2.33      12.98
+ ID2= 2 (0204):    .16      .006      2.17      12.94
=====
ID = 3 (0903):    .61      .021      2.17      12.97
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0301) |
| IN= 2--> OUT= 1 |
| DT= 5.0 min |
-----
      OUTFLOW      STORAGE      OUTFLOW      STORAGE
      (cms)      (ha.m.)      (cms)      (ha.m.)
      .0000      .0000      .0707      .0775
      .0010      .0052      .1232      .0859
      .0020      .0108      .2290      .0944
      .0030      .0233      .3811      .1031
      .0040      .0302      .5760      .1120
      .0164      .0376      .8126      .1210
      .0392      .0453      1.0915      .1301
      .0602      .0531      1.4134      .1394
      .0639      .0611      1.7793      .1488
      .0674      .0692      .0000      .0000

      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
INFLOW : ID= 2 (0201)    1.925      .218      2.00      30.71
OUTFLOW: ID= 1 (0301)    1.925      .035      2.83      30.03
  
```

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.17  
 TIME SHIFT OF PEAK FLOW (min) = 50.00  
 MAXIMUM STORAGE USED (ha.m.) = .0440

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0302):    1.14      .004      4.08      28.14
+ ID2= 2 (0903):    .61      .021      2.17      12.97
=====
ID = 3 (0902):    1.74      .024      2.25      22.84
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0902):    1.74      .024      2.25      22.84
+ ID2= 2 (0301):    1.92      .035      2.83      30.03
=====
ID = 3 (0901):    3.67      .051      2.58      26.61
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```

-----
| READ STORM |
|           |
|           |
| Ptotal= 59.08 mm |
-----
Filename: I:\2015 Projects\115
          185 - Monterra Phase 2 Natural Hazard Assessm
          \Design\Hydrology\115185 vo2\STORMS\OSCHI25.4
Comments: OWEN SOUND 25 YEAR 4 HOUR DURATION CHICA
  
```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.69  | 1.10 | 6.28   | 2.10 | 32.51 | 3.10 | 4.41  |
| .20  | 2.85  | 1.20 | 7.27   | 2.20 | 20.58 | 3.20 | 4.06  |
| .30  | 3.03  | 1.30 | 8.63   | 2.30 | 14.82 | 3.30 | 3.76  |
| .40  | 3.24  | 1.40 | 10.61  | 2.40 | 11.50 | 3.40 | 3.50  |
| .50  | 3.47  | 1.50 | 13.69  | 2.50 | 9.37  | 3.50 | 3.28  |
| .60  | 3.75  | 1.60 | 19.10  | 2.60 | 7.89  | 3.60 | 3.08  |
| .70  | 4.07  | 1.70 | 30.50  | 2.70 | 6.82  | 3.70 | 2.91  |
| .80  | 4.46  | 1.80 | 65.56  | 2.80 | 6.00  | 3.80 | 2.76  |
| .90  | 4.94  | 1.90 | 170.99 | 2.90 | 5.35  | 3.90 | 2.62  |
| 1.00 | 5.53  | 2.00 | 67.54  | 3.00 | 4.84  | 4.00 | 2.50  |

```

-----
| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
-----

```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME | RAIN  |
|-------|-------|-------|--------|-------|-------|------|-------|
| hrs   | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs  | mm/hr |
| .083  | 2.69  | 1.083 | 6.28   | 2.083 | 32.51 | 3.08 | 4.41  |
| .167  | 2.82  | 1.167 | 7.07   | 2.167 | 22.97 | 3.17 | 4.13  |
| .250  | 2.96  | 1.250 | 8.09   | 2.250 | 17.12 | 3.25 | 3.88  |
| .333  | 3.11  | 1.333 | 9.42   | 2.333 | 13.49 | 3.33 | 3.66  |
| .417  | 3.29  | 1.417 | 11.23  | 2.417 | 11.07 | 3.42 | 3.46  |
| .500  | 3.47  | 1.500 | 13.69  | 2.500 | 9.37  | 3.50 | 3.28  |
| .583  | 3.75  | 1.583 | 19.10  | 2.583 | 7.89  | 3.58 | 3.08  |
| .667  | 4.01  | 1.667 | 28.22  | 2.667 | 7.03  | 3.67 | 2.94  |
| .750  | 4.30  | 1.750 | 51.54  | 2.750 | 6.33  | 3.75 | 2.82  |
| .833  | 4.65  | 1.833 | 107.73 | 2.833 | 5.74  | 3.83 | 2.70  |
| .917  | 5.06  | 1.917 | 150.30 | 2.917 | 5.25  | 3.92 | 2.60  |
| 1.000 | 5.53  | 2.000 | 67.54  | 3.000 | 4.84  | 4.00 | 2.50  |

|                         |           |           |
|-------------------------|-----------|-----------|
| Max.Eff.Inten. (mm/hr)= | 150.30    | 71.33     |
| over (min)              | 5.00      | 10.00     |
| Storage Coeff. (min)=   | 1.05 (ii) | 9.13 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=   | .34       | .12       |

```

*TOTALS*
.063 (iii)
2.00
27.04
59.08
.46

```

|                      |       |       |
|----------------------|-------|-------|
| PEAK FLOW (cms)=     | .01   | .06   |
| TIME TO PEAK (hrs)=  | 1.92  | 2.00  |
| RUNOFF VOLUME (mm)=  | 58.08 | 25.41 |
| TOTAL RAINFALL (mm)= | 59.08 | 59.08 |
| RUNOFF COEFFICIENT = | .98   | .43   |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0202) | Area (ha)= 1.14
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
-----

```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .44        | .69          |
| Dep. Storage (mm)= | 1.00       | 3.80         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 65.00      | 40.00        |
| Mannings n =       | .013       | .250         |

|                         |           |           |
|-------------------------|-----------|-----------|
| Max.Eff.Inten. (mm/hr)= | 150.30    | 101.86    |
| over (min)              | 5.00      | 10.00     |
| Storage Coeff. (min)=   | 1.68 (ii) | 8.68 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 10.00     |

|                       |       |       |            |
|-----------------------|-------|-------|------------|
| Unit Hyd. peak (cms)= | .32   | .12   |            |
| PEAK FLOW (cms)=      | .08   | .15   | *TOTALS*   |
| TIME TO PEAK (hrs)=   | 1.92  | 2.00  | .189 (iii) |
| RUNOFF VOLUME (mm)=   | 58.08 | 31.66 | 1.92       |
| TOTAL RAINFALL (mm)=  | 59.08 | 59.08 | 36.14      |
| RUNOFF COEFFICIENT =  | .98   | .54   | 59.08      |
|                       |       |       | .61        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

|                   |               |      |                            |
|-------------------|---------------|------|----------------------------|
| CALIB             |               |      |                            |
| NASHYD (0205)     | Area (ha)=    | .45  | Curve Number (CN)= 69.0    |
| ID= 1 DT=10.0 min | Ia (mm)=      | 5.00 | # of Linear Res. (N)= 3.00 |
|                   | U.H. Tp(hrs)= | .36  |                            |

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | 2.75  | 1.167 | 6.68   | 2.167 | 27.74 | 3.17 | 4.27  |
| .333                             | 3.04  | 1.333 | 8.75   | 2.333 | 15.31 | 3.33 | 3.77  |
| .500                             | 3.38  | 1.500 | 12.46  | 2.500 | 10.22 | 3.50 | 3.37  |
| .667                             | 3.88  | 1.667 | 23.66  | 2.667 | 7.46  | 3.67 | 3.01  |
| .833                             | 4.48  | 1.833 | 79.63  | 2.833 | 6.03  | 3.83 | 2.76  |
| 1.000                            | 5.29  | 2.000 | 108.92 | 3.000 | 5.04  | 4.00 | 2.55  |

Unit Hyd Qpeak (cms)= .047

|                      |          |
|----------------------|----------|
| PEAK FLOW (cms)=     | .020 (i) |
| TIME TO PEAK (hrs)=  | 2.333    |
| RUNOFF VOLUME (mm)=  | 17.335   |
| TOTAL RAINFALL (mm)= | 59.076   |
| RUNOFF COEFFICIENT = | .293     |

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

|                   |               |      |                            |
|-------------------|---------------|------|----------------------------|
| CALIB             |               |      |                            |
| NASHYD (0204)     | Area (ha)=    | .16  | Curve Number (CN)= 69.0    |
| ID= 1 DT=10.0 min | Ia (mm)=      | 5.00 | # of Linear Res. (N)= 3.00 |
|                   | U.H. Tp(hrs)= | .31  |                            |

Unit Hyd Qpeak (cms)= .020

|                      |          |
|----------------------|----------|
| PEAK FLOW (cms)=     | .008 (i) |
| TIME TO PEAK (hrs)=  | 2.167    |
| RUNOFF VOLUME (mm)=  | 17.292   |
| TOTAL RAINFALL (mm)= | 59.076   |
| RUNOFF COEFFICIENT = | .293     |

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

|                   |               |       |                      |
|-------------------|---------------|-------|----------------------|
| CALIB             |               |       |                      |
| STANDHYD (0201)   | Area (ha)=    | 1.92  |                      |
| ID= 1 DT= 5.0 min | Total Imp(%)= | 43.00 | Dir. Conn.(%)= 18.00 |

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

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

| ---- TRANSFORMED HYETOGRAPH ---- |       |       |       |       |       |      |       |
|----------------------------------|-------|-------|-------|-------|-------|------|-------|
| TIME                             | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME | RAIN  |
| hrs                              | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs  | mm/hr |
| .083                             | 2.69  | 1.083 | 6.28  | 2.083 | 32.51 | 3.08 | 4.41  |

|       |      |  |       |        |  |       |       |  |      |      |
|-------|------|--|-------|--------|--|-------|-------|--|------|------|
| .167  | 2.82 |  | 1.167 | 7.07   |  | 2.167 | 22.97 |  | 3.17 | 4.13 |
| .250  | 2.96 |  | 1.250 | 8.09   |  | 2.250 | 17.12 |  | 3.25 | 3.88 |
| .333  | 3.11 |  | 1.333 | 9.42   |  | 2.333 | 13.49 |  | 3.33 | 3.66 |
| .417  | 3.29 |  | 1.417 | 11.23  |  | 2.417 | 11.07 |  | 3.42 | 3.46 |
| .500  | 3.47 |  | 1.500 | 13.69  |  | 2.500 | 9.37  |  | 3.50 | 3.28 |
| .583  | 3.75 |  | 1.583 | 19.10  |  | 2.583 | 7.89  |  | 3.58 | 3.08 |
| .667  | 4.01 |  | 1.667 | 28.22  |  | 2.667 | 7.03  |  | 3.67 | 2.94 |
| .750  | 4.30 |  | 1.750 | 51.54  |  | 2.750 | 6.33  |  | 3.75 | 2.82 |
| .833  | 4.65 |  | 1.833 | 107.73 |  | 2.833 | 5.74  |  | 3.83 | 2.70 |
| .917  | 5.06 |  | 1.917 | 150.30 |  | 2.917 | 5.25  |  | 3.92 | 2.60 |
| 1.000 | 5.53 |  | 2.000 | 67.54  |  | 3.000 | 4.84  |  | 4.00 | 2.50 |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 150.30    | 114.71    |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 3.29 (ii) | 9.97 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .27       | .11       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .13   | .25   | .329 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.00  | 2.00       |
| RUNOFF VOLUME (mm)=  | 58.08 | 33.52 | 37.93      |
| TOTAL RAINFALL (mm)= | 59.08 | 59.08 | 59.08      |
| RUNOFF COEFFICIENT = | .98   | .57   | .64        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
 | RESERVOIR (0302) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW | STORAGE | OUTFLOW | STORAGE |
|---------|---------|---------|---------|
| (cms)   | (ha.m.) | (cms)   | (ha.m.) |
| .0000   | .0000   | .0054   | .0654   |
| .0011   | .0049   | .0393   | .0739   |
| .0021   | .0102   | .1153   | .0828   |
| .0027   | .0158   | .2258   | .0921   |
| .0033   | .0218   | .3706   | .1017   |
| .0037   | .0281   | .5506   | .1117   |
| .0041   | .0349   | .7671   | .1220   |
| .0045   | .0420   | 1.0214  | .1327   |
| .0048   | .0494   | 1.3149  | .1438   |
| .0051   | .0572   | .0000   | .0000   |

|                       | AREA  | QPEAK | TPEAK | R.V.  |
|-----------------------|-------|-------|-------|-------|
|                       | (ha)  | (cms) | (hrs) | (mm)  |
| INFLOW : ID= 2 (0202) | 1.136 | .189  | 1.92  | 36.14 |
| OUTFLOW: ID= 1 (0302) | 1.136 | .004  | 4.08  | 35.15 |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.25  
 TIME SHIFT OF PEAK FLOW (min) = 130.00  
 MAXIMUM STORAGE USED (ha.m.) = .0376

-----  
 | ADD HYD (0903) |  
 | 1 + 2 = 3 |  
 -----

|                  | AREA | QPEAK | TPEAK | R.V.  |
|------------------|------|-------|-------|-------|
|                  | (ha) | (cms) | (hrs) | (mm)  |
| ID1= 1 (0205):   | .45  | .020  | 2.33  | 17.33 |
| + ID2= 2 (0204): | .16  | .008  | 2.17  | 17.29 |
| =====            |      |       |       |       |
| ID = 3 (0903):   | .61  | .028  | 2.17  | 17.32 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----  
 | RESERVOIR (0301) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW | STORAGE | OUTFLOW | STORAGE |
|---------|---------|---------|---------|
| (cms)   | (ha.m.) | (cms)   | (ha.m.) |
| .0000   | .0000   | .0707   | .0775   |
| .0010   | .0052   | .1232   | .0859   |
| .0020   | .0108   | .2290   | .0944   |
| .0030   | .0233   | .3811   | .1031   |
| .0040   | .0302   | .5760   | .1120   |
| .0164   | .0376   | .8126   | .1210   |

|       |       |  |        |       |
|-------|-------|--|--------|-------|
| .0392 | .0453 |  | 1.0915 | .1301 |
| .0602 | .0531 |  | 1.4134 | .1394 |
| .0639 | .0611 |  | 1.7793 | .1488 |
| .0674 | .0692 |  | .0000  | .0000 |

|                       |       |       |       |       |
|-----------------------|-------|-------|-------|-------|
|                       | AREA  | QPEAK | TPEAK | R.V.  |
|                       | (ha)  | (cms) | (hrs) | (mm)  |
| INFLOW : ID= 2 (0201) | 1.925 | .329  | 2.00  | 37.93 |
| OUTFLOW: ID= 1 (0301) | 1.925 | .056  | 2.58  | 37.25 |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.91  
 TIME SHIFT OF PEAK FLOW (min) = 35.00  
 MAXIMUM STORAGE USED (ha.m.) = .0515

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0302):  1.14      .004      4.08      35.15
+ ID2= 2 (0903):  .61      .028      2.17      17.32
=====
ID = 3 (0902):  1.74      .032      2.17      28.93
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0902):  1.74      .032      2.17      28.93
+ ID2= 2 (0301):  1.92      .056      2.58      37.25
=====
ID = 3 (0901):  3.67      .081      2.42      33.29
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION NUMBER: 6 \*\*  
 \*\*\*\*\*

```

-----
| READ STORM |      Filename: I:\2015 Projects\l15
|             |      185 - Monterra Phase 2 Natural Hazard Assessm
|             |      \Design\Hydrology\l15185 vo2\STORMS\OSchi50.4
| Ptotal= 65.65 mm |      Comments: OWEN SOUND 50 YEAR 4 HOUR DURATION CHICA
-----
  
```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 2.87  | 1.10 | 6.88   | 2.10 | 36.93 | 3.10 | 4.78  |
| .20  | 3.04  | 1.20 | 8.01   | 2.20 | 23.25 | 3.20 | 4.39  |
| .30  | 3.24  | 1.30 | 9.55   | 2.30 | 16.64 | 3.30 | 4.05  |
| .40  | 3.47  | 1.40 | 11.81  | 2.40 | 12.83 | 3.40 | 3.76  |
| .50  | 3.73  | 1.50 | 15.34  | 2.50 | 10.39 | 3.50 | 3.52  |
| .60  | 4.04  | 1.60 | 21.55  | 2.60 | 8.71  | 3.60 | 3.30  |
| .70  | 4.40  | 1.70 | 34.62  | 2.70 | 7.49  | 3.70 | 3.11  |
| .80  | 4.84  | 1.80 | 74.20  | 2.80 | 6.56  | 3.80 | 2.94  |
| .90  | 5.37  | 1.90 | 187.94 | 2.90 | 5.84  | 3.90 | 2.79  |
| 1.00 | 6.03  | 2.00 | 76.42  | 3.00 | 5.26  | 4.00 | 2.65  |

```

-----
| CALIB |
| STANDHYD (0203) |      Area (ha)= .50
| ID= 1 DT= 5.0 min |      Total Imp(%)= 22.00      Dir. Conn.(%)= 5.00
-----
  
```

|               |            |              |
|---------------|------------|--------------|
|               | IMPERVIOUS | PERVIOUS (i) |
| Surface Area  | (ha)= .11  | .39          |
| Dep. Storage  | (mm)= 1.00 | 4.30         |
| Average Slope | (%)= 1.00  | 2.00         |
| Length        | (m)= 30.00 | 40.00        |
| Mannings n    | = .013     | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME      RAIN | TIME      RAIN | TIME      RAIN | TIME      RAIN
hrs      mm/hr | hrs      mm/hr | hrs      mm/hr | hrs      mm/hr
  
```



|       |      |       |        |       |       |      |      |
|-------|------|-------|--------|-------|-------|------|------|
| .083  | 2.87 | 1.083 | 6.88   | 2.083 | 36.93 | 3.08 | 4.78 |
| .167  | 3.01 | 1.167 | 7.78   | 2.167 | 25.99 | 3.17 | 4.47 |
| .250  | 3.16 | 1.250 | 8.93   | 2.250 | 19.28 | 3.25 | 4.19 |
| .333  | 3.33 | 1.333 | 10.45  | 2.333 | 15.12 | 3.33 | 3.93 |
| .417  | 3.52 | 1.417 | 12.52  | 2.417 | 12.34 | 3.42 | 3.71 |
| .500  | 3.73 | 1.500 | 15.34  | 2.500 | 10.39 | 3.50 | 3.52 |
| .583  | 4.04 | 1.583 | 21.55  | 2.583 | 8.71  | 3.58 | 3.30 |
| .667  | 4.33 | 1.667 | 32.01  | 2.667 | 7.73  | 3.67 | 3.15 |
| .750  | 4.66 | 1.750 | 58.37  | 2.750 | 6.93  | 3.75 | 3.01 |
| .833  | 5.05 | 1.833 | 119.70 | 2.833 | 6.27  | 3.83 | 2.88 |
| .917  | 5.50 | 1.917 | 165.64 | 2.917 | 5.72  | 3.92 | 2.76 |
| 1.000 | 6.03 | 2.000 | 76.42  | 3.000 | 5.26  | 4.00 | 2.65 |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 165.64    | 84.80     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.01 (ii) | 8.55 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .34       | .12       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .07   | .076 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.00  | 2.00       |
| RUNOFF VOLUME (mm)=  | 64.65 | 30.16 | 31.87      |
| TOTAL RAINFALL (mm)= | 65.65 | 65.65 | 65.65      |
| RUNOFF COEFFICIENT = | .98   | .46   | .49        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |  |                     |                      |
|-------------------|--|---------------------|----------------------|
| CALIB             |  |                     |                      |
| STANDHYD (0202)   |  | Area (ha)= 1.14     |                      |
| ID= 1 DT= 5.0 min |  | Total Imp(%)= 39.00 | Dir. Conn.(%)= 17.00 |

|                    |       | IMPERVIOUS | PERVIOUS (i) |
|--------------------|-------|------------|--------------|
| Surface Area (ha)= | .44   | .69        |              |
| Dep. Storage (mm)= | 1.00  | 3.80       |              |
| Average Slope (%)= | 1.00  | 2.00       |              |
| Length (m)=        | 65.00 | 40.00      |              |
| Mannings n =       | .013  | .250       |              |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 165.64    | 119.19    |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.61 (ii) | 8.19 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .32       | .13       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .09   | .18   | .222 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.00  | 2.00       |
| RUNOFF VOLUME (mm)=  | 64.65 | 37.05 | 41.74      |
| TOTAL RAINFALL (mm)= | 65.65 | 65.65 | 65.65      |
| RUNOFF COEFFICIENT = | .98   | .56   | .64        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

|                   |  |                   |                           |
|-------------------|--|-------------------|---------------------------|
| CALIB             |  |                   |                           |
| NASHYD (0205)     |  | Area (ha)= .45    | Curve Number (CN)= 69.0   |
| ID= 1 DT=10.0 min |  | Ia (mm)= 5.00     | # of Linear Res.(N)= 3.00 |
|                   |  | U.H. Tp(hrs)= .36 |                           |

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | 2.94  | 1.167 | 7.33  | 2.167 | 31.46 | 3.17 | 4.62  |
| .333                             | 3.25  | 1.333 | 9.69  | 2.333 | 17.20 | 3.33 | 4.06  |

|       |      |       |        |       |       |      |      |
|-------|------|-------|--------|-------|-------|------|------|
| .500  | 3.63 | 1.500 | 13.93  | 2.500 | 11.37 | 3.50 | 3.62 |
| .667  | 4.18 | 1.667 | 26.78  | 2.667 | 8.22  | 3.67 | 3.22 |
| .833  | 4.86 | 1.833 | 89.03  | 2.833 | 6.60  | 3.83 | 2.94 |
| 1.000 | 5.77 | 2.000 | 121.03 | 3.000 | 5.49  | 4.00 | 2.71 |

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .024 (i)  
 TIME TO PEAK (hrs)= 2.167  
 RUNOFF VOLUME (mm)= 20.988  
 TOTAL RAINFALL (mm)= 65.654  
 RUNOFF COEFFICIENT = .320

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

```

-----
| CALIB |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= .31
  
```

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .010 (i)  
 TIME TO PEAK (hrs)= 2.167  
 RUNOFF VOLUME (mm)= 20.936  
 TOTAL RAINFALL (mm)= 65.654  
 RUNOFF COEFFICIENT = .319

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

```

-----
| CALIB |
| STANDHYD (0201) | Area (ha)= 1.92
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
|-----|
  
```

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .83        | 1.10         |
| Dep. Storage  | (mm)= | 1.00       | 3.70         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 200.00     | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.083    2.87 | 1.083   6.88 | 2.083   36.93 | 3.08    4.78
.167    3.01 | 1.167   7.78 | 2.167   25.99 | 3.17    4.47
.250    3.16 | 1.250   8.93 | 2.250   19.28 | 3.25    4.19
.333    3.33 | 1.333  10.45 | 2.333   15.12 | 3.33    3.93
.417    3.52 | 1.417  12.52 | 2.417   12.34 | 3.42    3.71
.500    3.73 | 1.500  15.34 | 2.500   10.39 | 3.50    3.52
.583    4.04 | 1.583  21.55 | 2.583    8.71 | 3.58    3.30
.667    4.33 | 1.667  32.01 | 2.667    7.73 | 3.67    3.15
.750    4.66 | 1.750  58.37 | 2.750    6.93 | 3.75    3.01
.833    5.05 | 1.833 119.70 | 2.833    6.27 | 3.83    2.88
.917    5.50 | 1.917 165.64 | 2.917    5.72 | 3.92    2.76
1.000    6.03 | 2.000  76.42 | 3.000    5.26 | 4.00    2.65
  
```

Max.Eff.Inten.(mm/hr)= 165.64 133.59  
 over (min) 5.00 10.00  
 Storage Coeff. (min)= 3.16 (ii) 9.45 (ii)  
 Unit Hyd. Tpeak (min)= 5.00 10.00  
 Unit Hyd. peak (cms)= .27 .12

\*TOTALS\*

|                    |        |       |       |            |
|--------------------|--------|-------|-------|------------|
| PEAK FLOW          | (cms)= | .15   | .30   | .387 (iii) |
| TIME TO PEAK       | (hrs)= | 1.92  | 2.00  | 2.00       |
| RUNOFF VOLUME      | (mm)=  | 64.65 | 39.07 | 43.68      |
| TOTAL RAINFALL     | (mm)=  | 65.65 | 65.65 | 65.65      |
| RUNOFF COEFFICIENT | =      | .98   | .60   | .67        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| RESERVOIR (0302) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
|-----

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .222           | 2.00           | 41.74        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .005           | 4.08           | 40.75        |

```

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.06
TIME SHIFT OF PEAK FLOW (min) = 125.00
MAXIMUM STORAGE USED (ha.m.) = .0437

```

```

-----
| ADD HYD (0903) |
| 1 + 2 = 3      |
|-----

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0205):   | .45          | .024           | 2.17           | 20.99        |
| + ID2= 2 (0204): | .16          | .010           | 2.17           | 20.94        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .034           | 2.17           | 20.97        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
|-----

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .387           | 2.00           | 43.68        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .063           | 2.58           | 42.99        |

```

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.19
TIME SHIFT OF PEAK FLOW (min) = 35.00
MAXIMUM STORAGE USED (ha.m.) = .0586

```

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3      |
|-----

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0302):   | 1.14         | .005           | 4.08           | 40.75        |
| + ID2= 2 (0903): | .61          | .034           | 2.17           | 20.97        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .038           | 2.17           | 33.85        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3      |
|-----

```

| AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|--------------|----------------|----------------|--------------|
|--------------|----------------|----------------|--------------|

```

ID1= 1 (0902):      1.74      .038      2.17      33.85
+ ID2= 2 (0301):      1.92      .063      2.58      42.99
=====
ID = 3 (0901):      3.67      .099      2.33      38.65

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| READ STORM |      Filename: I:\2015 Projects\115
|            |      185 - Monterra Phase 2 Natural Hazard Assessm
|            |      \Design\Hydrology\115185 vo2\STORMS\OSCHI100.
| Ptotal= 71.77 mm |      Comments: OWEN SOUND 100 YEAR 4 HOUR DURATION CHIC
-----

```

| TIME | RAIN  | TIME | RAIN   | TIME | RAIN  | TIME | RAIN  |
|------|-------|------|--------|------|-------|------|-------|
| hrs  | mm/hr | hrs  | mm/hr  | hrs  | mm/hr | hrs  | mm/hr |
| .10  | 3.08  | 1.10 | 7.44   | 2.10 | 40.41 | 3.10 | 5.16  |
| .20  | 3.27  | 1.20 | 8.67   | 2.20 | 25.38 | 3.20 | 4.73  |
| .30  | 3.49  | 1.30 | 10.36  | 2.30 | 18.12 | 3.30 | 4.37  |
| .40  | 3.73  | 1.40 | 12.83  | 2.40 | 13.95 | 3.40 | 4.05  |
| .50  | 4.02  | 1.50 | 16.70  | 2.50 | 11.28 | 3.50 | 3.79  |
| .60  | 4.35  | 1.60 | 23.51  | 2.60 | 9.44  | 3.60 | 3.55  |
| .70  | 4.75  | 1.70 | 37.88  | 2.70 | 8.10  | 3.70 | 3.35  |
| .80  | 5.22  | 1.80 | 81.47  | 2.80 | 7.09  | 3.80 | 3.16  |
| .90  | 5.80  | 1.90 | 206.92 | 2.90 | 6.31  | 3.90 | 3.00  |
| 1.00 | 6.52  | 2.00 | 83.92  | 3.00 | 5.67  | 4.00 | 2.85  |

```

-----
| CALIB      |
| STANDHYD (0203) |      Area (ha)= .50
| ID= 1 DT= 5.0 min |      Total Imp(%)= 22.00      Dir. Conn.(%)= 5.00
-----

```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.083    3.08 | 1.083   7.44 | 2.083   40.41 | 3.08    5.16
.167    3.23 | 1.167   8.42 | 2.167   28.39 | 3.17    4.82
.250    3.40 | 1.250   9.68 | 2.250   21.02 | 3.25    4.51
.333    3.59 | 1.333  11.35 | 2.333   16.45 | 3.33    4.24
.417    3.79 | 1.417  13.60 | 2.417   13.42 | 3.42    4.00
.500    4.02 | 1.500  16.70 | 2.500   11.28 | 3.50    3.79
.583    4.35 | 1.583  23.51 | 2.583    9.44 | 3.58    3.55
.667    4.67 | 1.667  35.01 | 2.667    8.37 | 3.67    3.39
.750    5.03 | 1.750  64.03 | 2.750    7.49 | 3.75    3.24
.833    5.45 | 1.833 131.65 | 2.833    6.78 | 3.83    3.10
.917    5.94 | 1.917 182.32 | 2.917    6.18 | 3.92    2.97
1.000    6.52 | 2.000  83.92 | 3.000    5.67 | 4.00    2.85

```

```

Max.Eff.Inten.(mm/hr)=      182.32      98.82
over (min)              5.00      10.00
Storage Coeff. (min)=      .98 (ii)      8.07 (ii)
Unit Hyd. Tpeak (min)=      5.00      10.00
Unit Hyd. peak (cms)=      .34      .13

```

```

*TOTALS*
PEAK FLOW (cms)=      .01      .08      .091 (iii)
TIME TO PEAK (hrs)=      1.92      2.00      2.00
RUNOFF VOLUME (mm)=      70.77      34.73      36.52
TOTAL RAINFALL (mm)=      71.77      71.77      71.77
RUNOFF COEFFICIENT =      .99      .48      .51

```

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)  
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.

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

```
-----
| CALIB          |
| STANDHYD (0202) | Area (ha)= 1.14
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
-----
```

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

|                         |           |           |
|-------------------------|-----------|-----------|
| Max.Eff.Inten. (mm/hr)= | 182.32    | 137.07    |
| over (min)              | 5.00      | 10.00     |
| Storage Coeff. (min)=   | 1.55 (ii) | 7.77 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=   | .33       | .13       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .10   | .21   | .257 (iii) |
| TIME TO PEAK (hrs)=  | 1.92  | 2.00  | 2.00       |
| RUNOFF VOLUME (mm)=  | 70.77 | 42.19 | 47.05      |
| TOTAL RAINFALL (mm)= | 71.77 | 71.77 | 71.77      |
| RUNOFF COEFFICIENT   | .99   | .59   | .66        |

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

\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

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

```
-----
| CALIB          |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= .36
-----
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | 3.16  | 1.167 | 7.93   | 2.167 | 34.40 | 3.17 | 4.99  |
| .333                             | 3.49  | 1.333 | 10.52  | 2.333 | 18.74 | 3.33 | 4.38  |
| .500                             | 3.90  | 1.500 | 15.15  | 2.500 | 12.35 | 3.50 | 3.89  |
| .667                             | 4.51  | 1.667 | 29.26  | 2.667 | 8.90  | 3.67 | 3.47  |
| .833                             | 5.24  | 1.833 | 97.84  | 2.833 | 7.14  | 3.83 | 3.17  |
| 1.000                            | 6.23  | 2.000 | 133.12 | 3.000 | 5.93  | 4.00 | 2.91  |

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .029 (i)  
TIME TO PEAK (hrs)= 2.167  
RUNOFF VOLUME (mm)= 24.573  
TOTAL RAINFALL (mm)= 71.769  
RUNOFF COEFFICIENT = .342

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

```
-----
| CALIB          |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= .31
-----
```

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .012 (i)  
TIME TO PEAK (hrs)= 2.167  
RUNOFF VOLUME (mm)= 24.517  
TOTAL RAINFALL (mm)= 71.769  
RUNOFF COEFFICIENT = .342

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

```

-----
| CALIB |
| STANDHYD (0201) |
| ID= 1 DT= 5.0 min |
-----

```

```

Area (ha)= 1.92
Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00

```

```

                IMPERVIOUS    PERVIOUS (i)
Surface Area    (ha)=        .83        1.10
Dep. Storage    (mm)=        1.00        3.70
Average Slope    (%)=        1.00        2.00
Length          (m)=       200.00       40.00
Mannings n      =         .013        .250

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.083    3.08 | 1.083   7.44 | 2.083  40.41 | 3.08    5.16
.167    3.23 | 1.167   8.42 | 2.167  28.39 | 3.17    4.82
.250    3.40 | 1.250   9.68 | 2.250  21.02 | 3.25    4.51
.333    3.59 | 1.333  11.35 | 2.333  16.45 | 3.33    4.24
.417    3.79 | 1.417  13.60 | 2.417  13.42 | 3.42    4.00
.500    4.02 | 1.500  16.70 | 2.500  11.28 | 3.50    3.79
.583    4.35 | 1.583  23.51 | 2.583   9.44 | 3.58    3.55
.667    4.67 | 1.667  35.01 | 2.667   8.37 | 3.67    3.39
.750    5.03 | 1.750  64.03 | 2.750   7.49 | 3.75    3.24
.833    5.45 | 1.833 131.65 | 2.833   6.78 | 3.83    3.10
.917    5.94 | 1.917 182.32 | 2.917   6.18 | 3.92    2.97
1.000    6.52 | 2.000  83.92 | 3.000   5.67 | 4.00    2.85

```

```

Max.Eff.Inten.(mm/hr)= 182.32    153.03
over (min)           5.00    10.00
Storage Coeff. (min)= 3.05 (ii)   9.00 (ii)
Unit Hyd. Tpeak (min)= 5.00    10.00
Unit Hyd. peak (cms)= .27      .12

```

```

                *TOTALS*
PEAK FLOW      (cms)=        .16        .35        .445 (iii)
TIME TO PEAK   (hrs)=        1.92        2.00        2.00
RUNOFF VOLUME  (mm)=       70.77       44.35       49.11
TOTAL RAINFALL (mm)=       71.77       71.77       71.77
RUNOFF COEFFICIENT =        .99        .62        .68

```

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| RESERVOIR (0302) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----

```

```

OUTFLOW    STORAGE | OUTFLOW    STORAGE
(cms)      (ha.m.) | (cms)      (ha.m.)
.0000      .0000 | .0054      .0654
.0011      .0049 | .0393      .0739
.0021      .0102 | .1153      .0828
.0027      .0158 | .2258      .0921
.0033      .0218 | .3706      .1017
.0037      .0281 | .5506      .1117
.0041      .0349 | .7671      .1220
.0045      .0420 | 1.0214     .1327
.0048      .0494 | 1.3149     .1438
.0051      .0572 | .0000      .0000

```

```

                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 (0202) 1.136    .257    2.00    47.05
OUTFLOW: ID= 1 (0302) 1.136    .005    4.08    46.05

```

```

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.87
TIME SHIFT OF PEAK FLOW (min)=125.00
MAXIMUM STORAGE USED (ha.m.)= .0495

```

```

-----
| ADD HYD (0903) |
| 1 + 2 = 3 |
-----

```

```

                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)

```

```

ID1= 1 (0205):      .45      .029      2.17      24.57
+ ID2= 2 (0204):      .16      .012      2.17      24.52
=====
ID = 3 (0903):      .61      .041      2.17      24.56

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .445           | 2.00           | 49.11        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .066           | 2.58           | 48.42        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 14.85  
 TIME SHIFT OF PEAK FLOW (min) = 35.00  
 MAXIMUM STORAGE USED (ha.m.) = .0663

```

| ADD HYD (0902) |
| 1 + 2 = 3      |

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0302):   | 1.14         | .005           | 4.08           | 46.05        |
| + ID2= 2 (0903): | .61          | .041           | 2.17           | 24.56        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .045           | 2.17           | 38.56        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ADD HYD (0901) |
| 1 + 2 = 3      |

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0902):   | 1.74         | .045           | 2.17           | 38.56        |
| + ID2= 2 (0301): | 1.92         | .066           | 2.58           | 48.42        |
| =====            |              |                |                |              |
| ID = 3 (0901):   | 3.67         | .108           | 2.33           | 43.73        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

*****
** SIMULATION NUMBER: 8 **
*****

```

```

| READ STORM |
|           |
| Ptotal=193.00 mm |

```

Filename: I:\2015 Projects\115  
 185 - Monterra Phase 2 Natural Hazard Assessm  
 \Design\Hydrology\115185 vo2\STORMS\Timmins.s  
 Comments: REGIONAL STORM TIMMINS - 12 hour storm

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| 1.00        | 15.00         | 4.00        | 3.00          | 7.00        | 43.00         | 10.00       | 13.00         |
| 2.00        | 20.00         | 5.00        | 5.00          | 8.00        | 20.00         | 11.00       | 13.00         |
| 3.00        | 10.00         | 6.00        | 20.00         | 9.00        | 23.00         | 12.00       | 8.00          |

```

| CALIB |
| STANDHYD (0203) |
| ID= 1 DT= 5.0 min |

```

Area (ha) = .50  
 Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00

IMPERVIOUS PERVIOUS (i)

Surface Area (ha)= .11 .39  
 Dep. Storage (mm)= 1.00 4.30  
 Average Slope (%)= 1.00 2.00  
 Length (m)= 30.00 40.00  
 Mannings n = .013 .250

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.083    15.00 | 3.083   3.00 | 6.083   43.00 | 9.08    13.00
.167    15.00 | 3.167   3.00 | 6.167   43.00 | 9.17    13.00
.250    15.00 | 3.250   3.00 | 6.250   43.00 | 9.25    13.00
.333    15.00 | 3.333   3.00 | 6.333   43.00 | 9.33    13.00
.417    15.00 | 3.417   3.00 | 6.417   43.00 | 9.42    13.00
.500    15.00 | 3.500   3.00 | 6.500   43.00 | 9.50    13.00
.583    15.00 | 3.583   3.00 | 6.583   43.00 | 9.58    13.00
.667    15.00 | 3.667   3.00 | 6.667   43.00 | 9.67    13.00
.750    15.00 | 3.750   3.00 | 6.750   43.00 | 9.75    13.00
.833    15.00 | 3.833   3.00 | 6.833   43.00 | 9.83    13.00
.917    15.00 | 3.917   3.00 | 6.917   43.00 | 9.92    13.00
1.000    15.00 | 4.000   3.00 | 7.000   43.00 | 10.00   13.00
1.083    20.00 | 4.083   5.00 | 7.083   20.00 | 10.08   13.00
1.167    20.00 | 4.167   5.00 | 7.167   20.00 | 10.17   13.00
1.250    20.00 | 4.250   5.00 | 7.250   20.00 | 10.25   13.00
1.333    20.00 | 4.333   5.00 | 7.333   20.00 | 10.33   13.00
1.417    20.00 | 4.417   5.00 | 7.417   20.00 | 10.42   13.00
1.500    20.00 | 4.500   5.00 | 7.500   20.00 | 10.50   13.00
1.583    20.00 | 4.583   5.00 | 7.583   20.00 | 10.58   13.00
1.667    20.00 | 4.667   5.00 | 7.667   20.00 | 10.67   13.00
1.750    20.00 | 4.750   5.00 | 7.750   20.00 | 10.75   13.00
1.833    20.00 | 4.833   5.00 | 7.833   20.00 | 10.83   13.00
1.917    20.00 | 4.917   5.00 | 7.917   20.00 | 10.92   13.00
2.000    20.00 | 5.000   5.00 | 8.000   20.00 | 11.00   13.00
2.083    10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
2.167    10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
2.250    10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
2.333    10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
2.417    10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
2.500    10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
2.583    10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
2.667    10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
2.750    10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
2.833    10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
2.917    10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
3.000    10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00
  
```

Max.Eff.Inten.(mm/hr)= 43.00 44.93  
 over (min) 5.00 15.00  
 Storage Coeff. (min)= 1.74 (ii) 11.46 (ii)  
 Unit Hyd. Tpeak (min)= 5.00 15.00  
 Unit Hyd. peak (cms)= .32 .09

\*TOTALS\*

PEAK FLOW (cms)= .00 .05 .050 (iii)  
 TIME TO PEAK (hrs)= 6.42 7.00 7.00  
 RUNOFF VOLUME (mm)= 192.00 140.60 143.15  
 TOTAL RAINFALL (mm)= 193.00 193.00 193.00  
 RUNOFF COEFFICIENT = .99 .73 .74

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0202) | Area (ha)= 1.14
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
-----
  
```

IMPERVIOUS PERVIOUS (i)  
 Surface Area (ha)= .44 .69  
 Dep. Storage (mm)= 1.00 3.80  
 Average Slope (%)= 1.00 2.00  
 Length (m)= 65.00 40.00  
 Mannings n = .013 .250

Max.Eff.Inten.(mm/hr)= 43.00 53.74



|                         |           |            |            |
|-------------------------|-----------|------------|------------|
| over (min)              | 5.00      | 15.00      |            |
| * Storage Coeff. (min)= | 2.77 (ii) | 11.81 (ii) |            |
| Unit Hyd. Tpeak (min)=  | 5.00      | 15.00      |            |
| Unit Hyd. peak (cms)=   | .28       | .09        |            |
|                         |           |            | *TOTALS*   |
| PEAK FLOW (cms)=        | .02       | .10        | .125 (iii) |
| TIME TO PEAK (hrs)=     | 6.67      | 7.00       | 7.00       |
| RUNOFF VOLUME (mm)=     | 192.00    | 154.61     | 160.96     |
| TOTAL RAINFALL (mm)=    | 193.00    | 193.00     | 193.00     |
| RUNOFF COEFFICIENT =    | .99       | .80        | .83        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

```

-----
| CALIB          |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
-----
| U.H. Tp(hrs)= .36
  
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
.167 15.00 | 3.167 3.00 | 6.167 43.00 | 9.17 13.00
.333 15.00 | 3.333 3.00 | 6.333 43.00 | 9.33 13.00
.500 15.00 | 3.500 3.00 | 6.500 43.00 | 9.50 13.00
.667 15.00 | 3.667 3.00 | 6.667 43.00 | 9.67 13.00
.833 15.00 | 3.833 3.00 | 6.833 43.00 | 9.83 13.00
1.000 15.00 | 4.000 3.00 | 7.000 43.00 | 10.00 13.00
1.167 20.00 | 4.167 5.00 | 7.167 20.00 | 10.17 13.00
1.333 20.00 | 4.333 5.00 | 7.333 20.00 | 10.33 13.00
1.500 20.00 | 4.500 5.00 | 7.500 20.00 | 10.50 13.00
1.667 20.00 | 4.667 5.00 | 7.667 20.00 | 10.67 13.00
1.833 20.00 | 4.833 5.00 | 7.833 20.00 | 10.83 13.00
2.000 20.00 | 5.000 5.00 | 8.000 20.00 | 11.00 13.00
2.167 10.00 | 5.167 20.00 | 8.167 23.00 | 11.17 8.00
2.333 10.00 | 5.333 20.00 | 8.333 23.00 | 11.33 8.00
2.500 10.00 | 5.500 20.00 | 8.500 23.00 | 11.50 8.00
2.667 10.00 | 5.667 20.00 | 8.667 23.00 | 11.67 8.00
2.833 10.00 | 5.833 20.00 | 8.833 23.00 | 11.83 8.00
3.000 10.00 | 6.000 20.00 | 9.000 23.00 | 12.00 8.00
  
```

Unit Hyd Qpeak (cms)= .047  
 PEAK FLOW (cms)= .036 (i)  
 TIME TO PEAK (hrs)= 7.000  
 RUNOFF VOLUME (mm)= 116.652  
 TOTAL RAINFALL (mm)= 193.000  
 RUNOFF COEFFICIENT = .604

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

```

-----
| CALIB          |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
-----
| U.H. Tp(hrs)= .31
  
```

Unit Hyd Qpeak (cms)= .020  
 PEAK FLOW (cms)= .013 (i)  
 TIME TO PEAK (hrs)= 7.000  
 RUNOFF VOLUME (mm)= 116.388  
 TOTAL RAINFALL (mm)= 193.000  
 RUNOFF COEFFICIENT = .603

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

```

-----
| CALIB          |
| STANDHYD (0201) | Area (ha)= 1.92
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
  
```

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .83        | 1.10         |
| Dep. Storage  | (mm)= | 1.00       | 3.70         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 200.00     | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

| ---- TRANSFORMED HYETOGRAPH ---- |       |       |       |       |       |       |       |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|
| TIME                             | RAIN  | TIME  | RAIN  | TIME  | RAIN  | TIME  | RAIN  |
| hrs                              | mm/hr | hrs   | mm/hr | hrs   | mm/hr | hrs   | mm/hr |
| .083                             | 15.00 | 3.083 | 3.00  | 6.083 | 43.00 | 9.08  | 13.00 |
| .167                             | 15.00 | 3.167 | 3.00  | 6.167 | 43.00 | 9.17  | 13.00 |
| .250                             | 15.00 | 3.250 | 3.00  | 6.250 | 43.00 | 9.25  | 13.00 |
| .333                             | 15.00 | 3.333 | 3.00  | 6.333 | 43.00 | 9.33  | 13.00 |
| .417                             | 15.00 | 3.417 | 3.00  | 6.417 | 43.00 | 9.42  | 13.00 |
| .500                             | 15.00 | 3.500 | 3.00  | 6.500 | 43.00 | 9.50  | 13.00 |
| .583                             | 15.00 | 3.583 | 3.00  | 6.583 | 43.00 | 9.58  | 13.00 |
| .667                             | 15.00 | 3.667 | 3.00  | 6.667 | 43.00 | 9.67  | 13.00 |
| .750                             | 15.00 | 3.750 | 3.00  | 6.750 | 43.00 | 9.75  | 13.00 |
| .833                             | 15.00 | 3.833 | 3.00  | 6.833 | 43.00 | 9.83  | 13.00 |
| .917                             | 15.00 | 3.917 | 3.00  | 6.917 | 43.00 | 9.92  | 13.00 |
| 1.000                            | 15.00 | 4.000 | 3.00  | 7.000 | 43.00 | 10.00 | 13.00 |
| 1.083                            | 20.00 | 4.083 | 5.00  | 7.083 | 20.00 | 10.08 | 13.00 |
| 1.167                            | 20.00 | 4.167 | 5.00  | 7.167 | 20.00 | 10.17 | 13.00 |
| 1.250                            | 20.00 | 4.250 | 5.00  | 7.250 | 20.00 | 10.25 | 13.00 |
| 1.333                            | 20.00 | 4.333 | 5.00  | 7.333 | 20.00 | 10.33 | 13.00 |
| 1.417                            | 20.00 | 4.417 | 5.00  | 7.417 | 20.00 | 10.42 | 13.00 |
| 1.500                            | 20.00 | 4.500 | 5.00  | 7.500 | 20.00 | 10.50 | 13.00 |
| 1.583                            | 20.00 | 4.583 | 5.00  | 7.583 | 20.00 | 10.58 | 13.00 |
| 1.667                            | 20.00 | 4.667 | 5.00  | 7.667 | 20.00 | 10.67 | 13.00 |
| 1.750                            | 20.00 | 4.750 | 5.00  | 7.750 | 20.00 | 10.75 | 13.00 |
| 1.833                            | 20.00 | 4.833 | 5.00  | 7.833 | 20.00 | 10.83 | 13.00 |
| 1.917                            | 20.00 | 4.917 | 5.00  | 7.917 | 20.00 | 10.92 | 13.00 |
| 2.000                            | 20.00 | 5.000 | 5.00  | 8.000 | 20.00 | 11.00 | 13.00 |
| 2.083                            | 10.00 | 5.083 | 20.00 | 8.083 | 23.00 | 11.08 | 8.00  |
| 2.167                            | 10.00 | 5.167 | 20.00 | 8.167 | 23.00 | 11.17 | 8.00  |
| 2.250                            | 10.00 | 5.250 | 20.00 | 8.250 | 23.00 | 11.25 | 8.00  |
| 2.333                            | 10.00 | 5.333 | 20.00 | 8.333 | 23.00 | 11.33 | 8.00  |
| 2.417                            | 10.00 | 5.417 | 20.00 | 8.417 | 23.00 | 11.42 | 8.00  |
| 2.500                            | 10.00 | 5.500 | 20.00 | 8.500 | 23.00 | 11.50 | 8.00  |
| 2.583                            | 10.00 | 5.583 | 20.00 | 8.583 | 23.00 | 11.58 | 8.00  |
| 2.667                            | 10.00 | 5.667 | 20.00 | 8.667 | 23.00 | 11.67 | 8.00  |
| 2.750                            | 10.00 | 5.750 | 20.00 | 8.750 | 23.00 | 11.75 | 8.00  |
| 2.833                            | 10.00 | 5.833 | 20.00 | 8.833 | 23.00 | 11.83 | 8.00  |
| 2.917                            | 10.00 | 5.917 | 20.00 | 8.917 | 23.00 | 11.92 | 8.00  |
| 3.000                            | 10.00 | 6.000 | 20.00 | 9.000 | 23.00 | 12.00 | 8.00  |

|                           |           |            |
|---------------------------|-----------|------------|
| Max. Eff. Inten. (mm/hr)= | 43.00     | 57.65      |
| over (min)                | 5.00      | 15.00      |
| Storage Coeff. (min)=     | 5.43 (ii) | 14.22 (ii) |
| Unit Hyd. Tpeak (min)=    | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=     | .20       | .08        |

\*TOTALS\*

|                      |        |        |            |
|----------------------|--------|--------|------------|
| PEAK FLOW (cms)=     | .04    | .17    | .213 (iii) |
| TIME TO PEAK (hrs)=  | 6.92   | 7.00   | 7.00       |
| RUNOFF VOLUME (mm)=  | 192.00 | 158.22 | 164.30     |
| TOTAL RAINFALL (mm)= | 193.00 | 193.00 | 193.00     |
| RUNOFF COEFFICIENT = | .99    | .82    | .85        |

\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
| RESERVOIR (0302) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW | STORAGE | OUTFLOW | STORAGE |
|---------|---------|---------|---------|
| (cms)   | (ha.m.) | (cms)   | (ha.m.) |
| .0000   | .0000   | .0054   | .0654   |
| .0011   | .0049   | .0393   | .0739   |
| .0021   | .0102   | .1153   | .0828   |
| .0027   | .0158   | .2258   | .0921   |
| .0033   | .0218   | .3706   | .1017   |
| .0037   | .0281   | .5506   | .1117   |
| .0041   | .0349   | .7671   | .1220   |

|       |       |  |        |       |
|-------|-------|--|--------|-------|
| .0045 | .0420 |  | 1.0214 | .1327 |
| .0048 | .0494 |  | 1.3149 | .1438 |
| .0051 | .0572 |  | .0000  | .0000 |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .125           | 7.00           | 160.96       |
| OUTFLOW: ID= 1 (0302) | 1.136        | .084           | 7.25           | 159.97       |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 67.65  
 TIME SHIFT OF PEAK FLOW (min) = 15.00  
 MAXIMUM STORAGE USED (ha.m.) = .0792

```

-----
| ADD HYD (0903) |
| 1 + 2 = 3 |
-----
      AREA  QPEAK  TPEAK  R.V.
      (ha)  (cms)  (hrs)  (mm)
ID1= 1 (0205):    .45    .036    7.00  116.65
+ ID2= 2 (0204):    .16    .013    7.00  116.39
=====
ID = 3 (0903):    .61    .049    7.00  116.58
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----
      OUTFLOW  STORAGE  |  OUTFLOW  STORAGE
      (cms)    (ha.m.)  |  (cms)    (ha.m.)
      .0000    .0000    |  .0707    .0775
      .0010    .0052    |  .1232    .0859
      .0020    .0108    |  .2290    .0944
      .0030    .0233    |  .3811    .1031
      .0040    .0302    |  .5760    .1120
      .0164    .0376    |  .8126    .1210
      .0392    .0453    |  1.0915    .1301
      .0602    .0531    |  1.4134    .1394
      .0639    .0611    |  1.7793    .1488
      .0674    .0692    |  .0000    .0000
  
```

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .213           | 7.00           | 164.30       |
| OUTFLOW: ID= 1 (0301) | 1.925        | .172           | 7.17           | 163.61       |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 80.93  
 TIME SHIFT OF PEAK FLOW (min) = 10.00  
 MAXIMUM STORAGE USED (ha.m.) = .0899

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3 |
-----
      AREA  QPEAK  TPEAK  R.V.
      (ha)  (cms)  (hrs)  (mm)
ID1= 1 (0302):    1.14    .084    7.25  159.97
+ ID2= 2 (0903):    .61    .049    7.00  116.58
=====
ID = 3 (0902):    1.74    .128    7.17  144.84
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
      AREA  QPEAK  TPEAK  R.V.
      (ha)  (cms)  (hrs)  (mm)
ID1= 1 (0902):    1.74    .128    7.17  144.84
+ ID2= 2 (0301):    1.92    .172    7.17  163.61
=====
ID = 3 (0901):    3.67    .300    7.17  154.69
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

```

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

```

SCS - Post

```

OOO   TTTT   TTTT   H   H   Y   Y   M   M   OOO
O   O   T   T   H   H   Y   Y   MM   MM   O   O
O   O   T   T   H   H   Y   M   M   O   O
OOO   T   T   H   H   Y   M   M   OOO

```

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.2\voin.dat  
Output filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Post Development SCS.out  
Summary filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Post Development SCS.sum

DATE: 9/20/2017

TIME: 9:11:26 AM

USER:

COMMENTS: \_\_\_\_\_

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

```

-----
| MASS STORM |
|            |
|            |
| Ptotal= 48.70 mm |
-----

```

Filename: I:\2015 Projects\115  
185 - Monterra Phase 2 Natural Hazard Assessm  
\Design\Hydrology\115185 vo2\STORMS\SCS24H.MS  
Comments: SCS Type II 24 HR MASS CURVE

Duration of storm = 23.75 hrs  
Mass curve time step = 15.00 min

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | .58           | 6.25        | .97           | 12.25       | 7.01          | 18.25       | .78           |
| .50         | .39           | 6.50        | .78           | 12.50       | 3.70          | 18.50       | .97           |
| .75         | .58           | 6.75        | .97           | 12.75       | 3.51          | 18.75       | .78           |
| 1.00        | .58           | 7.00        | .97           | 13.00       | 2.73          | 19.00       | .97           |
| 1.25        | .58           | 7.25        | 1.17          | 13.25       | 2.53          | 19.25       | .78           |
| 1.50        | .39           | 7.50        | .97           | 13.50       | 2.14          | 19.50       | .97           |
| 1.75        | .58           | 7.75        | 1.17          | 13.75       | 1.95          | 19.75       | .78           |
| 2.00        | .58           | 8.00        | 1.17          | 14.00       | 1.56          | 20.00       | .58           |
| 2.25        | .78           | 8.25        | 1.36          | 14.25       | 1.36          | 20.25       | .58           |
| 2.50        | .58           | 8.50        | 1.36          | 14.50       | 1.56          | 20.50       | .58           |
| 2.75        | .58           | 8.75        | 1.36          | 14.75       | 1.36          | 20.75       | .58           |
| 3.00        | .58           | 9.00        | 1.56          | 15.00       | 1.56          | 21.00       | .58           |
| 3.25        | .78           | 9.25        | 1.56          | 15.25       | 1.36          | 21.25       | .58           |
| 3.50        | .58           | 9.50        | 1.75          | 15.50       | 1.56          | 21.50       | .58           |
| 3.75        | .58           | 9.75        | 1.75          | 15.75       | 1.36          | 21.75       | .58           |
| 4.00        | .78           | 10.00       | 2.14          | 16.00       | .97           | 22.00       | .58           |
| 4.25        | .78           | 10.25       | 2.34          | 16.25       | .78           | 22.25       | .58           |
| 4.50        | .78           | 10.50       | 2.92          | 16.50       | .97           | 22.50       | .58           |
| 4.75        | .78           | 10.75       | 3.12          | 16.75       | .78           | 22.75       | .58           |
| 5.00        | .78           | 11.00       | 4.68          | 17.00       | .97           | 23.00       | .58           |
| 5.25        | .78           | 11.25       | 4.68          | 17.25       | .78           | 23.25       | .58           |
| 5.50        | .78           | 11.50       | 14.42         | 17.50       | .97           | 23.50       | .58           |
| 5.75        | .78           | 11.75       | 59.61         | 17.75       | .78           | 23.75       | .58           |
| 6.00        | .78           | 12.00       | 7.01          | 18.00       | .97           |             |               |

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-----
| CALIB |
| STANDHYD (0203) |
| ID= 1 DT= 5.0 min |
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```

Area (ha)= .50  
Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |

Average Slope (%)= 1.00 2.00  
Length (m)= 30.00 40.00  
Mannings n = .013 .250

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

| ----- TRANSFORMED HYETOGRAPH ----- |       |        |       |        |       |       |       |
|------------------------------------|-------|--------|-------|--------|-------|-------|-------|
| TIME                               | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
| hrs                                | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083                               | .58   | 6.083  | .97   | 12.083 | 7.01  | 18.08 | .78   |
| .167                               | .58   | 6.167  | .97   | 12.167 | 7.01  | 18.17 | .78   |
| .250                               | .58   | 6.250  | .97   | 12.250 | 7.01  | 18.25 | .78   |
| .333                               | .39   | 6.333  | .78   | 12.333 | 3.70  | 18.33 | .97   |
| .417                               | .39   | 6.417  | .78   | 12.417 | 3.70  | 18.42 | .97   |
| .500                               | .39   | 6.500  | .78   | 12.500 | 3.70  | 18.50 | .97   |
| .583                               | .58   | 6.583  | .97   | 12.583 | 3.51  | 18.58 | .78   |
| .667                               | .58   | 6.667  | .97   | 12.667 | 3.51  | 18.67 | .78   |
| .750                               | .58   | 6.750  | .97   | 12.750 | 3.51  | 18.75 | .78   |
| .833                               | .58   | 6.833  | .97   | 12.833 | 2.73  | 18.83 | .97   |
| .917                               | .58   | 6.917  | .97   | 12.917 | 2.73  | 18.92 | .97   |
| 1.000                              | .58   | 7.000  | .97   | 13.000 | 2.73  | 19.00 | .97   |
| 1.083                              | .58   | 7.083  | 1.17  | 13.083 | 2.53  | 19.08 | .78   |
| 1.167                              | .58   | 7.167  | 1.17  | 13.167 | 2.53  | 19.17 | .78   |
| 1.250                              | .58   | 7.250  | 1.17  | 13.250 | 2.53  | 19.25 | .78   |
| 1.333                              | .39   | 7.333  | .97   | 13.333 | 2.14  | 19.33 | .97   |
| 1.417                              | .39   | 7.417  | .97   | 13.417 | 2.14  | 19.42 | .97   |
| 1.500                              | .39   | 7.500  | .97   | 13.500 | 2.14  | 19.50 | .97   |
| 1.583                              | .58   | 7.583  | 1.17  | 13.583 | 1.95  | 19.58 | .78   |
| 1.667                              | .58   | 7.667  | 1.17  | 13.667 | 1.95  | 19.67 | .78   |
| 1.750                              | .58   | 7.750  | 1.17  | 13.750 | 1.95  | 19.75 | .78   |
| 1.833                              | .58   | 7.833  | 1.17  | 13.833 | 1.56  | 19.83 | .58   |
| 1.917                              | .58   | 7.917  | 1.17  | 13.917 | 1.56  | 19.92 | .58   |
| 2.000                              | .58   | 8.000  | 1.17  | 14.000 | 1.56  | 20.00 | .58   |
| 2.083                              | .78   | 8.083  | 1.36  | 14.083 | 1.36  | 20.08 | .58   |
| 2.167                              | .78   | 8.167  | 1.36  | 14.167 | 1.36  | 20.17 | .58   |
| 2.250                              | .78   | 8.250  | 1.36  | 14.250 | 1.36  | 20.25 | .58   |
| 2.333                              | .58   | 8.333  | 1.36  | 14.333 | 1.56  | 20.33 | .58   |
| 2.417                              | .58   | 8.417  | 1.36  | 14.417 | 1.56  | 20.42 | .58   |
| 2.500                              | .58   | 8.500  | 1.36  | 14.500 | 1.56  | 20.50 | .58   |
| 2.583                              | .58   | 8.583  | 1.36  | 14.583 | 1.36  | 20.58 | .58   |
| 2.667                              | .58   | 8.667  | 1.36  | 14.667 | 1.36  | 20.67 | .58   |
| 2.750                              | .58   | 8.750  | 1.36  | 14.750 | 1.36  | 20.75 | .58   |
| 2.833                              | .58   | 8.833  | 1.56  | 14.833 | 1.56  | 20.83 | .58   |
| 2.917                              | .58   | 8.917  | 1.56  | 14.917 | 1.56  | 20.92 | .58   |
| 3.000                              | .58   | 9.000  | 1.56  | 15.000 | 1.56  | 21.00 | .58   |
| 3.083                              | .78   | 9.083  | 1.56  | 15.083 | 1.36  | 21.08 | .58   |
| 3.167                              | .78   | 9.167  | 1.56  | 15.167 | 1.36  | 21.17 | .58   |
| 3.250                              | .78   | 9.250  | 1.56  | 15.250 | 1.36  | 21.25 | .58   |
| 3.333                              | .58   | 9.333  | 1.75  | 15.333 | 1.56  | 21.33 | .58   |
| 3.417                              | .58   | 9.417  | 1.75  | 15.417 | 1.56  | 21.42 | .58   |
| 3.500                              | .58   | 9.500  | 1.75  | 15.500 | 1.56  | 21.50 | .58   |
| 3.583                              | .58   | 9.583  | 1.75  | 15.583 | 1.36  | 21.58 | .58   |
| 3.667                              | .58   | 9.667  | 1.75  | 15.667 | 1.36  | 21.67 | .58   |
| 3.750                              | .58   | 9.750  | 1.75  | 15.750 | 1.36  | 21.75 | .58   |
| 3.833                              | .78   | 9.833  | 2.14  | 15.833 | .97   | 21.83 | .58   |
| 3.917                              | .78   | 9.917  | 2.14  | 15.917 | .97   | 21.92 | .58   |
| 4.000                              | .78   | 10.000 | 2.14  | 16.000 | .97   | 22.00 | .58   |
| 4.083                              | .78   | 10.083 | 2.34  | 16.083 | .78   | 22.08 | .58   |
| 4.167                              | .78   | 10.167 | 2.34  | 16.167 | .78   | 22.17 | .58   |
| 4.250                              | .78   | 10.250 | 2.34  | 16.250 | .78   | 22.25 | .58   |
| 4.333                              | .78   | 10.333 | 2.92  | 16.333 | .97   | 22.33 | .58   |
| 4.417                              | .78   | 10.417 | 2.92  | 16.417 | .97   | 22.42 | .58   |
| 4.500                              | .78   | 10.500 | 2.92  | 16.500 | .97   | 22.50 | .58   |
| 4.583                              | .78   | 10.583 | 3.12  | 16.583 | .78   | 22.58 | .58   |
| 4.667                              | .78   | 10.667 | 3.12  | 16.667 | .78   | 22.67 | .58   |
| 4.750                              | .78   | 10.750 | 3.12  | 16.750 | .78   | 22.75 | .58   |
| 4.833                              | .78   | 10.833 | 4.68  | 16.833 | .97   | 22.83 | .58   |
| 4.917                              | .78   | 10.917 | 4.68  | 16.917 | .97   | 22.92 | .58   |
| 5.000                              | .78   | 11.000 | 4.68  | 17.000 | .97   | 23.00 | .58   |
| 5.083                              | .78   | 11.083 | 4.68  | 17.083 | .78   | 23.08 | .58   |
| 5.167                              | .78   | 11.167 | 4.68  | 17.167 | .78   | 23.17 | .58   |
| 5.250                              | .78   | 11.250 | 4.68  | 17.250 | .78   | 23.25 | .58   |
| 5.333                              | .78   | 11.333 | 14.41 | 17.333 | .97   | 23.33 | .58   |
| 5.417                              | .78   | 11.417 | 14.42 | 17.417 | .97   | 23.42 | .58   |
| 5.500                              | .78   | 11.500 | 14.42 | 17.500 | .97   | 23.50 | .58   |
| 5.583                              | .78   | 11.583 | 59.60 | 17.583 | .78   | 23.58 | .58   |
| 5.667                              | .78   | 11.667 | 59.61 | 17.667 | .78   | 23.67 | .58   |
| 5.750                              | .78   | 11.750 | 59.61 | 17.750 | .78   | 23.75 | .58   |
| 5.833                              | .78   | 11.833 | 7.02  | 17.833 | .97   |       |       |
| 5.917                              | .78   | 11.917 | 7.01  | 17.917 | .97   |       |       |
| 6.000                              | .78   | 12.000 | 7.01  | 18.000 | .97   |       |       |

Max.Eff.Inten.(mm/hr)= 59.61 30.71  
over (min) 5.00 15.00

|                        |           |            |            |
|------------------------|-----------|------------|------------|
| Storage Coeff. (min)=  | 1.53 (ii) | 12.84 (ii) |            |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |            |
| Unit Hyd. peak (cms)=  | .33       | .08        |            |
|                        |           |            | *TOTALS*   |
| PEAK FLOW (cms)=       | .00       | .02        | .022 (iii) |
| TIME TO PEAK (hrs)=    | 11.75     | 11.83      | 11.75      |
| RUNOFF VOLUME (mm)=    | 47.55     | 18.28      | 19.73      |
| TOTAL RAINFALL (mm)=   | 48.55     | 48.55      | 48.55      |
| RUNOFF COEFFICIENT =   | .98       | .38        | .41        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0201) | Area (ha)= 1.92
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
-----
  
```

|                         |           |            |              |
|-------------------------|-----------|------------|--------------|
|                         |           | IMPERVIOUS | PERVIOUS (i) |
| Surface Area (ha)=      | .83       |            | 1.10         |
| Dep. Storage (mm)=      | 1.00      |            | 3.70         |
| Average Slope (%)=      | 1.00      |            | 2.00         |
| Length (m)=             | 200.00    |            | 40.00        |
| Mannings n =            | .013      |            | .250         |
| Max.Eff.Inten. (mm/hr)= | 59.61     |            | 53.47        |
| over (min)              | 5.00      |            | 15.00        |
| Storage Coeff. (min)=   | 4.76 (ii) |            | 13.83 (ii)   |
| Unit Hyd. Tpeak (min)=  | 5.00      |            | 15.00        |
| Unit Hyd. peak (cms)=   | .22       |            | .08          |
|                         |           |            | *TOTALS*     |
| PEAK FLOW (cms)=        | .06       | .09        | .136 (iii)   |
| TIME TO PEAK (hrs)=     | 11.75     | 11.83      | 11.75        |
| RUNOFF VOLUME (mm)=     | 47.55     | 24.95      | 29.02        |
| TOTAL RAINFALL (mm)=    | 48.55     | 48.55      | 48.55        |
| RUNOFF COEFFICIENT =    | .98       | .51        | .60          |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-----
| CALIB |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .31
  
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167  | .58   | 6.167 | .97   | 12.167 | 7.01  | 18.17 | .78   |
| .333  | .49   | 6.333 | .88   | 12.333 | 5.36  | 18.33 | .88   |
| .500  | .39   | 6.500 | .78   | 12.500 | 3.70  | 18.50 | .97   |
| .667  | .58   | 6.667 | .97   | 12.667 | 3.51  | 18.67 | .78   |
| .833  | .58   | 6.833 | .97   | 12.833 | 3.12  | 18.83 | .88   |
| 1.000 | .58   | 7.000 | .97   | 13.000 | 2.73  | 19.00 | .97   |
| 1.167 | .58   | 7.167 | 1.17  | 13.167 | 2.53  | 19.17 | .78   |
| 1.333 | .49   | 7.333 | 1.07  | 13.333 | 2.34  | 19.33 | .88   |
| 1.500 | .39   | 7.500 | .97   | 13.500 | 2.14  | 19.50 | .97   |
| 1.667 | .58   | 7.667 | 1.17  | 13.667 | 1.95  | 19.67 | .78   |
| 1.833 | .58   | 7.833 | 1.17  | 13.833 | 1.75  | 19.83 | .68   |
| 2.000 | .58   | 8.000 | 1.17  | 14.000 | 1.56  | 20.00 | .58   |
| 2.167 | .78   | 8.167 | 1.36  | 14.167 | 1.36  | 20.17 | .58   |
| 2.333 | .68   | 8.333 | 1.36  | 14.333 | 1.46  | 20.33 | .58   |
| 2.500 | .58   | 8.500 | 1.36  | 14.500 | 1.56  | 20.50 | .58   |
| 2.667 | .58   | 8.667 | 1.36  | 14.667 | 1.36  | 20.67 | .58   |
| 2.833 | .58   | 8.833 | 1.46  | 14.833 | 1.46  | 20.83 | .58   |

|       |     |  |        |       |  |        |      |  |       |     |
|-------|-----|--|--------|-------|--|--------|------|--|-------|-----|
| 3.000 | .58 |  | 9.000  | 1.56  |  | 15.000 | 1.56 |  | 21.00 | .58 |
| 3.167 | .78 |  | 9.167  | 1.56  |  | 15.167 | 1.36 |  | 21.17 | .58 |
| 3.333 | .68 |  | 9.333  | 1.66  |  | 15.333 | 1.46 |  | 21.33 | .58 |
| 3.500 | .58 |  | 9.500  | 1.75  |  | 15.500 | 1.56 |  | 21.50 | .58 |
| 3.667 | .58 |  | 9.667  | 1.75  |  | 15.667 | 1.36 |  | 21.67 | .58 |
| 3.833 | .68 |  | 9.833  | 1.95  |  | 15.833 | 1.17 |  | 21.83 | .58 |
| 4.000 | .78 |  | 10.000 | 2.14  |  | 16.000 | .97  |  | 22.00 | .58 |
| 4.167 | .78 |  | 10.167 | 2.34  |  | 16.167 | .78  |  | 22.17 | .58 |
| 4.333 | .78 |  | 10.333 | 2.63  |  | 16.333 | .88  |  | 22.33 | .58 |
| 4.500 | .78 |  | 10.500 | 2.92  |  | 16.500 | .97  |  | 22.50 | .58 |
| 4.667 | .78 |  | 10.667 | 3.12  |  | 16.667 | .78  |  | 22.67 | .58 |
| 4.833 | .78 |  | 10.833 | 3.90  |  | 16.833 | .88  |  | 22.83 | .58 |
| 5.000 | .78 |  | 11.000 | 4.68  |  | 17.000 | .97  |  | 23.00 | .58 |
| 5.167 | .78 |  | 11.167 | 4.68  |  | 17.167 | .78  |  | 23.17 | .58 |
| 5.333 | .78 |  | 11.333 | 9.55  |  | 17.333 | .88  |  | 23.33 | .58 |
| 5.500 | .78 |  | 11.500 | 14.42 |  | 17.500 | .97  |  | 23.50 | .58 |
| 5.667 | .78 |  | 11.667 | 59.61 |  | 17.667 | .78  |  | 23.67 | .58 |
| 5.833 | .78 |  | 11.833 | 33.31 |  | 17.833 | .88  |  | 23.83 | .29 |
| 6.000 | .78 |  | 12.000 | 7.01  |  | 18.000 | .97  |  |       |     |

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .003 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 11.966  
 TOTAL RAINFALL (mm)= 48.554  
 RUNOFF COEFFICIENT = .246

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

|                   |  |                    |                            |
|-------------------|--|--------------------|----------------------------|
| CALIB             |  |                    |                            |
| NASHYD (0205)     |  | Area (ha)= .45     | Curve Number (CN)= 69.0    |
| ID= 1 DT=10.0 min |  | Ia (mm)= 5.00      | # of Linear Res. (N)= 3.00 |
|                   |  | U.H. Tp (hrs)= .36 |                            |

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .009 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 11.995  
 TOTAL RAINFALL (mm)= 48.554  
 RUNOFF COEFFICIENT = .247

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

|                   |  |                     |                      |
|-------------------|--|---------------------|----------------------|
| CALIB             |  |                     |                      |
| STANDHYD (0202)   |  | Area (ha)= 1.14     |                      |
| ID= 1 DT= 5.0 min |  | Total Imp(%)= 39.00 | Dir. Conn.(%)= 17.00 |

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

| ---- TRANSFORMED HYETOGRAPH ---- |       |       |       |        |       |       |       |
|----------------------------------|-------|-------|-------|--------|-------|-------|-------|
| TIME                             | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
| hrs                              | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083                             | .58   | 6.083 | .97   | 12.083 | 7.01  | 18.08 | .78   |
| .167                             | .58   | 6.167 | .97   | 12.167 | 7.01  | 18.17 | .78   |
| .250                             | .58   | 6.250 | .97   | 12.250 | 7.01  | 18.25 | .78   |
| .333                             | .39   | 6.333 | .78   | 12.333 | 3.70  | 18.33 | .97   |
| .417                             | .39   | 6.417 | .78   | 12.417 | 3.70  | 18.42 | .97   |
| .500                             | .39   | 6.500 | .78   | 12.500 | 3.70  | 18.50 | .97   |
| .583                             | .58   | 6.583 | .97   | 12.583 | 3.51  | 18.58 | .78   |
| .667                             | .58   | 6.667 | .97   | 12.667 | 3.51  | 18.67 | .78   |
| .750                             | .58   | 6.750 | .97   | 12.750 | 3.51  | 18.75 | .78   |
| .833                             | .58   | 6.833 | .97   | 12.833 | 2.73  | 18.83 | .97   |
| .917                             | .58   | 6.917 | .97   | 12.917 | 2.73  | 18.92 | .97   |
| 1.000                            | .58   | 7.000 | .97   | 13.000 | 2.73  | 19.00 | .97   |
| 1.083                            | .58   | 7.083 | 1.17  | 13.083 | 2.53  | 19.08 | .78   |
| 1.167                            | .58   | 7.167 | 1.17  | 13.167 | 2.53  | 19.17 | .78   |
| 1.250                            | .58   | 7.250 | 1.17  | 13.250 | 2.53  | 19.25 | .78   |
| 1.333                            | .39   | 7.333 | .97   | 13.333 | 2.14  | 19.33 | .97   |
| 1.417                            | .39   | 7.417 | .97   | 13.417 | 2.14  | 19.42 | .97   |
| 1.500                            | .39   | 7.500 | .97   | 13.500 | 2.14  | 19.50 | .97   |
| 1.583                            | .58   | 7.583 | 1.17  | 13.583 | 1.95  | 19.58 | .78   |

|       |     |        |       |        |      |       |     |
|-------|-----|--------|-------|--------|------|-------|-----|
| 1.667 | .58 | 7.667  | 1.17  | 13.667 | 1.95 | 19.67 | .78 |
| 1.750 | .58 | 7.750  | 1.17  | 13.750 | 1.95 | 19.75 | .78 |
| 1.833 | .58 | 7.833  | 1.17  | 13.833 | 1.56 | 19.83 | .58 |
| 1.917 | .58 | 7.917  | 1.17  | 13.917 | 1.56 | 19.92 | .58 |
| 2.000 | .58 | 8.000  | 1.17  | 14.000 | 1.56 | 20.00 | .58 |
| 2.083 | .78 | 8.083  | 1.36  | 14.083 | 1.36 | 20.08 | .58 |
| 2.167 | .78 | 8.167  | 1.36  | 14.167 | 1.36 | 20.17 | .58 |
| 2.250 | .78 | 8.250  | 1.36  | 14.250 | 1.36 | 20.25 | .58 |
| 2.333 | .58 | 8.333  | 1.36  | 14.333 | 1.56 | 20.33 | .58 |
| 2.417 | .58 | 8.417  | 1.36  | 14.417 | 1.56 | 20.42 | .58 |
| 2.500 | .58 | 8.500  | 1.36  | 14.500 | 1.56 | 20.50 | .58 |
| 2.583 | .58 | 8.583  | 1.36  | 14.583 | 1.36 | 20.58 | .58 |
| 2.667 | .58 | 8.667  | 1.36  | 14.667 | 1.36 | 20.67 | .58 |
| 2.750 | .58 | 8.750  | 1.36  | 14.750 | 1.36 | 20.75 | .58 |
| 2.833 | .58 | 8.833  | 1.56  | 14.833 | 1.56 | 20.83 | .58 |
| 2.917 | .58 | 8.917  | 1.56  | 14.917 | 1.56 | 20.92 | .58 |
| 3.000 | .58 | 9.000  | 1.56  | 15.000 | 1.56 | 21.00 | .58 |
| 3.083 | .78 | 9.083  | 1.56  | 15.083 | 1.36 | 21.08 | .58 |
| 3.167 | .78 | 9.167  | 1.56  | 15.167 | 1.36 | 21.17 | .58 |
| 3.250 | .78 | 9.250  | 1.56  | 15.250 | 1.36 | 21.25 | .58 |
| 3.333 | .58 | 9.333  | 1.75  | 15.333 | 1.56 | 21.33 | .58 |
| 3.417 | .58 | 9.417  | 1.75  | 15.417 | 1.56 | 21.42 | .58 |
| 3.500 | .58 | 9.500  | 1.75  | 15.500 | 1.56 | 21.50 | .58 |
| 3.583 | .58 | 9.583  | 1.75  | 15.583 | 1.36 | 21.58 | .58 |
| 3.667 | .58 | 9.667  | 1.75  | 15.667 | 1.36 | 21.67 | .58 |
| 3.750 | .58 | 9.750  | 1.75  | 15.750 | 1.36 | 21.75 | .58 |
| 3.833 | .78 | 9.833  | 2.14  | 15.833 | .97  | 21.83 | .58 |
| 3.917 | .78 | 9.917  | 2.14  | 15.917 | .97  | 21.92 | .58 |
| 4.000 | .78 | 10.000 | 2.14  | 16.000 | .97  | 22.00 | .58 |
| 4.083 | .78 | 10.083 | 2.34  | 16.083 | .78  | 22.08 | .58 |
| 4.167 | .78 | 10.167 | 2.34  | 16.167 | .78  | 22.17 | .58 |
| 4.250 | .78 | 10.250 | 2.34  | 16.250 | .78  | 22.25 | .58 |
| 4.333 | .78 | 10.333 | 2.92  | 16.333 | .97  | 22.33 | .58 |
| 4.417 | .78 | 10.417 | 2.92  | 16.417 | .97  | 22.42 | .58 |
| 4.500 | .78 | 10.500 | 2.92  | 16.500 | .97  | 22.50 | .58 |
| 4.583 | .78 | 10.583 | 3.12  | 16.583 | .78  | 22.58 | .58 |
| 4.667 | .78 | 10.667 | 3.12  | 16.667 | .78  | 22.67 | .58 |
| 4.750 | .78 | 10.750 | 3.12  | 16.750 | .78  | 22.75 | .58 |
| 4.833 | .78 | 10.833 | 4.68  | 16.833 | .97  | 22.83 | .58 |
| 4.917 | .78 | 10.917 | 4.68  | 16.917 | .97  | 22.92 | .58 |
| 5.000 | .78 | 11.000 | 4.68  | 17.000 | .97  | 23.00 | .58 |
| 5.083 | .78 | 11.083 | 4.68  | 17.083 | .78  | 23.08 | .58 |
| 5.167 | .78 | 11.167 | 4.68  | 17.167 | .78  | 23.17 | .58 |
| 5.250 | .78 | 11.250 | 4.68  | 17.250 | .78  | 23.25 | .58 |
| 5.333 | .78 | 11.333 | 14.41 | 17.333 | .97  | 23.33 | .58 |
| 5.417 | .78 | 11.417 | 14.42 | 17.417 | .97  | 23.42 | .58 |
| 5.500 | .78 | 11.500 | 14.42 | 17.500 | .97  | 23.50 | .58 |
| 5.583 | .78 | 11.583 | 59.60 | 17.583 | .78  | 23.58 | .58 |
| 5.667 | .78 | 11.667 | 59.61 | 17.667 | .78  | 23.67 | .58 |
| 5.750 | .78 | 11.750 | 59.61 | 17.750 | .78  | 23.75 | .58 |
| 5.833 | .78 | 11.833 | 7.02  | 17.833 | .97  |       |     |
| 5.917 | .78 | 11.917 | 7.01  | 17.917 | .97  |       |     |
| 6.000 | .78 | 12.000 | 7.01  | 18.000 | .97  |       |     |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 59.61     | 47.46      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 2.43 (ii) | 11.94 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .30       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .03   | .06   | .080 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.83 | 11.75      |
| RUNOFF VOLUME (mm)=  | 47.55 | 23.38 | 27.49      |
| TOTAL RAINFALL (mm)= | 48.55 | 48.55 | 48.55      |
| RUNOFF COEFFICIENT = | .98   | .48   | .57        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
 | RESERVOIR (0301) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |



|       |       |  |        |       |
|-------|-------|--|--------|-------|
| .0030 | .0233 |  | .3811  | .1031 |
| .0040 | .0302 |  | .5760  | .1120 |
| .0164 | .0376 |  | .8126  | .1210 |
| .0392 | .0453 |  | 1.0915 | .1301 |
| .0602 | .0531 |  | 1.4134 | .1394 |
| .0639 | .0611 |  | 1.7793 | .1488 |
| .0674 | .0692 |  | .0000  | .0000 |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .136           | 11.75          | 29.02        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .011           | 13.33          | 28.33        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 8.11  
 TIME SHIFT OF PEAK FLOW (min) = 95.00  
 MAXIMUM STORAGE USED (ha.m.) = .0344

| ADD HYD (0903) |  
 | 1 + 2 = 3 |

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0204):   | .16          | .003           | 12.00          | 11.97        |
| + ID2= 2 (0205): | .45          | .009           | 12.00          | 11.99        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .012           | 12.00          | 11.99        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| RESERVOIR (0302) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .080           | 11.75          | 27.49        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .003           | 15.83          | 26.49        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.97  
 TIME SHIFT OF PEAK FLOW (min) = 245.00  
 MAXIMUM STORAGE USED (ha.m.) = .0205

| ADD HYD (0902) |  
 | 1 + 2 = 3 |

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0903):   | .61          | .012           | 12.00          | 11.99        |
| + ID2= 2 (0302): | 1.14         | .003           | 15.83          | 26.49        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .014           | 12.00          | 21.43        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0901) |  
 | 1 + 2 = 3 |

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0301):   | 1.92         | .011           | 13.33          | 28.33        |
| + ID2= 2 (0902): | 1.74         | .014           | 12.00          | 21.43        |
| =====            |              |                |                |              |
| ID = 3 (0901):   | 3.67         | .018           | 12.00          | 25.05        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*

MASS STORM  
Ptotal= 62.00 mm

Filename: I:\2015 Projects\115  
185 - Monterra Phase 2 Natural Hazard Assessm  
\Design\Hydrology\115185 vo2\STORMS\SCS24H.MS  
Comments: SCS Type II 24 HR MASS CURVE

Duration of storm = 23.75 hrs  
Mass curve time step = 15.00 min

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | .74           | 6.25        | 1.24          | 12.25       | 8.93          | 18.25       | .99           |
| .50         | .50           | 6.50        | .99           | 12.50       | 4.71          | 18.50       | 1.24          |
| .75         | .74           | 6.75        | 1.24          | 12.75       | 4.46          | 18.75       | .99           |
| 1.00        | .74           | 7.00        | 1.24          | 13.00       | 3.47          | 19.00       | 1.24          |
| 1.25        | .74           | 7.25        | 1.49          | 13.25       | 3.22          | 19.25       | .99           |
| 1.50        | .50           | 7.50        | 1.24          | 13.50       | 2.73          | 19.50       | 1.24          |
| 1.75        | .74           | 7.75        | 1.49          | 13.75       | 2.48          | 19.75       | .99           |
| 2.00        | .74           | 8.00        | 1.49          | 14.00       | 1.98          | 20.00       | .74           |
| 2.25        | .99           | 8.25        | 1.74          | 14.25       | 1.74          | 20.25       | .74           |
| 2.50        | .74           | 8.50        | 1.74          | 14.50       | 1.98          | 20.50       | .74           |
| 2.75        | .74           | 8.75        | 1.74          | 14.75       | 1.74          | 20.75       | .74           |
| 3.00        | .74           | 9.00        | 1.98          | 15.00       | 1.98          | 21.00       | .74           |
| 3.25        | .99           | 9.25        | 1.98          | 15.25       | 1.74          | 21.25       | .74           |
| 3.50        | .74           | 9.50        | 2.23          | 15.50       | 1.98          | 21.50       | .74           |
| 3.75        | .74           | 9.75        | 2.23          | 15.75       | 1.74          | 21.75       | .74           |
| 4.00        | .99           | 10.00       | 2.73          | 16.00       | 1.24          | 22.00       | .74           |
| 4.25        | .99           | 10.25       | 2.98          | 16.25       | .99           | 22.25       | .74           |
| 4.50        | .99           | 10.50       | 3.72          | 16.50       | 1.24          | 22.50       | .74           |
| 4.75        | .99           | 10.75       | 3.97          | 16.75       | .99           | 22.75       | .74           |
| 5.00        | .99           | 11.00       | 5.95          | 17.00       | 1.24          | 23.00       | .74           |
| 5.25        | .99           | 11.25       | 5.95          | 17.25       | .99           | 23.25       | .74           |
| 5.50        | .99           | 11.50       | 18.35         | 17.50       | 1.24          | 23.50       | .74           |
| 5.75        | .99           | 11.75       | 75.89         | 17.75       | .99           | 23.75       | .74           |
| 6.00        | .99           | 12.00       | 8.93          | 18.00       | 1.24          |             |               |

CALIB  
STANDHYD (0203)  
ID= 1 DT= 5.0 min

Area (ha)= .50  
Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

---- TRANSFORMED HYETOGRAPH ----

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .083        | .74           | 6.083       | 1.24          | 12.083      | 8.93          | 18.08       | .99           |
| .167        | .74           | 6.167       | 1.24          | 12.167      | 8.93          | 18.17       | .99           |
| .250        | .74           | 6.250       | 1.24          | 12.250      | 8.93          | 18.25       | .99           |
| .333        | .50           | 6.333       | .99           | 12.333      | 4.71          | 18.33       | 1.24          |
| .417        | .50           | 6.417       | .99           | 12.417      | 4.71          | 18.42       | 1.24          |
| .500        | .50           | 6.500       | .99           | 12.500      | 4.71          | 18.50       | 1.24          |
| .583        | .74           | 6.583       | 1.24          | 12.583      | 4.46          | 18.58       | .99           |
| .667        | .74           | 6.667       | 1.24          | 12.667      | 4.46          | 18.67       | .99           |
| .750        | .74           | 6.750       | 1.24          | 12.750      | 4.46          | 18.75       | .99           |
| .833        | .74           | 6.833       | 1.24          | 12.833      | 3.47          | 18.83       | 1.24          |
| .917        | .74           | 6.917       | 1.24          | 12.917      | 3.47          | 18.92       | 1.24          |
| 1.000       | .74           | 7.000       | 1.24          | 13.000      | 3.47          | 19.00       | 1.24          |
| 1.083       | .74           | 7.083       | 1.49          | 13.083      | 3.22          | 19.08       | .99           |
| 1.167       | .74           | 7.167       | 1.49          | 13.167      | 3.22          | 19.17       | .99           |
| 1.250       | .74           | 7.250       | 1.49          | 13.250      | 3.22          | 19.25       | .99           |
| 1.333       | .50           | 7.333       | 1.24          | 13.333      | 2.73          | 19.33       | 1.24          |
| 1.417       | .50           | 7.417       | 1.24          | 13.417      | 2.73          | 19.42       | 1.24          |
| 1.500       | .50           | 7.500       | 1.24          | 13.500      | 2.73          | 19.50       | 1.24          |
| 1.583       | .74           | 7.583       | 1.49          | 13.583      | 2.48          | 19.58       | .99           |
| 1.667       | .74           | 7.667       | 1.49          | 13.667      | 2.48          | 19.67       | .99           |
| 1.750       | .74           | 7.750       | 1.49          | 13.750      | 2.48          | 19.75       | .99           |
| 1.833       | .74           | 7.833       | 1.49          | 13.833      | 1.98          | 19.83       | .74           |
| 1.917       | .74           | 7.917       | 1.49          | 13.917      | 1.98          | 19.92       | .74           |
| 2.000       | .74           | 8.000       | 1.49          | 14.000      | 1.98          | 20.00       | .74           |
| 2.083       | .99           | 8.083       | 1.74          | 14.083      | 1.74          | 20.08       | .74           |
| 2.167       | .99           | 8.167       | 1.74          | 14.167      | 1.74          | 20.17       | .74           |
| 2.250       | .99           | 8.250       | 1.74          | 14.250      | 1.74          | 20.25       | .74           |
| 2.333       | .74           | 8.333       | 1.74          | 14.333      | 1.98          | 20.33       | .74           |

|       |     |        |       |        |      |       |     |
|-------|-----|--------|-------|--------|------|-------|-----|
| 2.417 | .74 | 8.417  | 1.74  | 14.417 | 1.98 | 20.42 | .74 |
| 2.500 | .74 | 8.500  | 1.74  | 14.500 | 1.98 | 20.50 | .74 |
| 2.583 | .74 | 8.583  | 1.74  | 14.583 | 1.74 | 20.58 | .74 |
| 2.667 | .74 | 8.667  | 1.74  | 14.667 | 1.74 | 20.67 | .74 |
| 2.750 | .74 | 8.750  | 1.74  | 14.750 | 1.74 | 20.75 | .74 |
| 2.833 | .74 | 8.833  | 1.98  | 14.833 | 1.98 | 20.83 | .74 |
| 2.917 | .74 | 8.917  | 1.98  | 14.917 | 1.98 | 20.92 | .74 |
| 3.000 | .74 | 9.000  | 1.98  | 15.000 | 1.98 | 21.00 | .74 |
| 3.083 | .99 | 9.083  | 1.98  | 15.083 | 1.74 | 21.08 | .74 |
| 3.167 | .99 | 9.167  | 1.98  | 15.167 | 1.74 | 21.17 | .74 |
| 3.250 | .99 | 9.250  | 1.98  | 15.250 | 1.74 | 21.25 | .74 |
| 3.333 | .74 | 9.333  | 2.23  | 15.333 | 1.98 | 21.33 | .74 |
| 3.417 | .74 | 9.417  | 2.23  | 15.417 | 1.98 | 21.42 | .74 |
| 3.500 | .74 | 9.500  | 2.23  | 15.500 | 1.98 | 21.50 | .74 |
| 3.583 | .74 | 9.583  | 2.23  | 15.583 | 1.74 | 21.58 | .74 |
| 3.667 | .74 | 9.667  | 2.23  | 15.667 | 1.74 | 21.67 | .74 |
| 3.750 | .74 | 9.750  | 2.23  | 15.750 | 1.74 | 21.75 | .74 |
| 3.833 | .99 | 9.833  | 2.73  | 15.833 | 1.24 | 21.83 | .74 |
| 3.917 | .99 | 9.917  | 2.73  | 15.917 | 1.24 | 21.92 | .74 |
| 4.000 | .99 | 10.000 | 2.73  | 16.000 | 1.24 | 22.00 | .74 |
| 4.083 | .99 | 10.083 | 2.98  | 16.083 | .99  | 22.08 | .74 |
| 4.167 | .99 | 10.167 | 2.98  | 16.167 | .99  | 22.17 | .74 |
| 4.250 | .99 | 10.250 | 2.98  | 16.250 | .99  | 22.25 | .74 |
| 4.333 | .99 | 10.333 | 3.72  | 16.333 | 1.24 | 22.33 | .74 |
| 4.417 | .99 | 10.417 | 3.72  | 16.417 | 1.24 | 22.42 | .74 |
| 4.500 | .99 | 10.500 | 3.72  | 16.500 | 1.24 | 22.50 | .74 |
| 4.583 | .99 | 10.583 | 3.97  | 16.583 | .99  | 22.58 | .74 |
| 4.667 | .99 | 10.667 | 3.97  | 16.667 | .99  | 22.67 | .74 |
| 4.750 | .99 | 10.750 | 3.97  | 16.750 | .99  | 22.75 | .74 |
| 4.833 | .99 | 10.833 | 5.95  | 16.833 | 1.24 | 22.83 | .74 |
| 4.917 | .99 | 10.917 | 5.95  | 16.917 | 1.24 | 22.92 | .74 |
| 5.000 | .99 | 11.000 | 5.95  | 17.000 | 1.24 | 23.00 | .74 |
| 5.083 | .99 | 11.083 | 5.95  | 17.083 | .99  | 23.08 | .74 |
| 5.167 | .99 | 11.167 | 5.95  | 17.167 | .99  | 23.17 | .74 |
| 5.250 | .99 | 11.250 | 5.95  | 17.250 | .99  | 23.25 | .74 |
| 5.333 | .99 | 11.333 | 18.35 | 17.333 | 1.24 | 23.33 | .74 |
| 5.417 | .99 | 11.417 | 18.35 | 17.417 | 1.24 | 23.42 | .74 |
| 5.500 | .99 | 11.500 | 18.35 | 17.500 | 1.24 | 23.50 | .74 |
| 5.583 | .99 | 11.583 | 75.88 | 17.583 | .99  | 23.58 | .74 |
| 5.667 | .99 | 11.667 | 75.89 | 17.667 | .99  | 23.67 | .74 |
| 5.750 | .99 | 11.750 | 75.89 | 17.750 | .99  | 23.75 | .74 |
| 5.833 | .99 | 11.833 | 8.94  | 17.833 | 1.24 |       |     |
| 5.917 | .99 | 11.917 | 8.93  | 17.917 | 1.24 |       |     |
| 6.000 | .99 | 12.000 | 8.93  | 18.000 | 1.24 |       |     |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 75.89     | 49.57      |
| over (min)              | 5.00      | 15.00      |
| Storage Coeff. (min)=   | 1.39 (ii) | 10.73 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=   | .33       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .03   | .035 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.83 | 11.83      |
| RUNOFF VOLUME (mm)=  | 60.81 | 27.36 | 29.02      |
| TOTAL RAINFALL (mm)= | 61.81 | 61.81 | 61.81      |
| RUNOFF COEFFICIENT = | .98   | .44   | .47        |

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

\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |  |
|-------------------|--|
| CALIB             |  |
| STANDHYD (0201)   |  |
| ID= 1 DT= 5.0 min |  |

|                |       |
|----------------|-------|
| Area (ha)=     | 1.92  |
| Total Imp(%)=  | 43.00 |
| Dir. Conn.(%)= | 18.00 |

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

|                         |           |            |
|-------------------------|-----------|------------|
| Max.Eff.Inten. (mm/hr)= | 75.89     | 76.18      |
| over (min)              | 5.00      | 15.00      |
| Storage Coeff. (min)=   | 4.32 (ii) | 12.19 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=   | .23       | .09        |

\*TOTALS\*

|                    |        |       |       |            |
|--------------------|--------|-------|-------|------------|
| PEAK FLOW          | (cms)= | .07   | .14   | .196 (iii) |
| TIME TO PEAK       | (hrs)= | 11.75 | 11.83 | 11.75      |
| RUNOFF VOLUME      | (mm)=  | 60.81 | 35.81 | 40.31      |
| TOTAL RAINFALL     | (mm)=  | 61.81 | 61.81 | 61.81      |
| RUNOFF COEFFICIENT | =      | .98   | .58   | .65        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-----
| CALIB          |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
|-----|
| U.H. Tp(hrs)= .31
  
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

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-----
          ---- TRANSFORMED HYETOGRAPH ----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.167    .74 | 6.167    1.24 |12.167    8.93 |18.17    .99
.333    .62 | 6.333    1.12 |12.333    6.82 |18.33    1.12
.500    .50 | 6.500    .99 |12.500    4.71 |18.50    1.24
.667    .74 | 6.667    1.24 |12.667    4.46 |18.67    .99
.833    .74 | 6.833    1.24 |12.833    3.97 |18.83    1.12
1.000    .74 | 7.000    1.24 |13.000    3.47 |19.00    1.24
1.167    .74 | 7.167    1.49 |13.167    3.22 |19.17    .99
1.333    .62 | 7.333    1.36 |13.333    2.98 |19.33    1.12
1.500    .50 | 7.500    1.24 |13.500    2.73 |19.50    1.24
1.667    .74 | 7.667    1.49 |13.667    2.48 |19.67    .99
1.833    .74 | 7.833    1.49 |13.833    2.23 |19.83    .87
2.000    .74 | 8.000    1.49 |14.000    1.98 |20.00    .74
2.167    .99 | 8.167    1.74 |14.167    1.74 |20.17    .74
2.333    .87 | 8.333    1.74 |14.333    1.86 |20.33    .74
2.500    .74 | 8.500    1.74 |14.500    1.98 |20.50    .74
2.667    .74 | 8.667    1.74 |14.667    1.74 |20.67    .74
2.833    .74 | 8.833    1.86 |14.833    1.86 |20.83    .74
3.000    .74 | 9.000    1.98 |15.000    1.98 |21.00    .74
3.167    .99 | 9.167    1.98 |15.167    1.74 |21.17    .74
3.333    .87 | 9.333    2.11 |15.333    1.86 |21.33    .74
3.500    .74 | 9.500    2.23 |15.500    1.98 |21.50    .74
3.667    .74 | 9.667    2.23 |15.667    1.74 |21.67    .74
3.833    .87 | 9.833    2.48 |15.833    1.49 |21.83    .74
4.000    .99 |10.000    2.73 |16.000    1.24 |22.00    .74
4.167    .99 |10.167    2.98 |16.167    .99 |22.17    .74
4.333    .99 |10.333    3.35 |16.333    1.12 |22.33    .74
4.500    .99 |10.500    3.72 |16.500    1.24 |22.50    .74
4.667    .99 |10.667    3.97 |16.667    .99 |22.67    .74
4.833    .99 |10.833    4.96 |16.833    1.12 |22.83    .74
5.000    .99 |11.000    5.95 |17.000    1.24 |23.00    .74
5.167    .99 |11.167    5.95 |17.167    .99 |23.17    .74
5.333    .99 |11.333    12.15 |17.333    1.12 |23.33    .74
5.500    .99 |11.500    18.35 |17.500    1.24 |23.50    .74
5.667    .99 |11.667    75.89 |17.667    .99 |23.67    .74
5.833    .99 |11.833    42.41 |17.833    1.12 |23.83    .37
6.000    .99 |12.000    8.93 |18.000    1.24 |
  
```

Unit Hyd Qpeak (cms)= .020

|                    |        |          |
|--------------------|--------|----------|
| PEAK FLOW          | (cms)= | .005 (i) |
| TIME TO PEAK       | (hrs)= | 11.833   |
| RUNOFF VOLUME      | (mm)=  | 18.782   |
| TOTAL RAINFALL     | (mm)=  | 61.814   |
| RUNOFF COEFFICIENT | =      | .304     |

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

```

-----
| CALIB          |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
|-----|
| U.H. Tp(hrs)= .36
  
```

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .014 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 18.828  
 TOTAL RAINFALL (mm)= 61.814  
 RUNOFF COEFFICIENT = .305

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

-----  
 | CALIB |  
 | STANDHYD (0202) | Area (ha)= 1.14  
 | ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00  
 -----

|               |       |            |              |
|---------------|-------|------------|--------------|
|               |       | IMPERVIOUS | PERVIOUS (i) |
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|--------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .74   | 6.083  | 1.24  | 12.083 | 8.93  | 18.08 | .99   |
| .167  | .74   | 6.167  | 1.24  | 12.167 | 8.93  | 18.17 | .99   |
| .250  | .74   | 6.250  | 1.24  | 12.250 | 8.93  | 18.25 | .99   |
| .333  | .50   | 6.333  | .99   | 12.333 | 4.71  | 18.33 | 1.24  |
| .417  | .50   | 6.417  | .99   | 12.417 | 4.71  | 18.42 | 1.24  |
| .500  | .50   | 6.500  | .99   | 12.500 | 4.71  | 18.50 | 1.24  |
| .583  | .74   | 6.583  | 1.24  | 12.583 | 4.46  | 18.58 | .99   |
| .667  | .74   | 6.667  | 1.24  | 12.667 | 4.46  | 18.67 | .99   |
| .750  | .74   | 6.750  | 1.24  | 12.750 | 4.46  | 18.75 | .99   |
| .833  | .74   | 6.833  | 1.24  | 12.833 | 3.47  | 18.83 | 1.24  |
| .917  | .74   | 6.917  | 1.24  | 12.917 | 3.47  | 18.92 | 1.24  |
| 1.000 | .74   | 7.000  | 1.24  | 13.000 | 3.47  | 19.00 | 1.24  |
| 1.083 | .74   | 7.083  | 1.49  | 13.083 | 3.22  | 19.08 | .99   |
| 1.167 | .74   | 7.167  | 1.49  | 13.167 | 3.22  | 19.17 | .99   |
| 1.250 | .74   | 7.250  | 1.49  | 13.250 | 3.22  | 19.25 | .99   |
| 1.333 | .50   | 7.333  | 1.24  | 13.333 | 2.73  | 19.33 | 1.24  |
| 1.417 | .50   | 7.417  | 1.24  | 13.417 | 2.73  | 19.42 | 1.24  |
| 1.500 | .50   | 7.500  | 1.24  | 13.500 | 2.73  | 19.50 | 1.24  |
| 1.583 | .74   | 7.583  | 1.49  | 13.583 | 2.48  | 19.58 | .99   |
| 1.667 | .74   | 7.667  | 1.49  | 13.667 | 2.48  | 19.67 | .99   |
| 1.750 | .74   | 7.750  | 1.49  | 13.750 | 2.48  | 19.75 | .99   |
| 1.833 | .74   | 7.833  | 1.49  | 13.833 | 1.98  | 19.83 | .74   |
| 1.917 | .74   | 7.917  | 1.49  | 13.917 | 1.98  | 19.92 | .74   |
| 2.000 | .74   | 8.000  | 1.49  | 14.000 | 1.98  | 20.00 | .74   |
| 2.083 | .99   | 8.083  | 1.74  | 14.083 | 1.74  | 20.08 | .74   |
| 2.167 | .99   | 8.167  | 1.74  | 14.167 | 1.74  | 20.17 | .74   |
| 2.250 | .99   | 8.250  | 1.74  | 14.250 | 1.74  | 20.25 | .74   |
| 2.333 | .74   | 8.333  | 1.74  | 14.333 | 1.98  | 20.33 | .74   |
| 2.417 | .74   | 8.417  | 1.74  | 14.417 | 1.98  | 20.42 | .74   |
| 2.500 | .74   | 8.500  | 1.74  | 14.500 | 1.98  | 20.50 | .74   |
| 2.583 | .74   | 8.583  | 1.74  | 14.583 | 1.74  | 20.58 | .74   |
| 2.667 | .74   | 8.667  | 1.74  | 14.667 | 1.74  | 20.67 | .74   |
| 2.750 | .74   | 8.750  | 1.74  | 14.750 | 1.74  | 20.75 | .74   |
| 2.833 | .74   | 8.833  | 1.98  | 14.833 | 1.98  | 20.83 | .74   |
| 2.917 | .74   | 8.917  | 1.98  | 14.917 | 1.98  | 20.92 | .74   |
| 3.000 | .74   | 9.000  | 1.98  | 15.000 | 1.98  | 21.00 | .74   |
| 3.083 | .99   | 9.083  | 1.98  | 15.083 | 1.74  | 21.08 | .74   |
| 3.167 | .99   | 9.167  | 1.98  | 15.167 | 1.74  | 21.17 | .74   |
| 3.250 | .99   | 9.250  | 1.98  | 15.250 | 1.74  | 21.25 | .74   |
| 3.333 | .74   | 9.333  | 2.23  | 15.333 | 1.98  | 21.33 | .74   |
| 3.417 | .74   | 9.417  | 2.23  | 15.417 | 1.98  | 21.42 | .74   |
| 3.500 | .74   | 9.500  | 2.23  | 15.500 | 1.98  | 21.50 | .74   |
| 3.583 | .74   | 9.583  | 2.23  | 15.583 | 1.74  | 21.58 | .74   |
| 3.667 | .74   | 9.667  | 2.23  | 15.667 | 1.74  | 21.67 | .74   |
| 3.750 | .74   | 9.750  | 2.23  | 15.750 | 1.74  | 21.75 | .74   |
| 3.833 | .99   | 9.833  | 2.73  | 15.833 | 1.24  | 21.83 | .74   |
| 3.917 | .99   | 9.917  | 2.73  | 15.917 | 1.24  | 21.92 | .74   |
| 4.000 | .99   | 10.000 | 2.73  | 16.000 | 1.24  | 22.00 | .74   |
| 4.083 | .99   | 10.083 | 2.98  | 16.083 | .99   | 22.08 | .74   |
| 4.167 | .99   | 10.167 | 2.98  | 16.167 | .99   | 22.17 | .74   |
| 4.250 | .99   | 10.250 | 2.98  | 16.250 | .99   | 22.25 | .74   |
| 4.333 | .99   | 10.333 | 3.72  | 16.333 | 1.24  | 22.33 | .74   |
| 4.417 | .99   | 10.417 | 3.72  | 16.417 | 1.24  | 22.42 | .74   |
| 4.500 | .99   | 10.500 | 3.72  | 16.500 | 1.24  | 22.50 | .74   |
| 4.583 | .99   | 10.583 | 3.97  | 16.583 | .99   | 22.58 | .74   |
| 4.667 | .99   | 10.667 | 3.97  | 16.667 | .99   | 22.67 | .74   |
| 4.750 | .99   | 10.750 | 3.97  | 16.750 | .99   | 22.75 | .74   |

|       |     |        |       |        |      |       |     |
|-------|-----|--------|-------|--------|------|-------|-----|
| 4.833 | .99 | 10.833 | 5.95  | 16.833 | 1.24 | 22.83 | .74 |
| 4.917 | .99 | 10.917 | 5.95  | 16.917 | 1.24 | 22.92 | .74 |
| 5.000 | .99 | 11.000 | 5.95  | 17.000 | 1.24 | 23.00 | .74 |
| 5.083 | .99 | 11.083 | 5.95  | 17.083 | .99  | 23.08 | .74 |
| 5.167 | .99 | 11.167 | 5.95  | 17.167 | .99  | 23.17 | .74 |
| 5.250 | .99 | 11.250 | 5.95  | 17.250 | .99  | 23.25 | .74 |
| 5.333 | .99 | 11.333 | 18.35 | 17.333 | 1.24 | 23.33 | .74 |
| 5.417 | .99 | 11.417 | 18.35 | 17.417 | 1.24 | 23.42 | .74 |
| 5.500 | .99 | 11.500 | 18.35 | 17.500 | 1.24 | 23.50 | .74 |
| 5.583 | .99 | 11.583 | 75.88 | 17.583 | .99  | 23.58 | .74 |
| 5.667 | .99 | 11.667 | 75.89 | 17.667 | .99  | 23.67 | .74 |
| 5.750 | .99 | 11.750 | 75.89 | 17.750 | .99  | 23.75 | .74 |
| 5.833 | .99 | 11.833 | 8.94  | 17.833 | 1.24 |       |     |
| 5.917 | .99 | 11.917 | 8.93  | 17.917 | 1.24 |       |     |
| 6.000 | .99 | 12.000 | 8.93  | 18.000 | 1.24 |       |     |

Max.Eff.Inten.(mm/hr)= 75.89 68.36  
over (min) 5.00 15.00  
Storage Coeff. (min)= 2.20 (ii) 10.42 (ii)  
Unit Hyd. Tpeak (min)= 5.00 15.00  
Unit Hyd. peak (cms)= .30 .09

\*TOTALS\*

PEAK FLOW (cms)= .04 .09 .116 (iii)  
TIME TO PEAK (hrs)= 11.75 11.83 11.75  
RUNOFF VOLUME (mm)= 60.81 33.88 38.46  
TOTAL RAINFALL (mm)= 61.81 61.81 61.81  
RUNOFF COEFFICIENT = .98 .55 .62

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
| RESERVOIR (0301) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .196           | 11.75          | 40.31        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .032           | 12.50          | 39.62        |

PEAK FLOW REDUCTION [Qout/Qin](%)= 16.10  
TIME SHIFT OF PEAK FLOW (min)= 45.00  
MAXIMUM STORAGE USED (ha.m.)= .0427

-----  
| ADD HYD (0903) |  
| 1 + 2 = 3 |  
-----

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0204):   | .16          | .005           | 11.83          | 18.78        |
| + ID2= 2 (0205): | .45          | .014           | 12.00          | 18.83        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .019           | 12.00          | 18.82        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----  
| RESERVOIR (0302) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |

|       |       |  |        |       |
|-------|-------|--|--------|-------|
| .0021 | .0102 |  | .1153  | .0828 |
| .0027 | .0158 |  | .2258  | .0921 |
| .0033 | .0218 |  | .3706  | .1017 |
| .0037 | .0281 |  | .5506  | .1117 |
| .0041 | .0349 |  | .7671  | .1220 |
| .0045 | .0420 |  | 1.0214 | .1327 |
| .0048 | .0494 |  | 1.3149 | .1438 |
| .0051 | .0572 |  | .0000  | .0000 |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .116           | 11.75          | 38.46        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .004           | 16.00          | 37.46        |

PEAK FLOW REDUCTION [Qout/Qin] (%)= 3.28  
 TIME SHIFT OF PEAK FLOW (min)=255.00  
 MAXIMUM STORAGE USED (ha.m.)= .0298

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0903):    .61    .019    12.00    18.82
+ ID2= 2 (0302):    1.14    .004    16.00    37.46
=====
ID = 3 (0902):    1.74    .022    12.00    30.96
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0301):    1.92    .032    12.50    39.62
+ ID2= 2 (0902):    1.74    .022    12.00    30.96
=====
ID = 3 (0901):    3.67    .046    12.33    35.50
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

-----
| MASS STORM |      Filename: I:\2015 Projects\l15
|             |      185 - Monterra Phase 2 Natural Hazard Assessm
|             |      \Design\Hydrology\l15185 vo2\STORMS\SCS24H.MS
| Ptotal= 70.90 mm |      Comments: SCS Type II 24 HR MASS CURVE
-----
  
```

Duration of storm = 23.75 hrs  
 Mass curve time step = 15.00 min

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | .85           | 6.25        | 1.42          | 12.25       | 10.21         | 18.25       | 1.13          |
| .50         | .57           | 6.50        | 1.13          | 12.50       | 5.39          | 18.50       | 1.42          |
| .75         | .85           | 6.75        | 1.42          | 12.75       | 5.10          | 18.75       | 1.13          |
| 1.00        | .85           | 7.00        | 1.42          | 13.00       | 3.97          | 19.00       | 1.42          |
| 1.25        | .85           | 7.25        | 1.70          | 13.25       | 3.69          | 19.25       | 1.13          |
| 1.50        | .57           | 7.50        | 1.42          | 13.50       | 3.12          | 19.50       | 1.42          |
| 1.75        | .85           | 7.75        | 1.70          | 13.75       | 2.84          | 19.75       | 1.13          |
| 2.00        | .85           | 8.00        | 1.70          | 14.00       | 2.27          | 20.00       | .85           |
| 2.25        | 1.13          | 8.25        | 1.99          | 14.25       | 1.99          | 20.25       | .85           |
| 2.50        | .85           | 8.50        | 1.99          | 14.50       | 2.27          | 20.50       | .85           |
| 2.75        | .85           | 8.75        | 1.99          | 14.75       | 1.99          | 20.75       | .85           |
| 3.00        | .85           | 9.00        | 2.27          | 15.00       | 2.27          | 21.00       | .85           |
| 3.25        | 1.13          | 9.25        | 2.27          | 15.25       | 1.99          | 21.25       | .85           |
| 3.50        | .85           | 9.50        | 2.55          | 15.50       | 2.27          | 21.50       | .85           |
| 3.75        | .85           | 9.75        | 2.55          | 15.75       | 1.99          | 21.75       | .85           |
| 4.00        | 1.13          | 10.00       | 3.12          | 16.00       | 1.42          | 22.00       | .85           |
| 4.25        | 1.13          | 10.25       | 3.40          | 16.25       | 1.13          | 22.25       | .85           |
| 4.50        | 1.13          | 10.50       | 4.25          | 16.50       | 1.42          | 22.50       | .85           |
| 4.75        | 1.13          | 10.75       | 4.54          | 16.75       | 1.13          | 22.75       | .85           |
| 5.00        | 1.13          | 11.00       | 6.81          | 17.00       | 1.42          | 23.00       | .85           |
| 5.25        | 1.13          | 11.25       | 6.81          | 17.25       | 1.13          | 23.25       | .85           |
| 5.50        | 1.13          | 11.50       | 20.99         | 17.50       | 1.42          | 23.50       | .85           |
| 5.75        | 1.13          | 11.75       | 86.78         | 17.75       | 1.13          | 23.75       | .85           |
| 6.00        | 1.13          | 12.00       | 10.21         | 18.00       | 1.42          |             |               |

```

-----
| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
-----

```

```

          IMPERVIOUS      PERVIOUS (i)
Surface Area (ha)= .11 .39
Dep. Storage (mm)= 1.00 4.30
Average Slope (%)= 1.00 2.00
Length (m)= 30.00 40.00
Mannings n = .013 .250

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
.083 .85 | 6.083 1.42 | 12.083 10.21 | 18.08 1.13
.167 .85 | 6.167 1.42 | 12.167 10.21 | 18.17 1.13
.250 .85 | 6.250 1.42 | 12.250 10.21 | 18.25 1.13
.333 .57 | 6.333 1.13 | 12.333 5.39 | 18.33 1.42
.417 .57 | 6.417 1.13 | 12.417 5.39 | 18.42 1.42
.500 .57 | 6.500 1.13 | 12.500 5.39 | 18.50 1.42
.583 .85 | 6.583 1.42 | 12.583 5.10 | 18.58 1.13
.667 .85 | 6.667 1.42 | 12.667 5.10 | 18.67 1.13
.750 .85 | 6.750 1.42 | 12.750 5.10 | 18.75 1.13
.833 .85 | 6.833 1.42 | 12.833 3.97 | 18.83 1.42
.917 .85 | 6.917 1.42 | 12.917 3.97 | 18.92 1.42
1.000 .85 | 7.000 1.42 | 13.000 3.97 | 19.00 1.42
1.083 .85 | 7.083 1.70 | 13.083 3.69 | 19.08 1.13
1.167 .85 | 7.167 1.70 | 13.167 3.69 | 19.17 1.13
1.250 .85 | 7.250 1.70 | 13.250 3.69 | 19.25 1.13
1.333 .57 | 7.333 1.42 | 13.333 3.12 | 19.33 1.42
1.417 .57 | 7.417 1.42 | 13.417 3.12 | 19.42 1.42
1.500 .57 | 7.500 1.42 | 13.500 3.12 | 19.50 1.42
1.583 .85 | 7.583 1.70 | 13.583 2.84 | 19.58 1.13
1.667 .85 | 7.667 1.70 | 13.667 2.84 | 19.67 1.13
1.750 .85 | 7.750 1.70 | 13.750 2.84 | 19.75 1.13
1.833 .85 | 7.833 1.70 | 13.833 2.27 | 19.83 .85
1.917 .85 | 7.917 1.70 | 13.917 2.27 | 19.92 .85
2.000 .85 | 8.000 1.70 | 14.000 2.27 | 20.00 .85
2.083 1.13 | 8.083 1.99 | 14.083 1.99 | 20.08 .85
2.167 1.13 | 8.167 1.99 | 14.167 1.99 | 20.17 .85
2.250 1.13 | 8.250 1.99 | 14.250 1.99 | 20.25 .85
2.333 .85 | 8.333 1.99 | 14.333 2.27 | 20.33 .85
2.417 .85 | 8.417 1.99 | 14.417 2.27 | 20.42 .85
2.500 .85 | 8.500 1.99 | 14.500 2.27 | 20.50 .85
2.583 .85 | 8.583 1.99 | 14.583 1.99 | 20.58 .85
2.667 .85 | 8.667 1.99 | 14.667 1.99 | 20.67 .85
2.750 .85 | 8.750 1.99 | 14.750 1.99 | 20.75 .85
2.833 .85 | 8.833 2.27 | 14.833 2.27 | 20.83 .85
2.917 .85 | 8.917 2.27 | 14.917 2.27 | 20.92 .85
3.000 .85 | 9.000 2.27 | 15.000 2.27 | 21.00 .85
3.083 1.13 | 9.083 2.27 | 15.083 1.99 | 21.08 .85
3.167 1.13 | 9.167 2.27 | 15.167 1.99 | 21.17 .85
3.250 1.13 | 9.250 2.27 | 15.250 1.99 | 21.25 .85
3.333 .85 | 9.333 2.55 | 15.333 2.27 | 21.33 .85
3.417 .85 | 9.417 2.55 | 15.417 2.27 | 21.42 .85
3.500 .85 | 9.500 2.55 | 15.500 2.27 | 21.50 .85
3.583 .85 | 9.583 2.55 | 15.583 1.99 | 21.58 .85
3.667 .85 | 9.667 2.55 | 15.667 1.99 | 21.67 .85
3.750 .85 | 9.750 2.55 | 15.750 1.99 | 21.75 .85
3.833 1.13 | 9.833 3.12 | 15.833 1.42 | 21.83 .85
3.917 1.13 | 9.917 3.12 | 15.917 1.42 | 21.92 .85
4.000 1.13 | 10.000 3.12 | 16.000 1.42 | 22.00 .85
4.083 1.13 | 10.083 3.40 | 16.083 1.13 | 22.08 .85
4.167 1.13 | 10.167 3.40 | 16.167 1.13 | 22.17 .85
4.250 1.13 | 10.250 3.40 | 16.250 1.13 | 22.25 .85
4.333 1.13 | 10.333 4.25 | 16.333 1.42 | 22.33 .85
4.417 1.13 | 10.417 4.25 | 16.417 1.42 | 22.42 .85
4.500 1.13 | 10.500 4.25 | 16.500 1.42 | 22.50 .85
4.583 1.13 | 10.583 4.54 | 16.583 1.13 | 22.58 .85
4.667 1.13 | 10.667 4.54 | 16.667 1.13 | 22.67 .85
4.750 1.13 | 10.750 4.54 | 16.750 1.13 | 22.75 .85
4.833 1.13 | 10.833 6.81 | 16.833 1.42 | 22.83 .85
4.917 1.13 | 10.917 6.81 | 16.917 1.42 | 22.92 .85
5.000 1.13 | 11.000 6.81 | 17.000 1.42 | 23.00 .85
5.083 1.13 | 11.083 6.81 | 17.083 1.13 | 23.08 .85
5.167 1.13 | 11.167 6.81 | 17.167 1.13 | 23.17 .85
5.250 1.13 | 11.250 6.81 | 17.250 1.13 | 23.25 .85
5.333 1.13 | 11.333 20.99 | 17.333 1.42 | 23.33 .85
5.417 1.13 | 11.417 20.99 | 17.417 1.42 | 23.42 .85
5.500 1.13 | 11.500 20.99 | 17.500 1.42 | 23.50 .85

```



|       |      |        |       |        |      |       |     |
|-------|------|--------|-------|--------|------|-------|-----|
| 5.583 | 1.13 | 11.583 | 86.78 | 17.583 | 1.13 | 23.58 | .85 |
| 5.667 | 1.13 | 11.667 | 86.78 | 17.667 | 1.13 | 23.67 | .85 |
| 5.750 | 1.13 | 11.750 | 86.78 | 17.750 | 1.13 | 23.75 | .85 |
| 5.833 | 1.13 | 11.833 | 10.22 | 17.833 | 1.42 |       |     |
| 5.917 | 1.13 | 11.917 | 10.21 | 17.917 | 1.42 |       |     |
| 6.000 | 1.13 | 12.000 | 10.21 | 18.000 | 1.42 |       |     |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 86.78     | 61.31     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.31 (ii) | 9.90 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .33       | .11       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .05   | .052 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 69.69 | 33.91 | 35.68      |
| TOTAL RAINFALL (mm)= | 70.69 | 70.69 | 70.69      |
| RUNOFF COEFFICIENT = | .99   | .48   | .50        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |               |       |                      |
|-------------------|---------------|-------|----------------------|
| CALIB             |               |       |                      |
| STANDHYD (0201)   | Area (ha)=    | 1.92  |                      |
| ID= 1 DT= 5.0 min | Total Imp(%)= | 43.00 | Dir. Conn.(%)= 18.00 |

|                    |        | IMPERVIOUS | PERVIOUS (i) |
|--------------------|--------|------------|--------------|
| Surface Area (ha)= | .83    | 1.10       |              |
| Dep. Storage (mm)= | 1.00   | 3.70       |              |
| Average Slope (%)= | 1.00   | 2.00       |              |
| Length (m)=        | 200.00 | 40.00      |              |
| Mannings n =       | .013   | .250       |              |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 86.78     | 91.86      |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 4.10 (ii) | 11.40 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .24       | .09        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .08   | .18   | .239 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.83 | 11.75      |
| RUNOFF VOLUME (mm)=  | 69.69 | 43.41 | 48.14      |
| TOTAL RAINFALL (mm)= | 70.69 | 70.69 | 70.69      |
| RUNOFF COEFFICIENT = | .99   | .61   | .68        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |            |               |                           |
|-------------------|------------|---------------|---------------------------|
| CALIB             |            |               |                           |
| NASHYD (0204)     | Area (ha)= | .16           | Curve Number (CN)= 69.0   |
| ID= 1 DT=10.0 min | Ia (mm)=   | 5.00          | # of Linear Res.(N)= 3.00 |
|                   |            | U.H. Tp(hrs)= | .31                       |

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167                             | .85   | 6.167 | 1.42  | 12.167 | 10.21 | 18.17 | 1.13  |
| .333                             | .71   | 6.333 | 1.28  | 12.333 | 7.80  | 18.33 | 1.28  |
| .500                             | .57   | 6.500 | 1.13  | 12.500 | 5.39  | 18.50 | 1.42  |
| .667                             | .85   | 6.667 | 1.42  | 12.667 | 5.10  | 18.67 | 1.13  |
| .833                             | .85   | 6.833 | 1.42  | 12.833 | 4.54  | 18.83 | 1.28  |
| 1.000                            | .85   | 7.000 | 1.42  | 13.000 | 3.97  | 19.00 | 1.42  |
| 1.167                            | .85   | 7.167 | 1.70  | 13.167 | 3.69  | 19.17 | 1.13  |
| 1.333                            | .71   | 7.333 | 1.56  | 13.333 | 3.40  | 19.33 | 1.28  |

|       |      |        |       |        |      |       |      |
|-------|------|--------|-------|--------|------|-------|------|
| 1.500 | .57  | 7.500  | 1.42  | 13.500 | 3.12 | 19.50 | 1.42 |
| 1.667 | .85  | 7.667  | 1.70  | 13.667 | 2.84 | 19.67 | 1.13 |
| 1.833 | .85  | 7.833  | 1.70  | 13.833 | 2.55 | 19.83 | .99  |
| 2.000 | .85  | 8.000  | 1.70  | 14.000 | 2.27 | 20.00 | .85  |
| 2.167 | 1.13 | 8.167  | 1.99  | 14.167 | 1.99 | 20.17 | .85  |
| 2.333 | .99  | 8.333  | 1.99  | 14.333 | 2.13 | 20.33 | .85  |
| 2.500 | .85  | 8.500  | 1.99  | 14.500 | 2.27 | 20.50 | .85  |
| 2.667 | .85  | 8.667  | 1.99  | 14.667 | 1.99 | 20.67 | .85  |
| 2.833 | .85  | 8.833  | 2.13  | 14.833 | 2.13 | 20.83 | .85  |
| 3.000 | .85  | 9.000  | 2.27  | 15.000 | 2.27 | 21.00 | .85  |
| 3.167 | 1.13 | 9.167  | 2.27  | 15.167 | 1.99 | 21.17 | .85  |
| 3.333 | .99  | 9.333  | 2.41  | 15.333 | 2.13 | 21.33 | .85  |
| 3.500 | .85  | 9.500  | 2.55  | 15.500 | 2.27 | 21.50 | .85  |
| 3.667 | .85  | 9.667  | 2.55  | 15.667 | 1.99 | 21.67 | .85  |
| 3.833 | .99  | 9.833  | 2.84  | 15.833 | 1.70 | 21.83 | .85  |
| 4.000 | 1.13 | 10.000 | 3.12  | 16.000 | 1.42 | 22.00 | .85  |
| 4.167 | 1.13 | 10.167 | 3.40  | 16.167 | 1.13 | 22.17 | .85  |
| 4.333 | 1.13 | 10.333 | 3.83  | 16.333 | 1.28 | 22.33 | .85  |
| 4.500 | 1.13 | 10.500 | 4.25  | 16.500 | 1.42 | 22.50 | .85  |
| 4.667 | 1.13 | 10.667 | 4.54  | 16.667 | 1.13 | 22.67 | .85  |
| 4.833 | 1.13 | 10.833 | 5.67  | 16.833 | 1.28 | 22.83 | .85  |
| 5.000 | 1.13 | 11.000 | 6.81  | 17.000 | 1.42 | 23.00 | .85  |
| 5.167 | 1.13 | 11.167 | 6.81  | 17.167 | 1.13 | 23.17 | .85  |
| 5.333 | 1.13 | 11.333 | 13.90 | 17.333 | 1.28 | 23.33 | .85  |
| 5.500 | 1.13 | 11.500 | 20.99 | 17.500 | 1.42 | 23.50 | .85  |
| 5.667 | 1.13 | 11.667 | 86.78 | 17.667 | 1.13 | 23.67 | .85  |
| 5.833 | 1.13 | 11.833 | 48.49 | 17.833 | 1.28 | 23.83 | .43  |
| 6.000 | 1.13 | 12.000 | 10.21 | 18.000 | 1.42 |       |      |

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .007 (i)  
 TIME TO PEAK (hrs)= 11.833  
 RUNOFF VOLUME (mm)= 23.872  
 TOTAL RAINFALL (mm)= 70.687  
 RUNOFF COEFFICIENT = .338

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

-----  
 | CALIB |  
 | NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0  
 | ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 -----  
 U.H. Tp(hrs)= .36

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .017 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 23.927  
 TOTAL RAINFALL (mm)= 70.687  
 RUNOFF COEFFICIENT = .338

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

-----  
 | CALIB |  
 | STANDHYD (0202) | Area (ha)= 1.14  
 | ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00  
 -----

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|------|-------|-------|-------|--------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083 | .85   | 6.083 | 1.42  | 12.083 | 10.21 | 18.08 | 1.13  |
| .167 | .85   | 6.167 | 1.42  | 12.167 | 10.21 | 18.17 | 1.13  |
| .250 | .85   | 6.250 | 1.42  | 12.250 | 10.21 | 18.25 | 1.13  |
| .333 | .57   | 6.333 | 1.13  | 12.333 | 5.39  | 18.33 | 1.42  |
| .417 | .57   | 6.417 | 1.13  | 12.417 | 5.39  | 18.42 | 1.42  |
| .500 | .57   | 6.500 | 1.13  | 12.500 | 5.39  | 18.50 | 1.42  |
| .583 | .85   | 6.583 | 1.42  | 12.583 | 5.10  | 18.58 | 1.13  |
| .667 | .85   | 6.667 | 1.42  | 12.667 | 5.10  | 18.67 | 1.13  |
| .750 | .85   | 6.750 | 1.42  | 12.750 | 5.10  | 18.75 | 1.13  |
| .833 | .85   | 6.833 | 1.42  | 12.833 | 3.97  | 18.83 | 1.42  |

|       |      |        |       |        |      |       |      |
|-------|------|--------|-------|--------|------|-------|------|
| .917  | .85  | 6.917  | 1.42  | 12.917 | 3.97 | 18.92 | 1.42 |
| 1.000 | .85  | 7.000  | 1.42  | 13.000 | 3.97 | 19.00 | 1.42 |
| 1.083 | .85  | 7.083  | 1.70  | 13.083 | 3.69 | 19.08 | 1.13 |
| 1.167 | .85  | 7.167  | 1.70  | 13.167 | 3.69 | 19.17 | 1.13 |
| 1.250 | .85  | 7.250  | 1.70  | 13.250 | 3.69 | 19.25 | 1.13 |
| 1.333 | .57  | 7.333  | 1.42  | 13.333 | 3.12 | 19.33 | 1.42 |
| 1.417 | .57  | 7.417  | 1.42  | 13.417 | 3.12 | 19.42 | 1.42 |
| 1.500 | .57  | 7.500  | 1.42  | 13.500 | 3.12 | 19.50 | 1.42 |
| 1.583 | .85  | 7.583  | 1.70  | 13.583 | 2.84 | 19.58 | 1.13 |
| 1.667 | .85  | 7.667  | 1.70  | 13.667 | 2.84 | 19.67 | 1.13 |
| 1.750 | .85  | 7.750  | 1.70  | 13.750 | 2.84 | 19.75 | 1.13 |
| 1.833 | .85  | 7.833  | 1.70  | 13.833 | 2.27 | 19.83 | .85  |
| 1.917 | .85  | 7.917  | 1.70  | 13.917 | 2.27 | 19.92 | .85  |
| 2.000 | .85  | 8.000  | 1.70  | 14.000 | 2.27 | 20.00 | .85  |
| 2.083 | 1.13 | 8.083  | 1.99  | 14.083 | 1.99 | 20.08 | .85  |
| 2.167 | 1.13 | 8.167  | 1.99  | 14.167 | 1.99 | 20.17 | .85  |
| 2.250 | 1.13 | 8.250  | 1.99  | 14.250 | 1.99 | 20.25 | .85  |
| 2.333 | .85  | 8.333  | 1.99  | 14.333 | 2.27 | 20.33 | .85  |
| 2.417 | .85  | 8.417  | 1.99  | 14.417 | 2.27 | 20.42 | .85  |
| 2.500 | .85  | 8.500  | 1.99  | 14.500 | 2.27 | 20.50 | .85  |
| 2.583 | .85  | 8.583  | 1.99  | 14.583 | 1.99 | 20.58 | .85  |
| 2.667 | .85  | 8.667  | 1.99  | 14.667 | 1.99 | 20.67 | .85  |
| 2.750 | .85  | 8.750  | 1.99  | 14.750 | 1.99 | 20.75 | .85  |
| 2.833 | .85  | 8.833  | 2.27  | 14.833 | 2.27 | 20.83 | .85  |
| 2.917 | .85  | 8.917  | 2.27  | 14.917 | 2.27 | 20.92 | .85  |
| 3.000 | .85  | 9.000  | 2.27  | 15.000 | 2.27 | 21.00 | .85  |
| 3.083 | 1.13 | 9.083  | 2.27  | 15.083 | 1.99 | 21.08 | .85  |
| 3.167 | 1.13 | 9.167  | 2.27  | 15.167 | 1.99 | 21.17 | .85  |
| 3.250 | 1.13 | 9.250  | 2.27  | 15.250 | 1.99 | 21.25 | .85  |
| 3.333 | .85  | 9.333  | 2.55  | 15.333 | 2.27 | 21.33 | .85  |
| 3.417 | .85  | 9.417  | 2.55  | 15.417 | 2.27 | 21.42 | .85  |
| 3.500 | .85  | 9.500  | 2.55  | 15.500 | 2.27 | 21.50 | .85  |
| 3.583 | .85  | 9.583  | 2.55  | 15.583 | 1.99 | 21.58 | .85  |
| 3.667 | .85  | 9.667  | 2.55  | 15.667 | 1.99 | 21.67 | .85  |
| 3.750 | .85  | 9.750  | 2.55  | 15.750 | 1.99 | 21.75 | .85  |
| 3.833 | 1.13 | 9.833  | 3.12  | 15.833 | 1.42 | 21.83 | .85  |
| 3.917 | 1.13 | 9.917  | 3.12  | 15.917 | 1.42 | 21.92 | .85  |
| 4.000 | 1.13 | 10.000 | 3.12  | 16.000 | 1.42 | 22.00 | .85  |
| 4.083 | 1.13 | 10.083 | 3.40  | 16.083 | 1.13 | 22.08 | .85  |
| 4.167 | 1.13 | 10.167 | 3.40  | 16.167 | 1.13 | 22.17 | .85  |
| 4.250 | 1.13 | 10.250 | 3.40  | 16.250 | 1.13 | 22.25 | .85  |
| 4.333 | 1.13 | 10.333 | 4.25  | 16.333 | 1.42 | 22.33 | .85  |
| 4.417 | 1.13 | 10.417 | 4.25  | 16.417 | 1.42 | 22.42 | .85  |
| 4.500 | 1.13 | 10.500 | 4.25  | 16.500 | 1.42 | 22.50 | .85  |
| 4.583 | 1.13 | 10.583 | 4.54  | 16.583 | 1.13 | 22.58 | .85  |
| 4.667 | 1.13 | 10.667 | 4.54  | 16.667 | 1.13 | 22.67 | .85  |
| 4.750 | 1.13 | 10.750 | 4.54  | 16.750 | 1.13 | 22.75 | .85  |
| 4.833 | 1.13 | 10.833 | 6.81  | 16.833 | 1.42 | 22.83 | .85  |
| 4.917 | 1.13 | 10.917 | 6.81  | 16.917 | 1.42 | 22.92 | .85  |
| 5.000 | 1.13 | 11.000 | 6.81  | 17.000 | 1.42 | 23.00 | .85  |
| 5.083 | 1.13 | 11.083 | 6.81  | 17.083 | 1.13 | 23.08 | .85  |
| 5.167 | 1.13 | 11.167 | 6.81  | 17.167 | 1.13 | 23.17 | .85  |
| 5.250 | 1.13 | 11.250 | 6.81  | 17.250 | 1.13 | 23.25 | .85  |
| 5.333 | 1.13 | 11.333 | 20.99 | 17.333 | 1.42 | 23.33 | .85  |
| 5.417 | 1.13 | 11.417 | 20.99 | 17.417 | 1.42 | 23.42 | .85  |
| 5.500 | 1.13 | 11.500 | 20.99 | 17.500 | 1.42 | 23.50 | .85  |
| 5.583 | 1.13 | 11.583 | 86.78 | 17.583 | 1.13 | 23.58 | .85  |
| 5.667 | 1.13 | 11.667 | 86.78 | 17.667 | 1.13 | 23.67 | .85  |
| 5.750 | 1.13 | 11.750 | 86.78 | 17.750 | 1.13 | 23.75 | .85  |
| 5.833 | 1.13 | 11.833 | 10.22 | 17.833 | 1.42 |       |      |
| 5.917 | 1.13 | 11.917 | 10.21 | 17.917 | 1.42 |       |      |
| 6.000 | 1.13 | 12.000 | 10.21 | 18.000 | 1.42 |       |      |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 86.78     | 82.91     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 2.09 (ii) | 9.70 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .31       | .11       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .05   | .11   | .161 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 69.69 | 41.27 | 46.10      |
| TOTAL RAINFALL (mm)= | 70.69 | 70.69 | 70.69      |
| RUNOFF COEFFICIENT = | .99   | .58   | .65        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

```

| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .239           | 11.75          | 48.14        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .048           | 12.42          | 47.45        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 20.12  
 TIME SHIFT OF PEAK FLOW (min) = 40.00  
 MAXIMUM STORAGE USED (ha.m.) = .0486

```

| ADD HYD (0903) |
| 1 + 2 = 3      |

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0204):   | .16          | .007           | 11.83          | 23.87        |
| + ID2= 2 (0205): | .45          | .017           | 12.00          | 23.93        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .024           | 12.00          | 23.91        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| RESERVOIR (0302) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .161           | 11.75          | 46.10        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .004           | 16.00          | 45.11        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.61  
 TIME SHIFT OF PEAK FLOW (min) = 255.00  
 MAXIMUM STORAGE USED (ha.m.) = .0364

```

| ADD HYD (0902) |
| 1 + 2 = 3      |

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0903):   | .61          | .024           | 12.00          | 23.91        |
| + ID2= 2 (0302): | 1.14         | .004           | 16.00          | 45.11        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .028           | 12.00          | 37.72        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ADD HYD (0901) |
| 1 + 2 = 3      |

```

|                | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|----------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0301): | 1.92         | .048           | 12.42          | 47.45        |

+ ID2= 2 (0902): 1.74 .028 12.00 37.72  
=====
ID = 3 (0901): 3.67 .069 12.25 42.83

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

\*\*\*\*\*
\*\* SIMULATION NUMBER: 4 \*\*
\*\*\*\*\*

-----
| MASS STORM | Filename: I:\2015 Projects\115
| | 185 - Monterra Phase 2 Natural Hazard Assessm
| | \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
| Ptotal= 82.00 mm | Comments: SCS Type II 24 HR MASS CURVE
-----

Duration of storm = 23.75 hrs
Mass curve time step = 15.00 min

| TIME | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|-------|--------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs   | mm/hr |
| .25  | .98   | 6.25  | 1.64   | 12.25 | 11.81 | 18.25 | 1.31  |
| .50  | .66   | 6.50  | 1.31   | 12.50 | 6.23  | 18.50 | 1.64  |
| .75  | .98   | 6.75  | 1.64   | 12.75 | 5.90  | 18.75 | 1.31  |
| 1.00 | .98   | 7.00  | 1.64   | 13.00 | 4.59  | 19.00 | 1.64  |
| 1.25 | .98   | 7.25  | 1.97   | 13.25 | 4.26  | 19.25 | 1.31  |
| 1.50 | .66   | 7.50  | 1.64   | 13.50 | 3.61  | 19.50 | 1.64  |
| 1.75 | .98   | 7.75  | 1.97   | 13.75 | 3.28  | 19.75 | 1.31  |
| 2.00 | .98   | 8.00  | 1.97   | 14.00 | 2.62  | 20.00 | .98   |
| 2.25 | 1.31  | 8.25  | 2.30   | 14.25 | 2.30  | 20.25 | .98   |
| 2.50 | .98   | 8.50  | 2.30   | 14.50 | 2.62  | 20.50 | .98   |
| 2.75 | .98   | 8.75  | 2.30   | 14.75 | 2.30  | 20.75 | .98   |
| 3.00 | .98   | 9.00  | 2.62   | 15.00 | 2.62  | 21.00 | .98   |
| 3.25 | 1.31  | 9.25  | 2.62   | 15.25 | 2.30  | 21.25 | .98   |
| 3.50 | .98   | 9.50  | 2.95   | 15.50 | 2.62  | 21.50 | .98   |
| 3.75 | .98   | 9.75  | 2.95   | 15.75 | 2.30  | 21.75 | .98   |
| 4.00 | 1.31  | 10.00 | 3.61   | 16.00 | 1.64  | 22.00 | .98   |
| 4.25 | 1.31  | 10.25 | 3.94   | 16.25 | 1.31  | 22.25 | .98   |
| 4.50 | 1.31  | 10.50 | 4.92   | 16.50 | 1.64  | 22.50 | .98   |
| 4.75 | 1.31  | 10.75 | 5.25   | 16.75 | 1.31  | 22.75 | .98   |
| 5.00 | 1.31  | 11.00 | 7.87   | 17.00 | 1.64  | 23.00 | .98   |
| 5.25 | 1.31  | 11.25 | 7.87   | 17.25 | 1.31  | 23.25 | .98   |
| 5.50 | 1.31  | 11.50 | 24.27  | 17.50 | 1.64  | 23.50 | .98   |
| 5.75 | 1.31  | 11.75 | 100.37 | 17.75 | 1.31  | 23.75 | .98   |
| 6.00 | 1.31  | 12.00 | 11.81  | 18.00 | 1.64  |       |       |

-----
| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
-----

|               | IMPERVIOUS | PERVIOUS (i) |
|---------------|------------|--------------|
| Surface Area  | (ha)= .11  | .39          |
| Dep. Storage  | (mm)= 1.00 | 4.30         |
| Average Slope | (%)= 1.00  | 2.00         |
| Length        | (m)= 30.00 | 40.00        |
| Mannings n    | = .013     | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|-------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .98   | 6.083 | 1.64  | 12.083 | 11.81 | 18.08 | 1.31  |
| .167  | .98   | 6.167 | 1.64  | 12.167 | 11.81 | 18.17 | 1.31  |
| .250  | .98   | 6.250 | 1.64  | 12.250 | 11.81 | 18.25 | 1.31  |
| .333  | .66   | 6.333 | 1.31  | 12.333 | 6.23  | 18.33 | 1.64  |
| .417  | .66   | 6.417 | 1.31  | 12.417 | 6.23  | 18.42 | 1.64  |
| .500  | .66   | 6.500 | 1.31  | 12.500 | 6.23  | 18.50 | 1.64  |
| .583  | .98   | 6.583 | 1.64  | 12.583 | 5.90  | 18.58 | 1.31  |
| .667  | .98   | 6.667 | 1.64  | 12.667 | 5.90  | 18.67 | 1.31  |
| .750  | .98   | 6.750 | 1.64  | 12.750 | 5.90  | 18.75 | 1.31  |
| .833  | .98   | 6.833 | 1.64  | 12.833 | 4.59  | 18.83 | 1.64  |
| .917  | .98   | 6.917 | 1.64  | 12.917 | 4.59  | 18.92 | 1.64  |
| 1.000 | .98   | 7.000 | 1.64  | 13.000 | 4.59  | 19.00 | 1.64  |
| 1.083 | .98   | 7.083 | 1.97  | 13.083 | 4.26  | 19.08 | 1.31  |
| 1.167 | .98   | 7.167 | 1.97  | 13.167 | 4.26  | 19.17 | 1.31  |
| 1.250 | .98   | 7.250 | 1.97  | 13.250 | 4.26  | 19.25 | 1.31  |
| 1.333 | .66   | 7.333 | 1.64  | 13.333 | 3.61  | 19.33 | 1.64  |
| 1.417 | .66   | 7.417 | 1.64  | 13.417 | 3.61  | 19.42 | 1.64  |
| 1.500 | .66   | 7.500 | 1.64  | 13.500 | 3.61  | 19.50 | 1.64  |
| 1.583 | .98   | 7.583 | 1.97  | 13.583 | 3.28  | 19.58 | 1.31  |

|       |      |        |        |        |      |       |      |
|-------|------|--------|--------|--------|------|-------|------|
| 1.667 | .98  | 7.667  | 1.97   | 13.667 | 3.28 | 19.67 | 1.31 |
| 1.750 | .98  | 7.750  | 1.97   | 13.750 | 3.28 | 19.75 | 1.31 |
| 1.833 | .98  | 7.833  | 1.97   | 13.833 | 2.62 | 19.83 | .98  |
| 1.917 | .98  | 7.917  | 1.97   | 13.917 | 2.62 | 19.92 | .98  |
| 2.000 | .98  | 8.000  | 1.97   | 14.000 | 2.62 | 20.00 | .98  |
| 2.083 | 1.31 | 8.083  | 2.30   | 14.083 | 2.30 | 20.08 | .98  |
| 2.167 | 1.31 | 8.167  | 2.30   | 14.167 | 2.30 | 20.17 | .98  |
| 2.250 | 1.31 | 8.250  | 2.30   | 14.250 | 2.30 | 20.25 | .98  |
| 2.333 | .98  | 8.333  | 2.30   | 14.333 | 2.62 | 20.33 | .98  |
| 2.417 | .98  | 8.417  | 2.30   | 14.417 | 2.62 | 20.42 | .98  |
| 2.500 | .98  | 8.500  | 2.30   | 14.500 | 2.62 | 20.50 | .98  |
| 2.583 | .98  | 8.583  | 2.30   | 14.583 | 2.30 | 20.58 | .98  |
| 2.667 | .98  | 8.667  | 2.30   | 14.667 | 2.30 | 20.67 | .98  |
| 2.750 | .98  | 8.750  | 2.30   | 14.750 | 2.30 | 20.75 | .98  |
| 2.833 | .98  | 8.833  | 2.62   | 14.833 | 2.62 | 20.83 | .98  |
| 2.917 | .98  | 8.917  | 2.62   | 14.917 | 2.62 | 20.92 | .98  |
| 3.000 | .98  | 9.000  | 2.62   | 15.000 | 2.62 | 21.00 | .98  |
| 3.083 | 1.31 | 9.083  | 2.62   | 15.083 | 2.30 | 21.08 | .98  |
| 3.167 | 1.31 | 9.167  | 2.62   | 15.167 | 2.30 | 21.17 | .98  |
| 3.250 | 1.31 | 9.250  | 2.62   | 15.250 | 2.30 | 21.25 | .98  |
| 3.333 | .98  | 9.333  | 2.95   | 15.333 | 2.62 | 21.33 | .98  |
| 3.417 | .98  | 9.417  | 2.95   | 15.417 | 2.62 | 21.42 | .98  |
| 3.500 | .98  | 9.500  | 2.95   | 15.500 | 2.62 | 21.50 | .98  |
| 3.583 | .98  | 9.583  | 2.95   | 15.583 | 2.30 | 21.58 | .98  |
| 3.667 | .98  | 9.667  | 2.95   | 15.667 | 2.30 | 21.67 | .98  |
| 3.750 | .98  | 9.750  | 2.95   | 15.750 | 2.30 | 21.75 | .98  |
| 3.833 | 1.31 | 9.833  | 3.61   | 15.833 | 1.64 | 21.83 | .98  |
| 3.917 | 1.31 | 9.917  | 3.61   | 15.917 | 1.64 | 21.92 | .98  |
| 4.000 | 1.31 | 10.000 | 3.61   | 16.000 | 1.64 | 22.00 | .98  |
| 4.083 | 1.31 | 10.083 | 3.94   | 16.083 | 1.31 | 22.08 | .98  |
| 4.167 | 1.31 | 10.167 | 3.94   | 16.167 | 1.31 | 22.17 | .98  |
| 4.250 | 1.31 | 10.250 | 3.94   | 16.250 | 1.31 | 22.25 | .98  |
| 4.333 | 1.31 | 10.333 | 4.92   | 16.333 | 1.64 | 22.33 | .98  |
| 4.417 | 1.31 | 10.417 | 4.92   | 16.417 | 1.64 | 22.42 | .98  |
| 4.500 | 1.31 | 10.500 | 4.92   | 16.500 | 1.64 | 22.50 | .98  |
| 4.583 | 1.31 | 10.583 | 5.25   | 16.583 | 1.31 | 22.58 | .98  |
| 4.667 | 1.31 | 10.667 | 5.25   | 16.667 | 1.31 | 22.67 | .98  |
| 4.750 | 1.31 | 10.750 | 5.25   | 16.750 | 1.31 | 22.75 | .98  |
| 4.833 | 1.31 | 10.833 | 7.87   | 16.833 | 1.64 | 22.83 | .98  |
| 4.917 | 1.31 | 10.917 | 7.87   | 16.917 | 1.64 | 22.92 | .98  |
| 5.000 | 1.31 | 11.000 | 7.87   | 17.000 | 1.64 | 23.00 | .98  |
| 5.083 | 1.31 | 11.083 | 7.87   | 17.083 | 1.31 | 23.08 | .98  |
| 5.167 | 1.31 | 11.167 | 7.87   | 17.167 | 1.31 | 23.17 | .98  |
| 5.250 | 1.31 | 11.250 | 7.87   | 17.250 | 1.31 | 23.25 | .98  |
| 5.333 | 1.31 | 11.333 | 24.27  | 17.333 | 1.64 | 23.33 | .98  |
| 5.417 | 1.31 | 11.417 | 24.27  | 17.417 | 1.64 | 23.42 | .98  |
| 5.500 | 1.31 | 11.500 | 24.27  | 17.500 | 1.64 | 23.50 | .98  |
| 5.583 | 1.31 | 11.583 | 100.36 | 17.583 | 1.31 | 23.58 | .98  |
| 5.667 | 1.31 | 11.667 | 100.37 | 17.667 | 1.31 | 23.67 | .98  |
| 5.750 | 1.31 | 11.750 | 100.37 | 17.750 | 1.31 | 23.75 | .98  |
| 5.833 | 1.31 | 11.833 | 11.82  | 17.833 | 1.64 |       |      |
| 5.917 | 1.31 | 11.917 | 11.81  | 17.917 | 1.64 |       |      |
| 6.000 | 1.31 | 12.000 | 11.81  | 18.000 | 1.64 |       |      |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 100.37    | 76.58     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.24 (ii) | 9.09 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .33       | .12       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .06   | .067 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 80.75 | 42.47 | 44.37      |
| TOTAL RAINFALL (mm)= | 81.75 | 81.75 | 81.75      |
| RUNOFF COEFFICIENT = | .99   | .52   | .54        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |  |
|-------------------|--|
| CALIB             |  |
| STANDHYD (0201)   |  |
| ID= 1 DT= 5.0 min |  |

|                |       |
|----------------|-------|
| Area (ha)=     | 1.92  |
| Total Imp(%)=  | 43.00 |
| Dir. Conn.(%)= | 18.00 |

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |

|                        |      |           |            |            |
|------------------------|------|-----------|------------|------------|
| Average Slope          | (%)= | 1.00      | 2.00       |            |
| Length                 | (m)= | 200.00    | 40.00      |            |
| Mannings n             | =    | .013      | .250       |            |
| Max.Eff.Inten.(mm/hr)= |      | 100.37    | 111.75     |            |
| over (min)             |      | 5.00      | 15.00      |            |
| Storage Coeff. (min)=  |      | 3.87 (ii) | 10.62 (ii) |            |
| Unit Hyd. Tpeak (min)= |      | 5.00      | 15.00      |            |
| Unit Hyd. peak (cms)=  |      | .25       | .09        |            |
|                        |      |           |            | *TOTALS*   |
| PEAK FLOW (cms)=       |      | .10       | .22        | .294 (iii) |
| TIME TO PEAK (hrs)=    |      | 11.75     | 11.83      | 11.75      |
| RUNOFF VOLUME (mm)=    |      | 80.75     | 53.16      | 58.13      |
| TOTAL RAINFALL (mm)=   |      | 81.75     | 81.75      | 81.75      |
| RUNOFF COEFFICIENT =   |      | .99       | .65        | .71        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
|-----|
| U.H. Tp(hrs)= .31
  
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
.167 .98 | 6.167 1.64 | 12.167 11.81 | 18.17 1.31
.333 .82 | 6.333 1.48 | 12.333 9.02 | 18.33 1.48
.500 .66 | 6.500 1.31 | 12.500 6.23 | 18.50 1.64
.667 .98 | 6.667 1.64 | 12.667 5.90 | 18.67 1.31
.833 .98 | 6.833 1.64 | 12.833 5.25 | 18.83 1.48
1.000 .98 | 7.000 1.64 | 13.000 4.59 | 19.00 1.64
1.167 .98 | 7.167 1.97 | 13.167 4.26 | 19.17 1.31
1.333 .82 | 7.333 1.80 | 13.333 3.94 | 19.33 1.48
1.500 .66 | 7.500 1.64 | 13.500 3.61 | 19.50 1.64
1.667 .98 | 7.667 1.97 | 13.667 3.28 | 19.67 1.31
1.833 .98 | 7.833 1.97 | 13.833 2.95 | 19.83 1.15
2.000 .98 | 8.000 1.97 | 14.000 2.62 | 20.00 .98
2.167 1.31 | 8.167 2.30 | 14.167 2.30 | 20.17 .98
2.333 1.15 | 8.333 2.30 | 14.333 2.46 | 20.33 .98
2.500 .98 | 8.500 2.30 | 14.500 2.62 | 20.50 .98
2.667 .98 | 8.667 2.30 | 14.667 2.30 | 20.67 .98
2.833 .98 | 8.833 2.46 | 14.833 2.46 | 20.83 .98
3.000 .98 | 9.000 2.62 | 15.000 2.62 | 21.00 .98
3.167 1.31 | 9.167 2.62 | 15.167 2.30 | 21.17 .98
3.333 1.15 | 9.333 2.79 | 15.333 2.46 | 21.33 .98
3.500 .98 | 9.500 2.95 | 15.500 2.62 | 21.50 .98
3.667 .98 | 9.667 2.95 | 15.667 2.30 | 21.67 .98
3.833 1.15 | 9.833 3.28 | 15.833 1.97 | 21.83 .98
4.000 1.31 | 10.000 3.61 | 16.000 1.64 | 22.00 .98
4.167 1.31 | 10.167 3.94 | 16.167 1.31 | 22.17 .98
4.333 1.31 | 10.333 4.43 | 16.333 1.48 | 22.33 .98
4.500 1.31 | 10.500 4.92 | 16.500 1.64 | 22.50 .98
4.667 1.31 | 10.667 5.25 | 16.667 1.31 | 22.67 .98
4.833 1.31 | 10.833 6.56 | 16.833 1.48 | 22.83 .98
5.000 1.31 | 11.000 7.87 | 17.000 1.64 | 23.00 .98
5.167 1.31 | 11.167 7.87 | 17.167 1.31 | 23.17 .98
5.333 1.31 | 11.333 16.07 | 17.333 1.48 | 23.33 .98
5.500 1.31 | 11.500 24.27 | 17.500 1.64 | 23.50 .98
5.667 1.31 | 11.667 100.37 | 17.667 1.31 | 23.67 .98
5.833 1.31 | 11.833 56.09 | 17.833 1.48 | 23.83 .49
6.000 1.31 | 12.000 11.81 | 18.000 1.64 |
  
```

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .009 (i)  
 TIME TO PEAK (hrs)= 11.833  
 RUNOFF VOLUME (mm)= 30.704  
 TOTAL RAINFALL (mm)= 81.754  
 RUNOFF COEFFICIENT = .376

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

```

-----
| CALIB |
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= .36

```

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .023 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 30.774  
 TOTAL RAINFALL (mm)= 81.754  
 RUNOFF COEFFICIENT = .376

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

```

-----
| CALIB |
| STANDHYD (0202) | Area (ha)= 1.14
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
-----

```

|               |       | IMPERVIOUS | PERVIOUS (i) |
|---------------|-------|------------|--------------|
| Surface Area  | (ha)= | .44        | .69          |
| Dep. Storage  | (mm)= | 1.00       | 3.80         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 65.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|--------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | .98   | 6.083  | 1.64  | 12.083 | 11.81 | 18.08 | 1.31  |
| .167  | .98   | 6.167  | 1.64  | 12.167 | 11.81 | 18.17 | 1.31  |
| .250  | .98   | 6.250  | 1.64  | 12.250 | 11.81 | 18.25 | 1.31  |
| .333  | .66   | 6.333  | 1.31  | 12.333 | 6.23  | 18.33 | 1.64  |
| .417  | .66   | 6.417  | 1.31  | 12.417 | 6.23  | 18.42 | 1.64  |
| .500  | .66   | 6.500  | 1.31  | 12.500 | 6.23  | 18.50 | 1.64  |
| .583  | .98   | 6.583  | 1.64  | 12.583 | 5.90  | 18.58 | 1.31  |
| .667  | .98   | 6.667  | 1.64  | 12.667 | 5.90  | 18.67 | 1.31  |
| .750  | .98   | 6.750  | 1.64  | 12.750 | 5.90  | 18.75 | 1.31  |
| .833  | .98   | 6.833  | 1.64  | 12.833 | 4.59  | 18.83 | 1.64  |
| .917  | .98   | 6.917  | 1.64  | 12.917 | 4.59  | 18.92 | 1.64  |
| 1.000 | .98   | 7.000  | 1.64  | 13.000 | 4.59  | 19.00 | 1.64  |
| 1.083 | .98   | 7.083  | 1.97  | 13.083 | 4.26  | 19.08 | 1.31  |
| 1.167 | .98   | 7.167  | 1.97  | 13.167 | 4.26  | 19.17 | 1.31  |
| 1.250 | .98   | 7.250  | 1.97  | 13.250 | 4.26  | 19.25 | 1.31  |
| 1.333 | .66   | 7.333  | 1.64  | 13.333 | 3.61  | 19.33 | 1.64  |
| 1.417 | .66   | 7.417  | 1.64  | 13.417 | 3.61  | 19.42 | 1.64  |
| 1.500 | .66   | 7.500  | 1.64  | 13.500 | 3.61  | 19.50 | 1.64  |
| 1.583 | .98   | 7.583  | 1.97  | 13.583 | 3.28  | 19.58 | 1.31  |
| 1.667 | .98   | 7.667  | 1.97  | 13.667 | 3.28  | 19.67 | 1.31  |
| 1.750 | .98   | 7.750  | 1.97  | 13.750 | 3.28  | 19.75 | 1.31  |
| 1.833 | .98   | 7.833  | 1.97  | 13.833 | 2.62  | 19.83 | .98   |
| 1.917 | .98   | 7.917  | 1.97  | 13.917 | 2.62  | 19.92 | .98   |
| 2.000 | .98   | 8.000  | 1.97  | 14.000 | 2.62  | 20.00 | .98   |
| 2.083 | 1.31  | 8.083  | 2.30  | 14.083 | 2.30  | 20.08 | .98   |
| 2.167 | 1.31  | 8.167  | 2.30  | 14.167 | 2.30  | 20.17 | .98   |
| 2.250 | 1.31  | 8.250  | 2.30  | 14.250 | 2.30  | 20.25 | .98   |
| 2.333 | .98   | 8.333  | 2.30  | 14.333 | 2.62  | 20.33 | .98   |
| 2.417 | .98   | 8.417  | 2.30  | 14.417 | 2.62  | 20.42 | .98   |
| 2.500 | .98   | 8.500  | 2.30  | 14.500 | 2.62  | 20.50 | .98   |
| 2.583 | .98   | 8.583  | 2.30  | 14.583 | 2.30  | 20.58 | .98   |
| 2.667 | .98   | 8.667  | 2.30  | 14.667 | 2.30  | 20.67 | .98   |
| 2.750 | .98   | 8.750  | 2.30  | 14.750 | 2.30  | 20.75 | .98   |
| 2.833 | .98   | 8.833  | 2.62  | 14.833 | 2.62  | 20.83 | .98   |
| 2.917 | .98   | 8.917  | 2.62  | 14.917 | 2.62  | 20.92 | .98   |
| 3.000 | .98   | 9.000  | 2.62  | 15.000 | 2.62  | 21.00 | .98   |
| 3.083 | 1.31  | 9.083  | 2.62  | 15.083 | 2.30  | 21.08 | .98   |
| 3.167 | 1.31  | 9.167  | 2.62  | 15.167 | 2.30  | 21.17 | .98   |
| 3.250 | 1.31  | 9.250  | 2.62  | 15.250 | 2.30  | 21.25 | .98   |
| 3.333 | .98   | 9.333  | 2.95  | 15.333 | 2.62  | 21.33 | .98   |
| 3.417 | .98   | 9.417  | 2.95  | 15.417 | 2.62  | 21.42 | .98   |
| 3.500 | .98   | 9.500  | 2.95  | 15.500 | 2.62  | 21.50 | .98   |
| 3.583 | .98   | 9.583  | 2.95  | 15.583 | 2.30  | 21.58 | .98   |
| 3.667 | .98   | 9.667  | 2.95  | 15.667 | 2.30  | 21.67 | .98   |
| 3.750 | .98   | 9.750  | 2.95  | 15.750 | 2.30  | 21.75 | .98   |
| 3.833 | 1.31  | 9.833  | 3.61  | 15.833 | 1.64  | 21.83 | .98   |
| 3.917 | 1.31  | 9.917  | 3.61  | 15.917 | 1.64  | 21.92 | .98   |
| 4.000 | 1.31  | 10.000 | 3.61  | 16.000 | 1.64  | 22.00 | .98   |



|       |      |        |        |        |      |       |     |
|-------|------|--------|--------|--------|------|-------|-----|
| 4.083 | 1.31 | 10.083 | 3.94   | 16.083 | 1.31 | 22.08 | .98 |
| 4.167 | 1.31 | 10.167 | 3.94   | 16.167 | 1.31 | 22.17 | .98 |
| 4.250 | 1.31 | 10.250 | 3.94   | 16.250 | 1.31 | 22.25 | .98 |
| 4.333 | 1.31 | 10.333 | 4.92   | 16.333 | 1.64 | 22.33 | .98 |
| 4.417 | 1.31 | 10.417 | 4.92   | 16.417 | 1.64 | 22.42 | .98 |
| 4.500 | 1.31 | 10.500 | 4.92   | 16.500 | 1.64 | 22.50 | .98 |
| 4.583 | 1.31 | 10.583 | 5.25   | 16.583 | 1.31 | 22.58 | .98 |
| 4.667 | 1.31 | 10.667 | 5.25   | 16.667 | 1.31 | 22.67 | .98 |
| 4.750 | 1.31 | 10.750 | 5.25   | 16.750 | 1.31 | 22.75 | .98 |
| 4.833 | 1.31 | 10.833 | 7.87   | 16.833 | 1.64 | 22.83 | .98 |
| 4.917 | 1.31 | 10.917 | 7.87   | 16.917 | 1.64 | 22.92 | .98 |
| 5.000 | 1.31 | 11.000 | 7.87   | 17.000 | 1.64 | 23.00 | .98 |
| 5.083 | 1.31 | 11.083 | 7.87   | 17.083 | 1.31 | 23.08 | .98 |
| 5.167 | 1.31 | 11.167 | 7.87   | 17.167 | 1.31 | 23.17 | .98 |
| 5.250 | 1.31 | 11.250 | 7.87   | 17.250 | 1.31 | 23.25 | .98 |
| 5.333 | 1.31 | 11.333 | 24.27  | 17.333 | 1.64 | 23.33 | .98 |
| 5.417 | 1.31 | 11.417 | 24.27  | 17.417 | 1.64 | 23.42 | .98 |
| 5.500 | 1.31 | 11.500 | 24.27  | 17.500 | 1.64 | 23.50 | .98 |
| 5.583 | 1.31 | 11.583 | 100.36 | 17.583 | 1.31 | 23.58 | .98 |
| 5.667 | 1.31 | 11.667 | 100.37 | 17.667 | 1.31 | 23.67 | .98 |
| 5.750 | 1.31 | 11.750 | 100.37 | 17.750 | 1.31 | 23.75 | .98 |
| 5.833 | 1.31 | 11.833 | 11.82  | 17.833 | 1.64 |       |     |
| 5.917 | 1.31 | 11.917 | 11.81  | 17.917 | 1.64 |       |     |
| 6.000 | 1.31 | 12.000 | 11.81  | 18.000 | 1.64 |       |     |

Max. Eff. Inten. (mm/hr) = 100.37 101.45  
over (min) 5.00 10.00  
Storage Coeff. (min) = 1.97 (ii) 8.99 (ii)  
Unit Hyd. Tpeak (min) = 5.00 10.00  
Unit Hyd. peak (cms) = .31 .12

\*TOTALS\*

PEAK FLOW (cms) = .05 .14 .199 (iii)  
TIME TO PEAK (hrs) = 11.75 11.75 11.75  
RUNOFF VOLUME (mm) = 80.75 50.79 55.88  
TOTAL RAINFALL (mm) = 81.75 81.75 81.75  
RUNOFF COEFFICIENT = .99 .62 .68

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
| RESERVOIR (0301) |  
| IN= 2---> OUT= 1 |  
| LT= 5.0 min |  
-----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .294           | 11.75          | 58.13        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .062           | 12.33          | 57.44        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 21.06  
TIME SHIFT OF PEAK FLOW (min) = 35.00  
MAXIMUM STORAGE USED (ha.m.) = .0570

-----  
| ADD HYD (0903) |  
| 1 + 2 = 3 |  
-----

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0204):   | .16          | .009           | 11.83          | 30.70        |
| + ID2= 2 (0205): | .45          | .023           | 12.00          | 30.77        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .031           | 12.00          | 30.76        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0302) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
-----

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .199           | 11.75          | 55.88        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .005           | 16.08          | 54.89        |

```

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.32
TIME SHIFT OF PEAK FLOW (min) = 260.00
MAXIMUM STORAGE USED (ha.m.) = .0450

```

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3      |
-----

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0903):   | .61          | .031           | 12.00          | 30.76        |
| + ID2= 2 (0302): | 1.14         | .005           | 16.08          | 54.89        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .035           | 12.00          | 46.48        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3      |
-----

```

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0301):   | 1.92         | .062           | 12.33          | 57.44        |
| + ID2= 2 (0902): | 1.74         | .035           | 12.00          | 46.48        |
| =====            |              |                |                |              |
| ID = 3 (0901):   | 3.67         | .094           | 12.08          | 52.23        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

```

-----
| MASS STORM      |
|                 |
|                 |
| Ptotal= 90.30 mm |
-----

```

```

Filename: I:\2015 Projects\115
185 - Monterra Phase 2 Natural Hazard Assessm
\Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
Comments: SCS Type II 24 HR MASS CURVE

```

```

Duration of storm = 23.75 hrs
Mass curve time step = 15.00 min

```

| TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr | TIME<br>hrs | RAIN<br>mm/hr |
|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| .25         | 1.08          | 6.25        | 1.81          | 12.25       | 13.00         | 18.25       | 1.44          |
| .50         | .72           | 6.50        | 1.44          | 12.50       | 6.86          | 18.50       | 1.81          |
| .75         | 1.08          | 6.75        | 1.81          | 12.75       | 6.50          | 18.75       | 1.44          |
| 1.00        | 1.08          | 7.00        | 1.81          | 13.00       | 5.06          | 19.00       | 1.81          |
| 1.25        | 1.08          | 7.25        | 2.17          | 13.25       | 4.70          | 19.25       | 1.44          |
| 1.50        | .72           | 7.50        | 1.81          | 13.50       | 3.97          | 19.50       | 1.81          |
| 1.75        | 1.08          | 7.75        | 2.17          | 13.75       | 3.61          | 19.75       | 1.44          |
| 2.00        | 1.08          | 8.00        | 2.17          | 14.00       | 2.89          | 20.00       | 1.08          |
| 2.25        | 1.44          | 8.25        | 2.53          | 14.25       | 2.53          | 20.25       | 1.08          |
| 2.50        | 1.08          | 8.50        | 2.53          | 14.50       | 2.89          | 20.50       | 1.08          |
| 2.75        | 1.08          | 8.75        | 2.53          | 14.75       | 2.53          | 20.75       | 1.08          |
| 3.00        | 1.08          | 9.00        | 2.89          | 15.00       | 2.89          | 21.00       | 1.08          |
| 3.25        | 1.44          | 9.25        | 2.89          | 15.25       | 2.53          | 21.25       | 1.08          |
| 3.50        | 1.08          | 9.50        | 3.25          | 15.50       | 2.89          | 21.50       | 1.08          |
| 3.75        | 1.08          | 9.75        | 3.25          | 15.75       | 2.53          | 21.75       | 1.08          |
| 4.00        | 1.44          | 10.00       | 3.97          | 16.00       | 1.81          | 22.00       | 1.08          |

|      |      |       |        |       |      |       |      |
|------|------|-------|--------|-------|------|-------|------|
| 4.25 | 1.44 | 10.25 | 4.33   | 16.25 | 1.44 | 22.25 | 1.08 |
| 4.50 | 1.44 | 10.50 | 5.42   | 16.50 | 1.81 | 22.50 | 1.08 |
| 4.75 | 1.44 | 10.75 | 5.78   | 16.75 | 1.44 | 22.75 | 1.08 |
| 5.00 | 1.44 | 11.00 | 8.67   | 17.00 | 1.81 | 23.00 | 1.08 |
| 5.25 | 1.44 | 11.25 | 8.67   | 17.25 | 1.44 | 23.25 | 1.08 |
| 5.50 | 1.44 | 11.50 | 26.73  | 17.50 | 1.81 | 23.50 | 1.08 |
| 5.75 | 1.44 | 11.75 | 110.53 | 17.75 | 1.44 | 23.75 | 1.08 |
| 6.00 | 1.44 | 12.00 | 13.00  | 18.00 | 1.81 |       |      |

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-----
| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
-----

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|               |       |            |              |
|---------------|-------|------------|--------------|
|               |       | IMPERVIOUS | PERVIOUS (i) |
| Surface Area  | (ha)= | .11        | .39          |
| Dep. Storage  | (mm)= | 1.00       | 4.30         |
| Average Slope | (%)=  | 1.00       | 2.00         |
| Length        | (m)=  | 30.00      | 40.00        |
| Mannings n    | =     | .013       | .250         |

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

```

----- TRANSFORMED HYETOGRAPH -----

```

| TIME  | RAIN  | TIME   | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|--------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs    | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | 1.08  | 6.083  | 1.81  | 12.083 | 13.00 | 18.08 | 1.44  |
| .167  | 1.08  | 6.167  | 1.81  | 12.167 | 13.00 | 18.17 | 1.44  |
| .250  | 1.08  | 6.250  | 1.81  | 12.250 | 13.00 | 18.25 | 1.44  |
| .333  | .72   | 6.333  | 1.44  | 12.333 | 6.86  | 18.33 | 1.81  |
| .417  | .72   | 6.417  | 1.44  | 12.417 | 6.86  | 18.42 | 1.81  |
| .500  | .72   | 6.500  | 1.44  | 12.500 | 6.86  | 18.50 | 1.81  |
| .583  | 1.08  | 6.583  | 1.81  | 12.583 | 6.50  | 18.58 | 1.44  |
| .667  | 1.08  | 6.667  | 1.81  | 12.667 | 6.50  | 18.67 | 1.44  |
| .750  | 1.08  | 6.750  | 1.81  | 12.750 | 6.50  | 18.75 | 1.44  |
| .833  | 1.08  | 6.833  | 1.81  | 12.833 | 5.06  | 18.83 | 1.81  |
| .917  | 1.08  | 6.917  | 1.81  | 12.917 | 5.06  | 18.92 | 1.81  |
| 1.000 | 1.08  | 7.000  | 1.81  | 13.000 | 5.06  | 19.00 | 1.81  |
| 1.083 | 1.08  | 7.083  | 2.17  | 13.083 | 4.70  | 19.08 | 1.44  |
| 1.167 | 1.08  | 7.167  | 2.17  | 13.167 | 4.70  | 19.17 | 1.44  |
| 1.250 | 1.08  | 7.250  | 2.17  | 13.250 | 4.70  | 19.25 | 1.44  |
| 1.333 | .72   | 7.333  | 1.81  | 13.333 | 3.97  | 19.33 | 1.81  |
| 1.417 | .72   | 7.417  | 1.81  | 13.417 | 3.97  | 19.42 | 1.81  |
| 1.500 | .72   | 7.500  | 1.81  | 13.500 | 3.97  | 19.50 | 1.81  |
| 1.583 | 1.08  | 7.583  | 2.17  | 13.583 | 3.61  | 19.58 | 1.44  |
| 1.667 | 1.08  | 7.667  | 2.17  | 13.667 | 3.61  | 19.67 | 1.44  |
| 1.750 | 1.08  | 7.750  | 2.17  | 13.750 | 3.61  | 19.75 | 1.44  |
| 1.833 | 1.08  | 7.833  | 2.17  | 13.833 | 2.89  | 19.83 | 1.08  |
| 1.917 | 1.08  | 7.917  | 2.17  | 13.917 | 2.89  | 19.92 | 1.08  |
| 2.000 | 1.08  | 8.000  | 2.17  | 14.000 | 2.89  | 20.00 | 1.08  |
| 2.083 | 1.44  | 8.083  | 2.53  | 14.083 | 2.53  | 20.08 | 1.08  |
| 2.167 | 1.44  | 8.167  | 2.53  | 14.167 | 2.53  | 20.17 | 1.08  |
| 2.250 | 1.44  | 8.250  | 2.53  | 14.250 | 2.53  | 20.25 | 1.08  |
| 2.333 | 1.08  | 8.333  | 2.53  | 14.333 | 2.89  | 20.33 | 1.08  |
| 2.417 | 1.08  | 8.417  | 2.53  | 14.417 | 2.89  | 20.42 | 1.08  |
| 2.500 | 1.08  | 8.500  | 2.53  | 14.500 | 2.89  | 20.50 | 1.08  |
| 2.583 | 1.08  | 8.583  | 2.53  | 14.583 | 2.53  | 20.58 | 1.08  |
| 2.667 | 1.08  | 8.667  | 2.53  | 14.667 | 2.53  | 20.67 | 1.08  |
| 2.750 | 1.08  | 8.750  | 2.53  | 14.750 | 2.53  | 20.75 | 1.08  |
| 2.833 | 1.08  | 8.833  | 2.89  | 14.833 | 2.89  | 20.83 | 1.08  |
| 2.917 | 1.08  | 8.917  | 2.89  | 14.917 | 2.89  | 20.92 | 1.08  |
| 3.000 | 1.08  | 9.000  | 2.89  | 15.000 | 2.89  | 21.00 | 1.08  |
| 3.083 | 1.44  | 9.083  | 2.89  | 15.083 | 2.53  | 21.08 | 1.08  |
| 3.167 | 1.44  | 9.167  | 2.89  | 15.167 | 2.53  | 21.17 | 1.08  |
| 3.250 | 1.44  | 9.250  | 2.89  | 15.250 | 2.53  | 21.25 | 1.08  |
| 3.333 | 1.08  | 9.333  | 3.25  | 15.333 | 2.89  | 21.33 | 1.08  |
| 3.417 | 1.08  | 9.417  | 3.25  | 15.417 | 2.89  | 21.42 | 1.08  |
| 3.500 | 1.08  | 9.500  | 3.25  | 15.500 | 2.89  | 21.50 | 1.08  |
| 3.583 | 1.08  | 9.583  | 3.25  | 15.583 | 2.53  | 21.58 | 1.08  |
| 3.667 | 1.08  | 9.667  | 3.25  | 15.667 | 2.53  | 21.67 | 1.08  |
| 3.750 | 1.08  | 9.750  | 3.25  | 15.750 | 2.53  | 21.75 | 1.08  |
| 3.833 | 1.44  | 9.833  | 3.97  | 15.833 | 1.81  | 21.83 | 1.08  |
| 3.917 | 1.44  | 9.917  | 3.97  | 15.917 | 1.81  | 21.92 | 1.08  |
| 4.000 | 1.44  | 10.000 | 3.97  | 16.000 | 1.81  | 22.00 | 1.08  |
| 4.083 | 1.44  | 10.083 | 4.33  | 16.083 | 1.44  | 22.08 | 1.08  |
| 4.167 | 1.44  | 10.167 | 4.33  | 16.167 | 1.44  | 22.17 | 1.08  |
| 4.250 | 1.44  | 10.250 | 4.33  | 16.250 | 1.44  | 22.25 | 1.08  |
| 4.333 | 1.44  | 10.333 | 5.42  | 16.333 | 1.81  | 22.33 | 1.08  |
| 4.417 | 1.44  | 10.417 | 5.42  | 16.417 | 1.81  | 22.42 | 1.08  |
| 4.500 | 1.44  | 10.500 | 5.42  | 16.500 | 1.81  | 22.50 | 1.08  |
| 4.583 | 1.44  | 10.583 | 5.78  | 16.583 | 1.44  | 22.58 | 1.08  |
| 4.667 | 1.44  | 10.667 | 5.78  | 16.667 | 1.44  | 22.67 | 1.08  |
| 4.750 | 1.44  | 10.750 | 5.78  | 16.750 | 1.44  | 22.75 | 1.08  |

|       |      |         |        |         |      |       |      |
|-------|------|---------|--------|---------|------|-------|------|
| 4.833 | 1.44 | 110.833 | 8.67   | 116.833 | 1.81 | 22.83 | 1.08 |
| 4.917 | 1.44 | 110.917 | 8.67   | 116.917 | 1.81 | 22.92 | 1.08 |
| 5.000 | 1.44 | 111.000 | 8.67   | 117.000 | 1.81 | 23.00 | 1.08 |
| 5.083 | 1.44 | 111.083 | 8.67   | 117.083 | 1.44 | 23.08 | 1.08 |
| 5.167 | 1.44 | 111.167 | 8.67   | 117.167 | 1.44 | 23.17 | 1.08 |
| 5.250 | 1.44 | 111.250 | 8.67   | 117.250 | 1.44 | 23.25 | 1.08 |
| 5.333 | 1.44 | 111.333 | 26.73  | 117.333 | 1.81 | 23.33 | 1.08 |
| 5.417 | 1.44 | 111.417 | 26.73  | 117.417 | 1.81 | 23.42 | 1.08 |
| 5.500 | 1.44 | 111.500 | 26.73  | 117.500 | 1.81 | 23.50 | 1.08 |
| 5.583 | 1.44 | 111.583 | 110.52 | 117.583 | 1.44 | 23.58 | 1.08 |
| 5.667 | 1.44 | 111.667 | 110.53 | 117.667 | 1.44 | 23.67 | 1.08 |
| 5.750 | 1.44 | 111.750 | 110.53 | 117.750 | 1.44 | 23.75 | 1.08 |
| 5.833 | 1.44 | 111.833 | 13.01  | 117.833 | 1.81 |       |      |
| 5.917 | 1.44 | 111.917 | 13.00  | 117.917 | 1.81 |       |      |
| 6.000 | 1.44 | 112.000 | 13.00  | 118.000 | 1.81 |       |      |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 110.53    | 88.35     |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.19 (ii) | 8.61 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .33       | .12       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .07   | .079 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 89.03 | 49.11 | 51.09      |
| TOTAL RAINFALL (mm)= | 90.03 | 90.03 | 90.03      |
| RUNOFF COEFFICIENT = | .99   | .55   | .57        |

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

\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |               |       |                      |
|-------------------|---------------|-------|----------------------|
| CALIB             |               |       |                      |
| STANDHYD (0201)   |               |       |                      |
| ID= 1 DT= 5.0 min | Area (ha)=    | 1.92  |                      |
|                   | Total Imp(%)= | 43.00 | Dir. Conn.(%)= 18.00 |

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .83        | 1.10         |
| Dep. Storage (mm)= | 1.00       | 3.70         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 200.00     | 40.00        |
| Mannings n =       | .013       | .250         |

|                        |           |            |
|------------------------|-----------|------------|
| Max.Eff.Inten.(mm/hr)= | 110.53    | 126.77     |
| over (min)             | 5.00      | 15.00      |
| Storage Coeff. (min)=  | 3.72 (ii) | 10.14 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 15.00      |
| Unit Hyd. peak (cms)=  | .25       | .10        |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .10   | .26   | .337 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.83 | 11.75      |
| RUNOFF VOLUME (mm)=  | 89.03 | 60.60 | 65.71      |
| TOTAL RAINFALL (mm)= | 90.03 | 90.03 | 90.03      |
| RUNOFF COEFFICIENT = | .99   | .67   | .73        |

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

\*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 82.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

|                   |               |      |                           |
|-------------------|---------------|------|---------------------------|
| CALIB             |               |      |                           |
| NASHYD (0204)     |               |      |                           |
| ID= 1 DT=10.0 min | Area (ha)=    | .16  | Curve Number (CN)= 69.0   |
|                   | Ia (mm)=      | 5.00 | # of Linear Res.(N)= 3.00 |
|                   | U.H. Tp(hrs)= | .31  |                           |

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

|      |      |      |      |      |      |
|------|------|------|------|------|------|
| TIME | RAIN | TIME | RAIN | TIME | RAIN |
|------|------|------|------|------|------|

| hrs   | mm/hr | hrs    | mm/hr  | hrs    | mm/hr | hrs   | mm/hr |
|-------|-------|--------|--------|--------|-------|-------|-------|
| .167  | 1.08  | 6.167  | 1.81   | 12.167 | 13.00 | 18.17 | 1.44  |
| .333  | .90   | 6.333  | 1.63   | 12.333 | 9.93  | 18.33 | 1.63  |
| .500  | .72   | 6.500  | 1.44   | 12.500 | 6.86  | 18.50 | 1.81  |
| .667  | 1.08  | 6.667  | 1.81   | 12.667 | 6.50  | 18.67 | 1.44  |
| .833  | 1.08  | 6.833  | 1.81   | 12.833 | 5.78  | 18.83 | 1.63  |
| 1.000 | 1.08  | 7.000  | 1.81   | 13.000 | 5.06  | 19.00 | 1.81  |
| 1.167 | 1.08  | 7.167  | 2.17   | 13.167 | 4.70  | 19.17 | 1.44  |
| 1.333 | .90   | 7.333  | 1.99   | 13.333 | 4.33  | 19.33 | 1.63  |
| 1.500 | .72   | 7.500  | 1.81   | 13.500 | 3.97  | 19.50 | 1.81  |
| 1.667 | 1.08  | 7.667  | 2.17   | 13.667 | 3.61  | 19.67 | 1.44  |
| 1.833 | 1.08  | 7.833  | 2.17   | 13.833 | 3.25  | 19.83 | 1.26  |
| 2.000 | 1.08  | 8.000  | 2.17   | 14.000 | 2.89  | 20.00 | 1.08  |
| 2.167 | 1.44  | 8.167  | 2.53   | 14.167 | 2.53  | 20.17 | 1.08  |
| 2.333 | 1.26  | 8.333  | 2.53   | 14.333 | 2.71  | 20.33 | 1.08  |
| 2.500 | 1.08  | 8.500  | 2.53   | 14.500 | 2.89  | 20.50 | 1.08  |
| 2.667 | 1.08  | 8.667  | 2.53   | 14.667 | 2.53  | 20.67 | 1.08  |
| 2.833 | 1.08  | 8.833  | 2.71   | 14.833 | 2.71  | 20.83 | 1.08  |
| 3.000 | 1.08  | 9.000  | 2.89   | 15.000 | 2.89  | 21.00 | 1.08  |
| 3.167 | 1.44  | 9.167  | 2.89   | 15.167 | 2.53  | 21.17 | 1.08  |
| 3.333 | 1.26  | 9.333  | 3.07   | 15.333 | 2.71  | 21.33 | 1.08  |
| 3.500 | 1.08  | 9.500  | 3.25   | 15.500 | 2.89  | 21.50 | 1.08  |
| 3.667 | 1.08  | 9.667  | 3.25   | 15.667 | 2.53  | 21.67 | 1.08  |
| 3.833 | 1.26  | 9.833  | 3.61   | 15.833 | 2.17  | 21.83 | 1.08  |
| 4.000 | 1.44  | 10.000 | 3.97   | 16.000 | 1.81  | 22.00 | 1.08  |
| 4.167 | 1.44  | 10.167 | 4.33   | 16.167 | 1.44  | 22.17 | 1.08  |
| 4.333 | 1.44  | 10.333 | 4.88   | 16.333 | 1.63  | 22.33 | 1.08  |
| 4.500 | 1.44  | 10.500 | 5.42   | 16.500 | 1.81  | 22.50 | 1.08  |
| 4.667 | 1.44  | 10.667 | 5.78   | 16.667 | 1.44  | 22.67 | 1.08  |
| 4.833 | 1.44  | 10.833 | 7.22   | 16.833 | 1.63  | 22.83 | 1.08  |
| 5.000 | 1.44  | 11.000 | 8.67   | 17.000 | 1.81  | 23.00 | 1.08  |
| 5.167 | 1.44  | 11.167 | 8.67   | 17.167 | 1.44  | 23.17 | 1.08  |
| 5.333 | 1.44  | 11.333 | 17.70  | 17.333 | 1.63  | 23.33 | 1.08  |
| 5.500 | 1.44  | 11.500 | 26.73  | 17.500 | 1.81  | 23.50 | 1.08  |
| 5.667 | 1.44  | 11.667 | 110.53 | 17.667 | 1.44  | 23.67 | 1.08  |
| 5.833 | 1.44  | 11.833 | 61.76  | 17.833 | 1.63  | 23.83 | .54   |
| 6.000 | 1.44  | 12.000 | 13.00  | 18.000 | 1.81  |       |       |

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .010 (i)  
 TIME TO PEAK (hrs)= 11.833  
 RUNOFF VOLUME (mm)= 36.116  
 TOTAL RAINFALL (mm)= 90.029  
 RUNOFF COEFFICIENT = .401

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

-----  
 | CALIB |  
 | NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0  
 | ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 -----  
 U.H. Tp(hrs)= .36

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .027 (i)  
 TIME TO PEAK (hrs)= 12.000  
 RUNOFF VOLUME (mm)= 36.198  
 TOTAL RAINFALL (mm)= 90.029  
 RUNOFF COEFFICIENT = .402

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

-----  
 | CALIB |  
 | STANDHYD (0202) | Area (ha)= 1.14  
 | ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00  
 -----  
 IMPERVIOUS PERVIOUS (i)  
 Surface Area (ha)= .44 .69  
 Dep. Storage (mm)= 1.00 3.80  
 Average Slope (%)= 1.00 2.00  
 Length (m)= 65.00 40.00  
 Mannings n = .013 .250

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

----- TRANSFORMED HYETOGRAPH -----  

| TIME | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|------|-------|-------|-------|--------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083 | 1.08  | 6.083 | 1.81  | 12.083 | 13.00 | 18.08 | 1.44  |

|       |      |        |        |        |       |       |      |
|-------|------|--------|--------|--------|-------|-------|------|
| .167  | 1.08 | 6.167  | 1.81   | 12.167 | 13.00 | 18.17 | 1.44 |
| .250  | 1.08 | 6.250  | 1.81   | 12.250 | 13.00 | 18.25 | 1.44 |
| .333  | .72  | 6.333  | 1.44   | 12.333 | 6.86  | 18.33 | 1.81 |
| .417  | .72  | 6.417  | 1.44   | 12.417 | 6.86  | 18.42 | 1.81 |
| .500  | .72  | 6.500  | 1.44   | 12.500 | 6.86  | 18.50 | 1.81 |
| .583  | 1.08 | 6.583  | 1.81   | 12.583 | 6.50  | 18.58 | 1.44 |
| .667  | 1.08 | 6.667  | 1.81   | 12.667 | 6.50  | 18.67 | 1.44 |
| .750  | 1.08 | 6.750  | 1.81   | 12.750 | 6.50  | 18.75 | 1.44 |
| .833  | 1.08 | 6.833  | 1.81   | 12.833 | 5.06  | 18.83 | 1.81 |
| .917  | 1.08 | 6.917  | 1.81   | 12.917 | 5.06  | 18.92 | 1.81 |
| 1.000 | 1.08 | 7.000  | 1.81   | 13.000 | 5.06  | 19.00 | 1.81 |
| 1.083 | 1.08 | 7.083  | 2.17   | 13.083 | 4.70  | 19.08 | 1.44 |
| 1.167 | 1.08 | 7.167  | 2.17   | 13.167 | 4.70  | 19.17 | 1.44 |
| 1.250 | 1.08 | 7.250  | 2.17   | 13.250 | 4.70  | 19.25 | 1.44 |
| 1.333 | .72  | 7.333  | 1.81   | 13.333 | 3.97  | 19.33 | 1.81 |
| 1.417 | .72  | 7.417  | 1.81   | 13.417 | 3.97  | 19.42 | 1.81 |
| 1.500 | .72  | 7.500  | 1.81   | 13.500 | 3.97  | 19.50 | 1.81 |
| 1.583 | 1.08 | 7.583  | 2.17   | 13.583 | 3.61  | 19.58 | 1.44 |
| 1.667 | 1.08 | 7.667  | 2.17   | 13.667 | 3.61  | 19.67 | 1.44 |
| 1.750 | 1.08 | 7.750  | 2.17   | 13.750 | 3.61  | 19.75 | 1.44 |
| 1.833 | 1.08 | 7.833  | 2.17   | 13.833 | 2.89  | 19.83 | 1.08 |
| 1.917 | 1.08 | 7.917  | 2.17   | 13.917 | 2.89  | 19.92 | 1.08 |
| 2.000 | 1.08 | 8.000  | 2.17   | 14.000 | 2.89  | 20.00 | 1.08 |
| 2.083 | 1.44 | 8.083  | 2.53   | 14.083 | 2.53  | 20.08 | 1.08 |
| 2.167 | 1.44 | 8.167  | 2.53   | 14.167 | 2.53  | 20.17 | 1.08 |
| 2.250 | 1.44 | 8.250  | 2.53   | 14.250 | 2.53  | 20.25 | 1.08 |
| 2.333 | 1.08 | 8.333  | 2.53   | 14.333 | 2.89  | 20.33 | 1.08 |
| 2.417 | 1.08 | 8.417  | 2.53   | 14.417 | 2.89  | 20.42 | 1.08 |
| 2.500 | 1.08 | 8.500  | 2.53   | 14.500 | 2.89  | 20.50 | 1.08 |
| 2.583 | 1.08 | 8.583  | 2.53   | 14.583 | 2.53  | 20.58 | 1.08 |
| 2.667 | 1.08 | 8.667  | 2.53   | 14.667 | 2.53  | 20.67 | 1.08 |
| 2.750 | 1.08 | 8.750  | 2.53   | 14.750 | 2.53  | 20.75 | 1.08 |
| 2.833 | 1.08 | 8.833  | 2.89   | 14.833 | 2.89  | 20.83 | 1.08 |
| 2.917 | 1.08 | 8.917  | 2.89   | 14.917 | 2.89  | 20.92 | 1.08 |
| 3.000 | 1.08 | 9.000  | 2.89   | 15.000 | 2.89  | 21.00 | 1.08 |
| 3.083 | 1.44 | 9.083  | 2.89   | 15.083 | 2.53  | 21.08 | 1.08 |
| 3.167 | 1.44 | 9.167  | 2.89   | 15.167 | 2.53  | 21.17 | 1.08 |
| 3.250 | 1.44 | 9.250  | 2.89   | 15.250 | 2.53  | 21.25 | 1.08 |
| 3.333 | 1.08 | 9.333  | 3.25   | 15.333 | 2.89  | 21.33 | 1.08 |
| 3.417 | 1.08 | 9.417  | 3.25   | 15.417 | 2.89  | 21.42 | 1.08 |
| 3.500 | 1.08 | 9.500  | 3.25   | 15.500 | 2.89  | 21.50 | 1.08 |
| 3.583 | 1.08 | 9.583  | 3.25   | 15.583 | 2.53  | 21.58 | 1.08 |
| 3.667 | 1.08 | 9.667  | 3.25   | 15.667 | 2.53  | 21.67 | 1.08 |
| 3.750 | 1.08 | 9.750  | 3.25   | 15.750 | 2.53  | 21.75 | 1.08 |
| 3.833 | 1.44 | 9.833  | 3.97   | 15.833 | 1.81  | 21.83 | 1.08 |
| 3.917 | 1.44 | 9.917  | 3.97   | 15.917 | 1.81  | 21.92 | 1.08 |
| 4.000 | 1.44 | 10.000 | 3.97   | 16.000 | 1.81  | 22.00 | 1.08 |
| 4.083 | 1.44 | 10.083 | 4.33   | 16.083 | 1.44  | 22.08 | 1.08 |
| 4.167 | 1.44 | 10.167 | 4.33   | 16.167 | 1.44  | 22.17 | 1.08 |
| 4.250 | 1.44 | 10.250 | 4.33   | 16.250 | 1.44  | 22.25 | 1.08 |
| 4.333 | 1.44 | 10.333 | 5.42   | 16.333 | 1.81  | 22.33 | 1.08 |
| 4.417 | 1.44 | 10.417 | 5.42   | 16.417 | 1.81  | 22.42 | 1.08 |
| 4.500 | 1.44 | 10.500 | 5.42   | 16.500 | 1.81  | 22.50 | 1.08 |
| 4.583 | 1.44 | 10.583 | 5.78   | 16.583 | 1.44  | 22.58 | 1.08 |
| 4.667 | 1.44 | 10.667 | 5.78   | 16.667 | 1.44  | 22.67 | 1.08 |
| 4.750 | 1.44 | 10.750 | 5.78   | 16.750 | 1.44  | 22.75 | 1.08 |
| 4.833 | 1.44 | 10.833 | 8.67   | 16.833 | 1.81  | 22.83 | 1.08 |
| 4.917 | 1.44 | 10.917 | 8.67   | 16.917 | 1.81  | 22.92 | 1.08 |
| 5.000 | 1.44 | 11.000 | 8.67   | 17.000 | 1.81  | 23.00 | 1.08 |
| 5.083 | 1.44 | 11.083 | 8.67   | 17.083 | 1.44  | 23.08 | 1.08 |
| 5.167 | 1.44 | 11.167 | 8.67   | 17.167 | 1.44  | 23.17 | 1.08 |
| 5.250 | 1.44 | 11.250 | 8.67   | 17.250 | 1.44  | 23.25 | 1.08 |
| 5.333 | 1.44 | 11.333 | 26.73  | 17.333 | 1.81  | 23.33 | 1.08 |
| 5.417 | 1.44 | 11.417 | 26.73  | 17.417 | 1.81  | 23.42 | 1.08 |
| 5.500 | 1.44 | 11.500 | 26.73  | 17.500 | 1.81  | 23.50 | 1.08 |
| 5.583 | 1.44 | 11.583 | 110.52 | 17.583 | 1.44  | 23.58 | 1.08 |
| 5.667 | 1.44 | 11.667 | 110.53 | 17.667 | 1.44  | 23.67 | 1.08 |
| 5.750 | 1.44 | 11.750 | 110.53 | 17.750 | 1.44  | 23.75 | 1.08 |
| 5.833 | 1.44 | 11.833 | 13.01  | 17.833 | 1.81  |       |      |
| 5.917 | 1.44 | 11.917 | 13.00  | 17.917 | 1.81  |       |      |
| 6.000 | 1.44 | 12.000 | 13.00  | 18.000 | 1.81  |       |      |

|                         |           |           |
|-------------------------|-----------|-----------|
| Max.Eff.Inten. (mm/hr)= | 110.53    | 115.50    |
| over (min)              | 5.00      | 10.00     |
| Storage Coeff. (min)=   | 1.90 (ii) | 8.56 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=   | .32       | .12       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .06   | .17   | .228 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 89.03 | 58.08 | 63.34      |
| TOTAL RAINFALL (mm)= | 90.03 | 90.03 | 90.03      |
| RUNOFF COEFFICIENT = | .99   | .65   | .70        |

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

\*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
| RESERVOIR (0301) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .337           | 11.75          | 65.71        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .065           | 12.33          | 65.03        |

PEAK FLOW REDUCTION [Qout/Qin] (%)= 19.41  
TIME SHIFT OF PEAK FLOW (min)= 35.00  
MAXIMUM STORAGE USED (ha.m.)= .0648

-----  
| ADD HYD (0903) |  
| 1 + 2 = 3 |  
-----

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0204):   | .16          | .010           | 11.83          | 36.12        |
| + ID2= 2 (0205): | .45          | .027           | 12.00          | 36.20        |
| =====            |              |                |                |              |
| ID = 3 (0903):   | .61          | .037           | 12.00          | 36.18        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----  
| RESERVOIR (0302) |  
| IN= 2---> OUT= 1 |  
| DT= 5.0 min |  
-----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .228           | 11.75          | 63.34        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .005           | 16.08          | 62.35        |

PEAK FLOW REDUCTION [Qout/Qin] (%)= 2.14  
TIME SHIFT OF PEAK FLOW (min)=260.00  
MAXIMUM STORAGE USED (ha.m.)= .0516

-----  
| ADD HYD (0902) |  
| 1 + 2 = 3 |  
-----

|                  | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|------------------|--------------|----------------|----------------|--------------|
| ID1= 1 (0903):   | .61          | .037           | 12.00          | 36.18        |
| + ID2= 2 (0302): | 1.14         | .005           | 16.08          | 62.35        |
| =====            |              |                |                |              |
| ID = 3 (0902):   | 1.74         | .041           | 12.00          | 53.22        |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
|-----|
| ID1= 1 (0301): | AREA   QPEAK   TPEAK   R.V.
|                  | (ha)   (cms)   (hrs)   (mm)
| + ID2= 2 (0902): | 1.92   .065   12.33   65.03
|                  | 1.74   .041   12.00   53.22
|-----|
| ID = 3 (0901): | 3.67   .104   12.00   59.42
|-----|
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```
-----
| MASS STORM | Filename: I:\2015 Projects\l15
|            | 185 - Monterra Phase 2 Natural Hazard Assessm
|            | \Design\Hydrology\l15185 vo2\STORMS\SCS24H.MS
| Ptotal= 98.50 mm | Comments: SCS Type II 24 HR MASS CURVE
|-----|
```

Duration of storm = 23.75 hrs  
Mass curve time step = 15.00 min

| TIME | RAIN  | TIME  | RAIN   | TIME  | RAIN  | TIME  | RAIN  |
|------|-------|-------|--------|-------|-------|-------|-------|
| hrs  | mm/hr | hrs   | mm/hr  | hrs   | mm/hr | hrs   | mm/hr |
| .25  | 1.18  | 6.25  | 1.97   | 12.25 | 14.18 | 18.25 | 1.58  |
| .50  | .79   | 6.50  | 1.58   | 12.50 | 7.49  | 18.50 | 1.97  |
| .75  | 1.18  | 6.75  | 1.97   | 12.75 | 7.09  | 18.75 | 1.58  |
| 1.00 | 1.18  | 7.00  | 1.97   | 13.00 | 5.52  | 19.00 | 1.97  |
| 1.25 | 1.18  | 7.25  | 2.36   | 13.25 | 5.12  | 19.25 | 1.58  |
| 1.50 | .79   | 7.50  | 1.97   | 13.50 | 4.33  | 19.50 | 1.97  |
| 1.75 | 1.18  | 7.75  | 2.36   | 13.75 | 3.94  | 19.75 | 1.58  |
| 2.00 | 1.18  | 8.00  | 2.36   | 14.00 | 3.15  | 20.00 | 1.18  |
| 2.25 | 1.58  | 8.25  | 2.76   | 14.25 | 2.76  | 20.25 | 1.18  |
| 2.50 | 1.18  | 8.50  | 2.76   | 14.50 | 3.15  | 20.50 | 1.18  |
| 2.75 | 1.18  | 8.75  | 2.76   | 14.75 | 2.76  | 20.75 | 1.18  |
| 3.00 | 1.18  | 9.00  | 3.15   | 15.00 | 3.15  | 21.00 | 1.18  |
| 3.25 | 1.58  | 9.25  | 3.15   | 15.25 | 2.76  | 21.25 | 1.18  |
| 3.50 | 1.18  | 9.50  | 3.55   | 15.50 | 3.15  | 21.50 | 1.18  |
| 3.75 | 1.18  | 9.75  | 3.55   | 15.75 | 2.76  | 21.75 | 1.18  |
| 4.00 | 1.58  | 10.00 | 4.33   | 16.00 | 1.97  | 22.00 | 1.18  |
| 4.25 | 1.58  | 10.25 | 4.73   | 16.25 | 1.58  | 22.25 | 1.18  |
| 4.50 | 1.58  | 10.50 | 5.91   | 16.50 | 1.97  | 22.50 | 1.18  |
| 4.75 | 1.58  | 10.75 | 6.30   | 16.75 | 1.58  | 22.75 | 1.18  |
| 5.00 | 1.58  | 11.00 | 9.46   | 17.00 | 1.97  | 23.00 | 1.18  |
| 5.25 | 1.58  | 11.25 | 9.46   | 17.25 | 1.58  | 23.25 | 1.18  |
| 5.50 | 1.58  | 11.50 | 29.16  | 17.50 | 1.97  | 23.50 | 1.18  |
| 5.75 | 1.58  | 11.75 | 120.56 | 17.75 | 1.58  | 23.75 | 1.18  |
| 6.00 | 1.58  | 12.00 | 14.18  | 18.00 | 1.97  |       |       |

```
-----
| CALIB |
| STANDHYD (0203) | Area (ha)= .50
| ID= 1 DT= 5.0 min | Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
|-----|
```

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .11        | .39          |
| Dep. Storage (mm)= | 1.00       | 4.30         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 30.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

```
----- TRANSFORMED HYETOGRAPH -----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs     mm/hr | hrs     mm/hr | hrs     mm/hr | hrs     mm/hr
.083    1.18 | 6.083   1.97 | 12.083  14.18 | 18.08   1.58
.167    1.18 | 6.167   1.97 | 12.167  14.18 | 18.17   1.58
.250    1.18 | 6.250   1.97 | 12.250  14.18 | 18.25   1.58
.333     .79 | 6.333   1.58 | 12.333  7.49  | 18.33   1.97
.417     .79 | 6.417   1.58 | 12.417  7.49  | 18.42   1.97
.500     .79 | 6.500   1.58 | 12.500  7.49  | 18.50   1.97
.583    1.18 | 6.583   1.97 | 12.583  7.09  | 18.58   1.58
.667    1.18 | 6.667   1.97 | 12.667  7.09  | 18.67   1.58
.750    1.18 | 6.750   1.97 | 12.750  7.09  | 18.75   1.58
.833    1.18 | 6.833   1.97 | 12.833  5.52  | 18.83   1.97
```



|       |      |        |        |        |      |       |      |
|-------|------|--------|--------|--------|------|-------|------|
| .917  | 1.18 | 6.917  | 1.97   | 12.917 | 5.52 | 18.92 | 1.97 |
| 1.000 | 1.18 | 7.000  | 1.97   | 13.000 | 5.52 | 19.00 | 1.97 |
| 1.083 | 1.18 | 7.083  | 2.36   | 13.083 | 5.12 | 19.08 | 1.58 |
| 1.167 | 1.18 | 7.167  | 2.36   | 13.167 | 5.12 | 19.17 | 1.58 |
| 1.250 | 1.18 | 7.250  | 2.36   | 13.250 | 5.12 | 19.25 | 1.58 |
| 1.333 | .79  | 7.333  | 1.97   | 13.333 | 4.33 | 19.33 | 1.97 |
| 1.417 | .79  | 7.417  | 1.97   | 13.417 | 4.33 | 19.42 | 1.97 |
| 1.500 | .79  | 7.500  | 1.97   | 13.500 | 4.33 | 19.50 | 1.97 |
| 1.583 | 1.18 | 7.583  | 2.36   | 13.583 | 3.94 | 19.58 | 1.58 |
| 1.667 | 1.18 | 7.667  | 2.36   | 13.667 | 3.94 | 19.67 | 1.58 |
| 1.750 | 1.18 | 7.750  | 2.36   | 13.750 | 3.94 | 19.75 | 1.58 |
| 1.833 | 1.18 | 7.833  | 2.36   | 13.833 | 3.15 | 19.83 | 1.18 |
| 1.917 | 1.18 | 7.917  | 2.36   | 13.917 | 3.15 | 19.92 | 1.18 |
| 2.000 | 1.18 | 8.000  | 2.36   | 14.000 | 3.15 | 20.00 | 1.18 |
| 2.083 | 1.58 | 8.083  | 2.76   | 14.083 | 2.76 | 20.08 | 1.18 |
| 2.167 | 1.58 | 8.167  | 2.76   | 14.167 | 2.76 | 20.17 | 1.18 |
| 2.250 | 1.58 | 8.250  | 2.76   | 14.250 | 2.76 | 20.25 | 1.18 |
| 2.333 | 1.18 | 8.333  | 2.76   | 14.333 | 3.15 | 20.33 | 1.18 |
| 2.417 | 1.18 | 8.417  | 2.76   | 14.417 | 3.15 | 20.42 | 1.18 |
| 2.500 | 1.18 | 8.500  | 2.76   | 14.500 | 3.15 | 20.50 | 1.18 |
| 2.583 | 1.18 | 8.583  | 2.76   | 14.583 | 2.76 | 20.58 | 1.18 |
| 2.667 | 1.18 | 8.667  | 2.76   | 14.667 | 2.76 | 20.67 | 1.18 |
| 2.750 | 1.18 | 8.750  | 2.76   | 14.750 | 2.76 | 20.75 | 1.18 |
| 2.833 | 1.18 | 8.833  | 3.15   | 14.833 | 3.15 | 20.83 | 1.18 |
| 2.917 | 1.18 | 8.917  | 3.15   | 14.917 | 3.15 | 20.92 | 1.18 |
| 3.000 | 1.18 | 9.000  | 3.15   | 15.000 | 3.15 | 21.00 | 1.18 |
| 3.083 | 1.58 | 9.083  | 3.15   | 15.083 | 2.76 | 21.08 | 1.18 |
| 3.167 | 1.58 | 9.167  | 3.15   | 15.167 | 2.76 | 21.17 | 1.18 |
| 3.250 | 1.58 | 9.250  | 3.15   | 15.250 | 2.76 | 21.25 | 1.18 |
| 3.333 | 1.18 | 9.333  | 3.55   | 15.333 | 3.15 | 21.33 | 1.18 |
| 3.417 | 1.18 | 9.417  | 3.55   | 15.417 | 3.15 | 21.42 | 1.18 |
| 3.500 | 1.18 | 9.500  | 3.55   | 15.500 | 3.15 | 21.50 | 1.18 |
| 3.583 | 1.18 | 9.583  | 3.55   | 15.583 | 2.76 | 21.58 | 1.18 |
| 3.667 | 1.18 | 9.667  | 3.55   | 15.667 | 2.76 | 21.67 | 1.18 |
| 3.750 | 1.18 | 9.750  | 3.55   | 15.750 | 2.76 | 21.75 | 1.18 |
| 3.833 | 1.58 | 9.833  | 4.33   | 15.833 | 1.97 | 21.83 | 1.18 |
| 3.917 | 1.58 | 9.917  | 4.33   | 15.917 | 1.97 | 21.92 | 1.18 |
| 4.000 | 1.58 | 10.000 | 4.33   | 16.000 | 1.97 | 22.00 | 1.18 |
| 4.083 | 1.58 | 10.083 | 4.73   | 16.083 | 1.58 | 22.08 | 1.18 |
| 4.167 | 1.58 | 10.167 | 4.73   | 16.167 | 1.58 | 22.17 | 1.18 |
| 4.250 | 1.58 | 10.250 | 4.73   | 16.250 | 1.58 | 22.25 | 1.18 |
| 4.333 | 1.58 | 10.333 | 5.91   | 16.333 | 1.97 | 22.33 | 1.18 |
| 4.417 | 1.58 | 10.417 | 5.91   | 16.417 | 1.97 | 22.42 | 1.18 |
| 4.500 | 1.58 | 10.500 | 5.91   | 16.500 | 1.97 | 22.50 | 1.18 |
| 4.583 | 1.58 | 10.583 | 6.30   | 16.583 | 1.58 | 22.58 | 1.18 |
| 4.667 | 1.58 | 10.667 | 6.30   | 16.667 | 1.58 | 22.67 | 1.18 |
| 4.750 | 1.58 | 10.750 | 6.30   | 16.750 | 1.58 | 22.75 | 1.18 |
| 4.833 | 1.58 | 10.833 | 9.46   | 16.833 | 1.97 | 22.83 | 1.18 |
| 4.917 | 1.58 | 10.917 | 9.46   | 16.917 | 1.97 | 22.92 | 1.18 |
| 5.000 | 1.58 | 11.000 | 9.46   | 17.000 | 1.97 | 23.00 | 1.18 |
| 5.083 | 1.58 | 11.083 | 9.46   | 17.083 | 1.58 | 23.08 | 1.18 |
| 5.167 | 1.58 | 11.167 | 9.46   | 17.167 | 1.58 | 23.17 | 1.18 |
| 5.250 | 1.58 | 11.250 | 9.46   | 17.250 | 1.58 | 23.25 | 1.18 |
| 5.333 | 1.58 | 11.333 | 29.15  | 17.333 | 1.97 | 23.33 | 1.18 |
| 5.417 | 1.58 | 11.417 | 29.16  | 17.417 | 1.97 | 23.42 | 1.18 |
| 5.500 | 1.58 | 11.500 | 29.16  | 17.500 | 1.97 | 23.50 | 1.18 |
| 5.583 | 1.58 | 11.583 | 120.56 | 17.583 | 1.58 | 23.58 | 1.18 |
| 5.667 | 1.58 | 11.667 | 120.56 | 17.667 | 1.58 | 23.67 | 1.18 |
| 5.750 | 1.58 | 11.750 | 120.56 | 17.750 | 1.58 | 23.75 | 1.18 |
| 5.833 | 1.58 | 11.833 | 14.20  | 17.833 | 1.97 |       |      |
| 5.917 | 1.58 | 11.917 | 14.18  | 17.917 | 1.97 |       |      |
| 6.000 | 1.58 | 12.000 | 14.18  | 18.000 | 1.97 |       |      |

|                        |           |           |
|------------------------|-----------|-----------|
| Max.Eff.Inten.(mm/hr)= | 120.56    | 100.20    |
| over (min)             | 5.00      | 10.00     |
| Storage Coeff. (min)=  | 1.15 (ii) | 8.20 (ii) |
| Unit Hyd. Tpeak (min)= | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=  | .34       | .13       |

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .01   | .08   | .091 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 97.20 | 55.83 | 57.89      |
| TOTAL RAINFALL (mm)= | 98.20 | 98.20 | 98.20      |
| RUNOFF COEFFICIENT = | .99   | .57   | .59        |

\*TOTALS\*

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:  
 CN\* = 76.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0201) | Area (ha)= 1.92
| ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
-----

```

|                        | IMPERVIOUS | PERVIOUS (i) |            |
|------------------------|------------|--------------|------------|
| Surface Area (ha)=     | .83        | 1.10         |            |
| Dep. Storage (mm)=     | 1.00       | 3.70         |            |
| Average Slope (%)=     | 1.00       | 2.00         |            |
| Length (m)=            | 200.00     | 40.00        |            |
| Mannings n =           | .013       | .250         |            |
| Max.Eff.Inten.(mm/hr)= | 120.56     | 141.70       |            |
| over (min)             | 5.00       | 10.00        |            |
| Storage Coeff. (min)=  | 3.59 (ii)  | 9.73 (ii)    |            |
| Unit Hyd. Tpeak (min)= | 5.00       | 10.00        |            |
| Unit Hyd. peak (cms)=  | .26        | .11          |            |
|                        |            |              | *TOTALS*   |
| PEAK FLOW (cms)=       | .11        | .32          | .430 (iii) |
| TIME TO PEAK (hrs)=    | 11.75      | 11.75        | 11.75      |
| RUNOFF VOLUME (mm)=    | 97.20      | 68.05        | 73.30      |
| TOTAL RAINFALL (mm)=   | 98.20      | 98.20        | 98.20      |
| RUNOFF COEFFICIENT =   | .99        | .69          | .75        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
 CN\* = 82.0 Ia = Dep. Storage (Above)  
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
 THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| NASHYD (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= .31
-----

```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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 |
| .167  | 1.18  | 6.167  | 1.97   | 12.167 | 14.18 | 18.17 | 1.58  |
| .333  | .98   | 6.333  | 1.77   | 12.333 | 10.83 | 18.33 | 1.77  |
| .500  | .79   | 6.500  | 1.58   | 12.500 | 7.49  | 18.50 | 1.97  |
| .667  | 1.18  | 6.667  | 1.97   | 12.667 | 7.09  | 18.67 | 1.58  |
| .833  | 1.18  | 6.833  | 1.97   | 12.833 | 6.30  | 18.83 | 1.77  |
| 1.000 | 1.18  | 7.000  | 1.97   | 13.000 | 5.52  | 19.00 | 1.97  |
| 1.167 | 1.18  | 7.167  | 2.36   | 13.167 | 5.12  | 19.17 | 1.58  |
| 1.333 | .98   | 7.333  | 2.17   | 13.333 | 4.73  | 19.33 | 1.77  |
| 1.500 | .79   | 7.500  | 1.97   | 13.500 | 4.33  | 19.50 | 1.97  |
| 1.667 | 1.18  | 7.667  | 2.36   | 13.667 | 3.94  | 19.67 | 1.58  |
| 1.833 | 1.18  | 7.833  | 2.36   | 13.833 | 3.55  | 19.83 | 1.38  |
| 2.000 | 1.18  | 8.000  | 2.36   | 14.000 | 3.15  | 20.00 | 1.18  |
| 2.167 | 1.58  | 8.167  | 2.76   | 14.167 | 2.76  | 20.17 | 1.18  |
| 2.333 | 1.38  | 8.333  | 2.76   | 14.333 | 2.96  | 20.33 | 1.18  |
| 2.500 | 1.18  | 8.500  | 2.76   | 14.500 | 3.15  | 20.50 | 1.18  |
| 2.667 | 1.18  | 8.667  | 2.76   | 14.667 | 2.76  | 20.67 | 1.18  |
| 2.833 | 1.18  | 8.833  | 2.95   | 14.833 | 2.96  | 20.83 | 1.18  |
| 3.000 | 1.18  | 9.000  | 3.15   | 15.000 | 3.15  | 21.00 | 1.18  |
| 3.167 | 1.58  | 9.167  | 3.15   | 15.167 | 2.76  | 21.17 | 1.18  |
| 3.333 | 1.38  | 9.333  | 3.35   | 15.333 | 2.96  | 21.33 | 1.18  |
| 3.500 | 1.18  | 9.500  | 3.55   | 15.500 | 3.15  | 21.50 | 1.18  |
| 3.667 | 1.18  | 9.667  | 3.55   | 15.667 | 2.76  | 21.67 | 1.18  |
| 3.833 | 1.38  | 9.833  | 3.94   | 15.833 | 2.36  | 21.83 | 1.18  |
| 4.000 | 1.58  | 10.000 | 4.33   | 16.000 | 1.97  | 22.00 | 1.18  |
| 4.167 | 1.58  | 10.167 | 4.73   | 16.167 | 1.58  | 22.17 | 1.18  |
| 4.333 | 1.58  | 10.333 | 5.32   | 16.333 | 1.77  | 22.33 | 1.18  |
| 4.500 | 1.58  | 10.500 | 5.91   | 16.500 | 1.97  | 22.50 | 1.18  |
| 4.667 | 1.58  | 10.667 | 6.30   | 16.667 | 1.58  | 22.67 | 1.18  |
| 4.833 | 1.58  | 10.833 | 7.88   | 16.833 | 1.77  | 22.83 | 1.18  |
| 5.000 | 1.58  | 11.000 | 9.46   | 17.000 | 1.97  | 23.00 | 1.18  |
| 5.167 | 1.58  | 11.167 | 9.46   | 17.167 | 1.58  | 23.17 | 1.18  |
| 5.333 | 1.58  | 11.333 | 19.31  | 17.333 | 1.77  | 23.33 | 1.18  |
| 5.500 | 1.58  | 11.500 | 29.16  | 17.500 | 1.97  | 23.50 | 1.18  |
| 5.667 | 1.58  | 11.667 | 120.56 | 17.667 | 1.58  | 23.67 | 1.18  |
| 5.833 | 1.58  | 11.833 | 67.37  | 17.833 | 1.77  | 23.83 | .59   |
| 6.000 | 1.58  | 12.000 | 14.18  | 18.000 | 1.97  |       |       |

Unit Hyd Qpeak (cms)= .020

PEAK FLOW (cms)= .012 (i)  
TIME TO PEAK (hrs)= 11.833  
RUNOFF VOLUME (mm)= 41.683  
TOTAL RAINFALL (mm)= 98.204  
RUNOFF COEFFICIENT = .424

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

-----  
| CALIB |  
| NASHYD (0205) | Area (ha)= .45 Curve Number (CN)= 69.0  
| ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00  
-----  
U.H. Tp(hrs)= .36

Unit Hyd Qpeak (cms)= .047

PEAK FLOW (cms)= .031 (i)  
TIME TO PEAK (hrs)= 12.000  
RUNOFF VOLUME (mm)= 41.780  
TOTAL RAINFALL (mm)= 98.204  
RUNOFF COEFFICIENT = .425

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

-----  
| CALIB |  
| STANDHYD (0202) | Area (ha)= 1.14  
| ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00  
-----

|                    | IMPERVIOUS | PERVIOUS (i) |
|--------------------|------------|--------------|
| Surface Area (ha)= | .44        | .69          |
| Dep. Storage (mm)= | 1.00       | 3.80         |
| Average Slope (%)= | 1.00       | 2.00         |
| Length (m)=        | 65.00      | 40.00        |
| Mannings n =       | .013       | .250         |

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

----- TRANSFORMED HYETOGRAPH -----

| TIME  | RAIN  | TIME  | RAIN  | TIME   | RAIN  | TIME  | RAIN  |
|-------|-------|-------|-------|--------|-------|-------|-------|
| hrs   | mm/hr | hrs   | mm/hr | hrs    | mm/hr | hrs   | mm/hr |
| .083  | 1.18  | 6.083 | 1.97  | 12.083 | 14.18 | 18.08 | 1.58  |
| .167  | 1.18  | 6.167 | 1.97  | 12.167 | 14.18 | 18.17 | 1.58  |
| .250  | 1.18  | 6.250 | 1.97  | 12.250 | 14.18 | 18.25 | 1.58  |
| .333  | .79   | 6.333 | 1.58  | 12.333 | 7.49  | 18.33 | 1.97  |
| .417  | .79   | 6.417 | 1.58  | 12.417 | 7.49  | 18.42 | 1.97  |
| .500  | .79   | 6.500 | 1.58  | 12.500 | 7.49  | 18.50 | 1.97  |
| .583  | 1.18  | 6.583 | 1.97  | 12.583 | 7.09  | 18.58 | 1.58  |
| .667  | 1.18  | 6.667 | 1.97  | 12.667 | 7.09  | 18.67 | 1.58  |
| .750  | 1.18  | 6.750 | 1.97  | 12.750 | 7.09  | 18.75 | 1.58  |
| .833  | 1.18  | 6.833 | 1.97  | 12.833 | 5.52  | 18.83 | 1.97  |
| .917  | 1.18  | 6.917 | 1.97  | 12.917 | 5.52  | 18.92 | 1.97  |
| 1.000 | 1.18  | 7.000 | 1.97  | 13.000 | 5.52  | 19.00 | 1.97  |
| 1.083 | 1.18  | 7.083 | 2.36  | 13.083 | 5.12  | 19.08 | 1.58  |
| 1.167 | 1.18  | 7.167 | 2.36  | 13.167 | 5.12  | 19.17 | 1.58  |
| 1.250 | 1.18  | 7.250 | 2.36  | 13.250 | 5.12  | 19.25 | 1.58  |
| 1.333 | .79   | 7.333 | 1.97  | 13.333 | 4.33  | 19.33 | 1.97  |
| 1.417 | .79   | 7.417 | 1.97  | 13.417 | 4.33  | 19.42 | 1.97  |
| 1.500 | .79   | 7.500 | 1.97  | 13.500 | 4.33  | 19.50 | 1.97  |
| 1.583 | 1.18  | 7.583 | 2.36  | 13.583 | 3.94  | 19.58 | 1.58  |
| 1.667 | 1.18  | 7.667 | 2.36  | 13.667 | 3.94  | 19.67 | 1.58  |
| 1.750 | 1.18  | 7.750 | 2.36  | 13.750 | 3.94  | 19.75 | 1.58  |
| 1.833 | 1.18  | 7.833 | 2.36  | 13.833 | 3.15  | 19.83 | 1.18  |
| 1.917 | 1.18  | 7.917 | 2.36  | 13.917 | 3.15  | 19.92 | 1.18  |
| 2.000 | 1.18  | 8.000 | 2.36  | 14.000 | 3.15  | 20.00 | 1.18  |
| 2.083 | 1.58  | 8.083 | 2.76  | 14.083 | 2.76  | 20.08 | 1.18  |
| 2.167 | 1.58  | 8.167 | 2.76  | 14.167 | 2.76  | 20.17 | 1.18  |
| 2.250 | 1.58  | 8.250 | 2.76  | 14.250 | 2.76  | 20.25 | 1.18  |
| 2.333 | 1.18  | 8.333 | 2.76  | 14.333 | 3.15  | 20.33 | 1.18  |
| 2.417 | 1.18  | 8.417 | 2.76  | 14.417 | 3.15  | 20.42 | 1.18  |
| 2.500 | 1.18  | 8.500 | 2.76  | 14.500 | 3.15  | 20.50 | 1.18  |
| 2.583 | 1.18  | 8.583 | 2.76  | 14.583 | 2.76  | 20.58 | 1.18  |
| 2.667 | 1.18  | 8.667 | 2.76  | 14.667 | 2.76  | 20.67 | 1.18  |
| 2.750 | 1.18  | 8.750 | 2.76  | 14.750 | 2.76  | 20.75 | 1.18  |
| 2.833 | 1.18  | 8.833 | 3.15  | 14.833 | 3.15  | 20.83 | 1.18  |
| 2.917 | 1.18  | 8.917 | 3.15  | 14.917 | 3.15  | 20.92 | 1.18  |
| 3.000 | 1.18  | 9.000 | 3.15  | 15.000 | 3.15  | 21.00 | 1.18  |
| 3.083 | 1.58  | 9.083 | 3.15  | 15.083 | 2.76  | 21.08 | 1.18  |
| 3.167 | 1.58  | 9.167 | 3.15  | 15.167 | 2.76  | 21.17 | 1.18  |
| 3.250 | 1.58  | 9.250 | 3.15  | 15.250 | 2.76  | 21.25 | 1.18  |

|       |      |  |        |        |  |        |      |  |       |      |
|-------|------|--|--------|--------|--|--------|------|--|-------|------|
| 3.333 | 1.18 |  | 9.333  | 3.55   |  | 15.333 | 3.15 |  | 21.33 | 1.18 |
| 3.417 | 1.18 |  | 9.417  | 3.55   |  | 15.417 | 3.15 |  | 21.42 | 1.18 |
| 3.500 | 1.18 |  | 9.500  | 3.55   |  | 15.500 | 3.15 |  | 21.50 | 1.18 |
| 3.583 | 1.18 |  | 9.583  | 3.55   |  | 15.583 | 2.76 |  | 21.58 | 1.18 |
| 3.667 | 1.18 |  | 9.667  | 3.55   |  | 15.667 | 2.76 |  | 21.67 | 1.18 |
| 3.750 | 1.18 |  | 9.750  | 3.55   |  | 15.750 | 2.76 |  | 21.75 | 1.18 |
| 3.833 | 1.58 |  | 9.833  | 4.33   |  | 15.833 | 1.97 |  | 21.83 | 1.18 |
| 3.917 | 1.58 |  | 9.917  | 4.33   |  | 15.917 | 1.97 |  | 21.92 | 1.18 |
| 4.000 | 1.58 |  | 10.000 | 4.33   |  | 16.000 | 1.97 |  | 22.00 | 1.18 |
| 4.083 | 1.58 |  | 10.083 | 4.73   |  | 16.083 | 1.58 |  | 22.08 | 1.18 |
| 4.167 | 1.58 |  | 10.167 | 4.73   |  | 16.167 | 1.58 |  | 22.17 | 1.18 |
| 4.250 | 1.58 |  | 10.250 | 4.73   |  | 16.250 | 1.58 |  | 22.25 | 1.18 |
| 4.333 | 1.58 |  | 10.333 | 5.91   |  | 16.333 | 1.97 |  | 22.33 | 1.18 |
| 4.417 | 1.58 |  | 10.417 | 5.91   |  | 16.417 | 1.97 |  | 22.42 | 1.18 |
| 4.500 | 1.58 |  | 10.500 | 5.91   |  | 16.500 | 1.97 |  | 22.50 | 1.18 |
| 4.583 | 1.58 |  | 10.583 | 6.30   |  | 16.583 | 1.58 |  | 22.58 | 1.18 |
| 4.667 | 1.58 |  | 10.667 | 6.30   |  | 16.667 | 1.58 |  | 22.67 | 1.18 |
| 4.750 | 1.58 |  | 10.750 | 6.30   |  | 16.750 | 1.58 |  | 22.75 | 1.18 |
| 4.833 | 1.58 |  | 10.833 | 9.46   |  | 16.833 | 1.97 |  | 22.83 | 1.18 |
| 4.917 | 1.58 |  | 10.917 | 9.46   |  | 16.917 | 1.97 |  | 22.92 | 1.18 |
| 5.000 | 1.58 |  | 11.000 | 9.46   |  | 17.000 | 1.97 |  | 23.00 | 1.18 |
| 5.083 | 1.58 |  | 11.083 | 9.46   |  | 17.083 | 1.58 |  | 23.08 | 1.18 |
| 5.167 | 1.58 |  | 11.167 | 9.46   |  | 17.167 | 1.58 |  | 23.17 | 1.18 |
| 5.250 | 1.58 |  | 11.250 | 9.46   |  | 17.250 | 1.58 |  | 23.25 | 1.18 |
| 5.333 | 1.58 |  | 11.333 | 29.15  |  | 17.333 | 1.97 |  | 23.33 | 1.18 |
| 5.417 | 1.58 |  | 11.417 | 29.16  |  | 17.417 | 1.97 |  | 23.42 | 1.18 |
| 5.500 | 1.58 |  | 11.500 | 29.16  |  | 17.500 | 1.97 |  | 23.50 | 1.18 |
| 5.583 | 1.58 |  | 11.583 | 120.56 |  | 17.583 | 1.58 |  | 23.58 | 1.18 |
| 5.667 | 1.58 |  | 11.667 | 120.56 |  | 17.667 | 1.58 |  | 23.67 | 1.18 |
| 5.750 | 1.58 |  | 11.750 | 120.56 |  | 17.750 | 1.58 |  | 23.75 | 1.18 |
| 5.833 | 1.58 |  | 11.833 | 14.20  |  | 17.833 | 1.97 |  |       |      |
| 5.917 | 1.58 |  | 11.917 | 14.18  |  | 17.917 | 1.97 |  |       |      |
| 6.000 | 1.58 |  | 12.000 | 14.18  |  | 18.000 | 1.97 |  |       |      |

|                         |           |           |
|-------------------------|-----------|-----------|
| Max.Eff.Inten. (mm/hr)= | 120.56    | 129.51    |
| over (min)              | 5.00      | 10.00     |
| Storage Coeff. (min)=   | 1.83 (ii) | 8.19 (ii) |
| Unit Hyd. Tpeak (min)=  | 5.00      | 10.00     |
| Unit Hyd. peak (cms)=   | .32       | .13       |

\*TOTALS\*

|                      |       |       |            |
|----------------------|-------|-------|------------|
| PEAK FLOW (cms)=     | .06   | .19   | .258 (iii) |
| TIME TO PEAK (hrs)=  | 11.75 | 11.75 | 11.75      |
| RUNOFF VOLUME (mm)=  | 97.20 | 65.40 | 70.80      |
| TOTAL RAINFALL (mm)= | 98.20 | 98.20 | 98.20      |
| RUNOFF COEFFICIENT = | .99   | .67   | .72        |

\*\*\*\*\* WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!  
 \*\*\*\*\* WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%  
 YOU SHOULD CONSIDER SPLITTING THE AREA.

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

-----  
 | RESERVOIR (0301) |  
 | IN= 2---> OUT= 1 |  
 | DT= 5.0 min |  
 -----

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0707            | .0775              |
| .0010            | .0052              | .1232            | .0859              |
| .0020            | .0108              | .2290            | .0944              |
| .0030            | .0233              | .3811            | .1031              |
| .0040            | .0302              | .5760            | .1120              |
| .0164            | .0376              | .8126            | .1210              |
| .0392            | .0453              | 1.0915           | .1301              |
| .0602            | .0531              | 1.4134           | .1394              |
| .0639            | .0611              | 1.7793           | .1488              |
| .0674            | .0692              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0201) | 1.925        | .430           | 11.75          | 73.30        |
| OUTFLOW: ID= 1 (0301) | 1.925        | .069           | 12.33          | 72.61        |

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.06  
 TIME SHIFT OF PEAK FLOW (min) = 35.00  
 MAXIMUM STORAGE USED (ha.m.) = .0733

-----

```

| ADD HYD (0903) |
| 1 + 2 = 3 |
-----
ID1= 1 (0204): .16 .012 11.83 41.68
+ ID2= 2 (0205): .45 .031 12.00 41.78
=====
ID = 3 (0903): .61 .043 12.00 41.75

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0302) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
-----

```

| OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) | OUTFLOW<br>(cms) | STORAGE<br>(ha.m.) |
|------------------|--------------------|------------------|--------------------|
| .0000            | .0000              | .0054            | .0654              |
| .0011            | .0049              | .0393            | .0739              |
| .0021            | .0102              | .1153            | .0828              |
| .0027            | .0158              | .2258            | .0921              |
| .0033            | .0218              | .3706            | .1017              |
| .0037            | .0281              | .5506            | .1117              |
| .0041            | .0349              | .7671            | .1220              |
| .0045            | .0420              | 1.0214           | .1327              |
| .0048            | .0494              | 1.3149           | .1438              |
| .0051            | .0572              | .0000            | .0000              |

|                       | AREA<br>(ha) | QPEAK<br>(cms) | TPEAK<br>(hrs) | R.V.<br>(mm) |
|-----------------------|--------------|----------------|----------------|--------------|
| INFLOW : ID= 2 (0202) | 1.136        | .258           | 11.75          | 70.80        |
| OUTFLOW: ID= 1 (0302) | 1.136        | .005           | 16.17          | 69.81        |

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.99  
 TIME SHIFT OF PEAK FLOW (min)=265.00  
 MAXIMUM STORAGE USED (ha.m.)= .0583

```

-----
| ADD HYD (0902) |
| 1 + 2 = 3 |
-----
ID1= 1 (0903): .61 .043 12.00 41.75
+ ID2= 2 (0302): 1.14 .005 16.17 69.81
=====
ID = 3 (0902): 1.74 .047 12.00 60.12

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0901) |
| 1 + 2 = 3 |
-----
ID1= 1 (0301): 1.92 .069 12.33 72.61
+ ID2= 2 (0902): 1.74 .047 12.00 60.12
=====
ID = 3 (0901): 3.67 .115 12.00 66.67

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

## **Appendix D:**

### **Stage-Storage-Discharge Tables**

**MONTERRA PHASE II - 115185**  
**NORTH WETLAND STAGE-STORAGE-DISCHARGE TABLE**

**Wet Cell**

Avg. Side Slope Varied

Bottom Elev.        187.30 m  
 Static Water        187.45 m  
 Stage                 0.05 m

| DICB   | Overflow |
|--------|----------|
| 0.60   | 3.00     |
| 187.70 | 188.00   |

|             | Orifice             | 450 mm              | DICB                | Weir                | Total               | Volume            |                   |
|-------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------|-------------------|
|             | 60mm                | Outlet Pipe         | 200 Outlet Pipe     | Overflow            |                     |                   |                   |
| Water Level | Discharge           | Discharge           | Discharge           | Discharge           | Discharge           | Live              | Total             |
| (m)         | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> ) | (m <sup>3</sup> ) |
|             |                     |                     |                     |                     |                     |                   |                   |
|             |                     |                     |                     |                     |                     |                   |                   |
|             |                     |                     |                     |                     |                     |                   |                   |
| 187.30      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.00              | 0.0               |
| 187.35      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.00              | 38.1              |
| 187.40      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.00              | 80.7              |
| 187.45      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.00              | 127.8             |
| 187.50      | 0.0011              | 0.0000              | 0.0000              | 0.0000              | 0.0011              | 51.52             | 179.3             |
| 187.55      | 0.0021              | 0.0000              | 0.0000              | 0.0000              | 0.0021              | 107.51            | 235.3             |
| 187.60      | 0.0027              | 0.0000              | 0.0000              | 0.0000              | 0.0027              | 167.95            | 295.8             |
| 187.65      | 0.0033              | 0.0000              | 0.0000              | 0.0000              | 0.0033              | 232.85            | 360.7             |
| 187.70      | 0.0037              | 0.0702              | 0.0000              | 0.0000              | 0.0037              | 302.21            | 430.0             |
| 187.75      | 0.0041              | 0.1215              | 0.0123              | 0.0000              | 0.0164              | 376.03            | 503.8             |
| 187.80      | 0.0045              | 0.1569              | 0.0347              | 0.0000              | 0.0392              | 452.81            | 580.6             |
| 187.85      | 0.0048              | 0.1857              | 0.0554              | 0.0000              | 0.0602              | 531.06            | 658.9             |
| 187.90      | 0.0051              | 0.2105              | 0.0588              | 0.0000              | 0.0639              | 610.77            | 738.6             |
| 187.95      | 0.0054              | 0.2327              | 0.0620              | 0.0000              | 0.0674              | 691.94            | 819.8             |
| 188.00      | 0.0057              | 0.2530              | 0.0650              | 0.0000              | 0.0707              | 774.58            | 902.4             |
| 188.05      | 0.0060              | 0.2718              | 0.0679              | 0.0493              | 0.1232              | 858.68            | 986.5             |
| 188.10      | 0.0062              | 0.2893              | 0.0707              | 0.1521              | 0.2290              | 944.24            | 1072.1            |
| 188.15      | 0.0065              | 0.3059              | 0.0733              | 0.3013              | 0.3811              | 1031.27           | 1159.1            |
| 188.20      | 0.0067              | 0.3216              | 0.0759              | 0.4934              | 0.5760              | 1119.77           | 1247.6            |
| 188.25      | 0.0069              | 0.3365              | 0.0784              | 0.7273              | 0.8126              | 1209.72           | 1337.5            |
| 188.30      | 0.0071              | 0.3509              | 0.0808              | 1.0035              | 1.0915              | 1301.14           | 1429.0            |
| 188.35      | 0.0074              | 0.3646              | 0.0832              | 1.3228              | 1.4134              | 1394.03           | 1521.8            |
| 188.40      | 0.0076              | 0.3779              | 0.0854              | 1.6862              | 1.7793              | 1488.38           | 1616.2            |

**MONTERRA PHASE II - 114185**  
**NORTH WETLAND VOLUME TABLE**

Side Slope            Varied  
 Bottom Elev.        187.30 m  
 Water Level         187.45 m  
 Stage                 0.05 m

| Elev.<br>(m) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Avg. Area<br>(m <sup>2</sup> ) | Volume                    |                                  |                           |                                  |                                   |                        |
|--------------|--------------|---------------------------|--------------------------------|---------------------------|----------------------------------|---------------------------|----------------------------------|-----------------------------------|------------------------|
|              |              |                           |                                | Dead<br>(m <sup>3</sup> ) | Accum. Dead<br>(m <sup>3</sup> ) | Live<br>(m <sup>3</sup> ) | Accum. Live<br>(m <sup>3</sup> ) | Accum. Total<br>(m <sup>3</sup> ) | Accum. Total<br>(ha-m) |
| 187.30       | 0.00         | <b>718.3</b>              | 718.30                         | 0.00                      | 0.00                             |                           |                                  |                                   |                        |
| 187.35       | 0.05         | 807.49                    | 762.89                         | 38.14                     | 38.14                            |                           |                                  | 38.14                             | 0.00                   |
| 187.40       | 0.10         | 896.68                    | 852.08                         | 42.60                     | 80.75                            |                           |                                  | 80.75                             | 0.01                   |
| 187.45       | 0.15         | 985.87                    | 941.27                         | 47.06                     | 127.81                           |                           |                                  | 127.81                            | 0.01                   |
| 187.50       | 0.20         | 1075.06                   | 1030.46                        |                           | 127.81                           | 51.52                     | 51.52                            | 179.34                            | 0.02                   |
| 187.55       | 0.25         | 1164.24                   | 1119.65                        |                           | 127.81                           | 55.98                     | 107.51                           | 235.32                            | 0.02                   |
| 187.60       | 0.30         | 1253.43                   | 1208.84                        |                           | 127.81                           | 60.44                     | 167.95                           | 295.76                            | 0.03                   |
| 187.65       | 0.35         | 1342.62                   | 1298.03                        |                           | 127.81                           | 64.90                     | 232.85                           | 360.66                            | 0.04                   |
| 187.70       | 0.40         | 1431.81                   | 1387.22                        |                           | 127.81                           | 69.36                     | 302.21                           | 430.02                            | 0.04                   |
| 187.75       | 0.45         | <b>1521.00</b>            | 1476.41                        |                           | 127.81                           | 73.82                     | 376.03                           | 503.84                            | 0.05                   |
| 187.80       | 0.50         | 1550.28                   | 1535.64                        |                           | 127.81                           | 76.78                     | 452.81                           | 580.62                            | 0.06                   |
| 187.85       | 0.55         | 1579.55                   | 1564.92                        |                           | 127.81                           | 78.25                     | 531.06                           | 658.87                            | 0.07                   |
| 187.90       | 0.60         | 1608.83                   | 1594.19                        |                           | 127.81                           | 79.71                     | 610.77                           | 738.58                            | 0.07                   |
| 187.95       | 0.65         | 1638.11                   | 1623.47                        |                           | 127.81                           | 81.17                     | 691.94                           | 819.75                            | 0.08                   |
| 188.00       | 0.70         | 1667.38                   | 1652.75                        |                           | 127.81                           | 82.64                     | 774.58                           | 902.39                            | 0.09                   |
| 188.05       | 0.75         | 1696.66                   | 1682.02                        |                           | 127.81                           | 84.10                     | 858.68                           | 986.49                            | 0.10                   |
| 188.10       | 0.80         | 1725.94                   | 1711.30                        |                           | 127.81                           | 85.56                     | 944.24                           | 1072.06                           | 0.11                   |
| 188.15       | 0.85         | 1755.22                   | 1740.58                        |                           | 127.81                           | 87.03                     | 1031.27                          | 1159.09                           | 0.12                   |
| 188.20       | 0.90         | 1784.49                   | 1769.85                        |                           | 127.81                           | 88.49                     | 1119.77                          | 1247.58                           | 0.12                   |
| 188.25       | 0.95         | 1813.77                   | 1799.13                        |                           | 127.81                           | 89.96                     | 1209.72                          | 1337.53                           | 0.13                   |
| 188.30       | 1.00         | 1843.05                   | 1828.41                        |                           | 127.81                           | 91.42                     | 1301.14                          | 1428.96                           | 0.14                   |
| 188.35       | 1.05         | 1872.32                   | 1857.68                        |                           | 127.81                           | 92.88                     | 1394.03                          | 1521.84                           | 0.15                   |
| 188.40       | 1.10         | <b>1901.60</b>            | 1886.96                        |                           | 127.81                           | 94.35                     | 1488.38                          | 1616.19                           | 0.16                   |



**MONTERRA PHASE II - 115185**  
**NORTH WETLAND DISCHARGE TABLE**

**INLET CONTROL For Outlet Pipe**

|               | Orifice 1 | Outlet Pipe | DICB Outlet Pipe |
|---------------|-----------|-------------|------------------|
| Diameter      | 60        | 450         | 200              |
| Area          | 0.002827  | 0.159043    | 0.031416         |
| Orifice Coef. | 0.63      | 0.63        | 0.63             |
| Invert        | 187.45    | 187.45      | 187.45           |

Orifice Equation  $Q = C \times A \times (2gH)^{0.5}$

where Q = flow rate (cms)

C = constant

A = area of opening(sq. m)

H = net head on the orifice

g = Acceleration due to gravity

**WEIR CONTROL**

|                                   | DICB   | Overflow |
|-----------------------------------|--------|----------|
|                                   | 0.6    | 3        |
|                                   | 187.70 | 188      |
| Weir constant K                   | 1.83   | Variable |
| Slope of weir opening sides (H:V) | -      | 4        |

Weir Equation

where  $Q = K \times L \times H^{1.5}$

Q = flow rate (cms)

K = constant

L = length (m)

H = head on the weir (m)

**CONTROL STRUCTURE CONFIGURATION**

| Water Level | Orifice Discharge |           | Pipe Capacity   |          | DICB Discharge |           | DICB Outlet     |           | Weir Discharge |           | Total Discharge |
|-------------|-------------------|-----------|-----------------|----------|----------------|-----------|-----------------|-----------|----------------|-----------|-----------------|
|             | 60                |           | 450 Outlet Pipe |          | DICB           |           | 200 Outlet Pipe |           | Overflow Weir  |           |                 |
|             | Head              | Discharge | Head            | Capacity | Head           | Discharge | Head            | Discharge | Head           | Discharge |                 |
| (m)         | (m)               | (cms)     | (m)             | (cms)    | (m)            | (cms)     | (m)             | (cms)     | (m)            | (cms)     | (cms)           |
|             |                   |           |                 |          |                |           |                 |           |                |           |                 |
| 187.45      | 0.00              | 0.0000    | 0.00            | 0.0000   | 0.00           | 0.0000    | 0.00            | 0.0000    | 0.0000         | 0.0000    | 0.0000          |
| 187.50      | 0.02              | 0.0011    | 0.00            | 0.0000   | 0.00           | 0.0000    | 0.05            | 0.0000    | 0.0000         | 0.0000    | 0.0011          |
| 187.55      | 0.07              | 0.0021    | 0.00            | 0.0000   | 0.00           | 0.0000    | 0.10            | 0.0000    | 0.0000         | 0.0000    | 0.0021          |
| 187.60      | 0.12              | 0.0027    | 0.00            | 0.0000   | 0.00           | 0.0000    | 0.15            | 0.0000    | 0.0000         | 0.0000    | 0.0027          |
| 187.65      | 0.17              | 0.0033    | 0.00            | 0.0000   | 0.00           | 0.0000    | 0.20            | 0.0000    | 0.0000         | 0.0000    | 0.0033          |
| 187.70      | 0.22              | 0.0037    | 0.03            | 0.0702   | 0.00           | 0.0000    | 0.25            | 0.0000    | 0.0000         | 0.0000    | 0.0037          |
| 187.75      | 0.27              | 0.0041    | 0.08            | 0.1215   | 0.05           | 0.0123    | 0.30            | 0.0123    | 0.0000         | 0.0000    | 0.0164          |
| 187.80      | 0.32              | 0.0045    | 0.13            | 0.1569   | 0.10           | 0.0347    | 0.35            | 0.0347    | 0.0000         | 0.0000    | 0.0392          |
| 187.85      | 0.37              | 0.0048    | 0.18            | 0.1857   | 0.15           | 0.0638    | 0.40            | 0.0554    | 0.0000         | 0.0000    | 0.0602          |
| 187.90      | 0.42              | 0.0051    | 0.23            | 0.2105   | 0.20           | 0.0982    | 0.45            | 0.0588    | 0.0000         | 0.0000    | 0.0639          |
| 187.95      | 0.47              | 0.0054    | 0.28            | 0.2327   | 0.25           | 0.1373    | 0.50            | 0.0620    | 0.0000         | 0.0000    | 0.0674          |
| 188.00      | 0.52              | 0.0057    | 0.33            | 0.2530   | 0.30           | 0.1804    | 0.55            | 0.0650    | 0.0000         | 0.0000    | 0.0707          |
| 188.05      | 0.57              | 0.0060    | 0.38            | 0.2718   | 0.35           | 0.2274    | 0.60            | 0.0679    | 0.0500         | 0.0493    | 0.1232          |
| 188.10      | 0.62              | 0.0062    | 0.43            | 0.2893   | 0.40           | 0.2778    | 0.65            | 0.0707    | 0.1000         | 0.1521    | 0.2290          |
| 188.15      | 0.67              | 0.0065    | 0.48            | 0.3059   | 0.45           | 0.3315    | 0.70            | 0.0733    | 0.1500         | 0.3013    | 0.3811          |
| 188.20      | 0.72              | 0.0067    | 0.53            | 0.3216   | 0.50           | 0.3882    | 0.75            | 0.0759    | 0.2000         | 0.4934    | 0.5760          |
| 188.25      | 0.77              | 0.0069    | 0.58            | 0.3365   | 0.55           | 0.4479    | 0.80            | 0.0784    | 0.2500         | 0.7273    | 0.8126          |
| 188.30      | 0.82              | 0.0071    | 0.63            | 0.3509   | 0.60           | 0.5103    | 0.85            | 0.0808    | 0.3000         | 1.0035    | 1.0915          |
| 188.35      | 0.87              | 0.0074    | 0.68            | 0.3646   | 0.65           | 0.5754    | 0.90            | 0.0832    | 0.3500         | 1.3228    | 1.4134          |
| 188.40      | 0.92              | 0.0076    | 0.73            | 0.3779   | 0.70           | 0.6431    | 0.95            | 0.0854    | 0.4000         | 1.6862    | 1.7793          |

**MONTERRA PHASE II - 115185**  
**EAST WETLAND STAGE-STORAGE-DISCHARGE TABLE**

**Wet Cell**

Avg. Side Slope Varied

|            | Outlet Pipe |
|------------|-------------|
| Dimensions | 450.00      |
| invert(m)  | 187.40      |

Bottom Elev.           187.25 m  
 Static Water           187.40 m  
 Stage                    0.05 m

|             | Orifice             | 450 mm              | Weir                | Total               | Volume            |                   |
|-------------|---------------------|---------------------|---------------------|---------------------|-------------------|-------------------|
|             | 60mm                | Outlet Pipe         | Overflow            |                     |                   |                   |
| Water Level | Discharge           | Discharge           | Discharge           | Discharge           | Dead              | Total             |
| (m)         | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> /s) | (m <sup>3</sup> ) | (m <sup>3</sup> ) |
|             |                     |                     |                     |                     |                   |                   |
|             |                     |                     |                     |                     |                   |                   |
|             |                     |                     |                     |                     |                   |                   |
| 187.25      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.00              | 0.0               |
| 187.30      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 38.15             | 38.2              |
| 187.35      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 79.94             | 79.9              |
| 187.40      | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 125.35            | 125.4             |
| 187.45      | 0.0011              | 0.0000              | 0.0000              | 0.0011              | 125.35            | 174.4             |
| 187.50      | 0.0021              | 0.0000              | 0.0000              | 0.0021              | 125.35            | 227.1             |
| 187.55      | 0.0027              | 0.0000              | 0.0000              | 0.0027              | 125.35            | 283.4             |
| 187.60      | 0.0033              | 0.0000              | 0.0000              | 0.0033              | 125.35            | 343.3             |
| 187.65      | 0.0037              | 0.0702              | 0.0000              | 0.0037              | 125.35            | 406.8             |
| 187.70      | 0.0041              | 0.1215              | 0.0000              | 0.0041              | 125.35            | 474.0             |
| 187.75      | 0.0045              | 0.1569              | 0.0000              | 0.0045              | 125.35            | 544.9             |
| 187.80      | 0.0048              | 0.1857              | 0.0000              | 0.0048              | 125.35            | 619.3             |
| 187.85      | 0.0051              | 0.2105              | 0.0000              | 0.0051              | 125.35            | 697.4             |
| 187.90      | 0.0054              | 0.2327              | 0.0000              | 0.0054              | 125.35            | 779.1             |
| 187.95      | 0.0057              | 0.2530              | 0.0339              | 0.0396              | 125.35            | 864.4             |
| 188.00      | 0.0060              | 0.2718              | 0.1093              | 0.1153              | 125.35            | 953.4             |
| 188.05      | 0.0062              | 0.2893              | 0.2196              | 0.2258              | 125.35            | 1046.0            |
| 188.10      | 0.0065              | 0.3059              | 0.3642              | 0.3706              | 125.35            | 1142.2            |
| 188.15      | 0.0067              | 0.3216              | 0.5440              | 0.5506              | 125.35            | 1242.0            |
| 188.20      | 0.0069              | 0.3365              | 0.7602              | 0.7671              | 125.35            | 1345.5            |
| 188.25      | 0.0071              | 0.3509              | 1.0142              | 1.0214              | 125.35            | 1452.6            |
| 188.30      | 0.0074              | 0.3646              | 1.3075              | 1.3149              | 125.35            | 1563.3            |

**MONTERRA PHASE II - 115185**  
**EAST WETLAND VOLUME TABLE**

Wet Cell

Side Slope            Varied  
 Bottom Elev.        187.25 m  
 Water Level         187.40 m  
 Stage                 0.05 m

| Elev.<br>(m) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Avg. Area<br>(m <sup>2</sup> ) | Volume                    |                                  |                           |                                  |                                   |                        |
|--------------|--------------|---------------------------|--------------------------------|---------------------------|----------------------------------|---------------------------|----------------------------------|-----------------------------------|------------------------|
|              |              |                           |                                | Dead<br>(m <sup>3</sup> ) | Accum. Dead<br>(m <sup>3</sup> ) | Live<br>(m <sup>3</sup> ) | Accum. Live<br>(m <sup>3</sup> ) | Accum. Total<br>(m <sup>3</sup> ) | Accum. Total<br>(ha-m) |
| 187.25       | 0.00         | <b>726.8</b>              | 726.80                         | 0.00                      | 0.00                             |                           |                                  |                                   |                        |
| 187.30       | 0.05         | 799.38                    | 763.09                         | 38.15                     | 38.15                            |                           |                                  | 38.15                             | 0.00                   |
| 187.35       | 0.10         | 871.96                    | 835.67                         | 41.78                     | 79.94                            |                           |                                  | 79.94                             | 0.01                   |
| 187.40       | 0.15         | 944.54                    | 908.25                         | 45.41                     | 125.35                           |                           |                                  | 125.35                            | 0.01                   |
| 187.45       | 0.20         | 1017.12                   | 980.83                         |                           | 125.35                           | 49.04                     | 49.04                            | 174.39                            | 0.02                   |
| 187.50       | 0.25         | 1089.70                   | 1053.41                        |                           | 125.35                           | 52.67                     | 101.71                           | 227.06                            | 0.02                   |
| 187.55       | 0.30         | 1162.29                   | 1126.00                        |                           | 125.35                           | 56.30                     | 158.01                           | 283.36                            | 0.03                   |
| 187.60       | 0.35         | 1234.87                   | 1198.58                        |                           | 125.35                           | 59.93                     | 217.94                           | 343.29                            | 0.03                   |
| 187.65       | 0.40         | 1307.45                   | 1271.16                        |                           | 125.35                           | 63.56                     | 281.50                           | 406.85                            | 0.04                   |
| 187.70       | 0.45         | 1380.03                   | 1343.74                        |                           | 125.35                           | 67.19                     | 348.69                           | 474.04                            | 0.05                   |
| 187.75       | 0.50         | 1452.61                   | 1416.32                        |                           | 125.35                           | 70.82                     | 419.50                           | 544.85                            | 0.05                   |
| 187.80       | 0.55         | 1525.19                   | 1488.90                        |                           | 125.35                           | 74.45                     | 493.95                           | 619.30                            | 0.06                   |
| 187.85       | 0.60         | 1597.77                   | 1561.48                        |                           | 125.35                           | 78.07                     | 572.02                           | 697.37                            | 0.07                   |
| 187.90       | 0.65         | 1670.35                   | 1634.06                        |                           | 125.35                           | 81.70                     | 653.72                           | 779.07                            | 0.08                   |
| 187.95       | 0.70         | 1742.93                   | 1706.64                        |                           | 125.35                           | 85.33                     | 739.06                           | 864.41                            | 0.09                   |
| 188.00       | 0.75         | 1815.51                   | 1779.22                        |                           | 125.35                           | 88.96                     | 828.02                           | 953.37                            | 0.10                   |
| 188.05       | 0.80         | 1888.10                   | 1851.80                        |                           | 125.35                           | 92.59                     | 920.61                           | 1045.96                           | 0.10                   |
| 188.10       | 0.85         | 1960.68                   | 1924.39                        |                           | 125.35                           | 96.22                     | 1016.83                          | 1142.18                           | 0.11                   |
| 188.15       | 0.90         | 2033.26                   | 1996.97                        |                           | 125.35                           | 99.85                     | 1116.68                          | 1242.03                           | 0.12                   |
| 188.20       | 0.95         | 2105.84                   | 2069.55                        |                           | 125.35                           | 103.48                    | 1220.15                          | 1345.50                           | 0.13                   |
| 188.25       | 1.00         | 2178.42                   | 2142.13                        |                           | 125.35                           | 107.11                    | 1327.26                          | 1452.61                           | 0.15                   |
| 188.30       | 1.05         | <b>2251.00</b>            | 2214.71                        |                           | 125.35                           | 110.74                    | 1437.99                          | 1563.35                           | 0.16                   |

**MONTERRA PHASE II - 115185**  
**EAST WETLAND DISCHARGE TABLE**

INLET CONTROL For Outlet Pipe

|                  |                                     |             |
|------------------|-------------------------------------|-------------|
|                  | Orifice 1                           | Outlet Pipe |
| Diameter         | 60                                  | 450         |
| Area             | 0.002827                            | 0.159043    |
| Orifice Coef.    | 0.63                                | 0.63        |
| Invert           | 187.40                              | 187.40      |
| Orifice Equation | $Q = C \times A \times (2gH)^{0.5}$ |             |

where Q = flow rate (cms)

C = constant

A = area of opening(sq. m)

H = net head on the orifice

g = Acceleration due to gravity

|                                   |
|-----------------------------------|
| Length of Weir (m)                |
| Weir Sill (m)                     |
| Weir constant K                   |
| Slope of weir opening sides (H:V) |
| Weir Equation                     |

WEIR CONTROL

|          |
|----------|
| Overflow |
| 2        |
| 187.9    |
| Variable |
| 4        |

where  $Q = K \times L \times H^{1.5}$

Q = flow rate (cms)

K = constant

L = length (m)

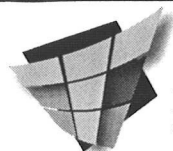
H = head on the weir (m)

CONTROL STRUCTURE CONFIGURATION

| Water Level | Orifice Discharge |           | Pipe Capacity   |          | Weir Discharge |           | Total Discharge |
|-------------|-------------------|-----------|-----------------|----------|----------------|-----------|-----------------|
|             | 60                |           | 450 Outlet Pipe |          | Overflow Weir  |           |                 |
|             | Head              | Discharge | Head            | Capacity | Head           | Discharge |                 |
| (m)         | (m)               | (cms)     | (m)             | (cms)    | (m)            | (cms)     | (cms)           |
|             |                   |           |                 |          |                |           |                 |
| 187.40      | 0.00              | 0.0000    | 0.00            | 0.0000   | 0.0000         | 0.0000    | 0.0000          |
| 187.45      | 0.02              | 0.0011    | 0.00            | 0.0000   | 0.0000         | 0.0000    | 0.0011          |
| 187.50      | 0.07              | 0.0021    | 0.00            | 0.0000   | 0.0000         | 0.0000    | 0.0021          |
| 187.55      | 0.12              | 0.0027    | 0.00            | 0.0000   | 0.0000         | 0.0000    | 0.0027          |
| 187.60      | 0.17              | 0.0033    | 0.00            | 0.0000   | 0.0000         | 0.0000    | 0.0033          |
| 187.65      | 0.22              | 0.0037    | 0.03            | 0.0702   | 0.0000         | 0.0000    | 0.0037          |
| 187.70      | 0.27              | 0.0041    | 0.07            | 0.1215   | 0.0000         | 0.0000    | 0.0041          |
| 187.75      | 0.32              | 0.0045    | 0.12            | 0.1569   | 0.0000         | 0.0000    | 0.0045          |
| 187.80      | 0.37              | 0.0048    | 0.18            | 0.1857   | 0.0000         | 0.0000    | 0.0048          |
| 187.85      | 0.42              | 0.0051    | 0.22            | 0.2105   | 0.0000         | 0.0000    | 0.0051          |
| 187.90      | 0.47              | 0.0054    | 0.28            | 0.2327   | 0.0000         | 0.0000    | 0.0054          |
| 187.95      | 0.52              | 0.0057    | 0.32            | 0.2530   | 0.0500         | 0.0339    | 0.0396          |
| 188.00      | 0.57              | 0.0060    | 0.37            | 0.2718   | 0.1000         | 0.1093    | 0.1153          |
| 188.05      | 0.62              | 0.0062    | 0.43            | 0.2893   | 0.1500         | 0.2196    | 0.2258          |
| 188.10      | 0.67              | 0.0065    | 0.47            | 0.3059   | 0.2000         | 0.3642    | 0.3706          |
| 188.15      | 0.72              | 0.0067    | 0.53            | 0.3216   | 0.2500         | 0.5440    | 0.5506          |
| 188.20      | 0.77              | 0.0069    | 0.57            | 0.3365   | 0.3000         | 0.7602    | 0.7671          |
| 188.25      | 0.82              | 0.0071    | 0.62            | 0.3509   | 0.3500         | 1.0142    | 1.0214          |
| 188.30      | 0.87              | 0.0074    | 0.68            | 0.3646   | 0.4000         | 1.3075    | 1.3149          |

## **Appendix E:**

### **Water Quality Calculations**



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers  
Collingwood Bracebridge Orillia Barrie

Project: Monterra Phase II

Date: September 18, 2017

File No.: 115185

Designed By: AO

Subject: Water Quality Requirements North Wetland

Checked By:

### Stormwater Management Facility Water Quality Storage Requirements

#### Contributing Areas

|                   |     |      |            |           |                    |           |
|-------------------|-----|------|------------|-----------|--------------------|-----------|
| Catchment         | 201 | Area | 1.9        | ha        | %Impervious        | 43        |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| Catchment         |     | Area |            | ha        | %Impervious        |           |
| <b>TOTAL AREA</b> |     |      | <b>1.9</b> | <b>ha</b> | <b>%Impervious</b> | <b>43</b> |

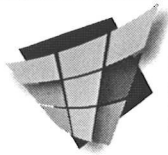
Required Level of Treatment 80 % Enhanced Level  
SWM Facility Type 2 (1-Infiltration, 2-Wetlands, 3-Hybrid Wet Pond/Wetland, 4-Wet Pond, 5-Dry Pond)

|                                           | Enhanced    | Normal | Basic |         |
|-------------------------------------------|-------------|--------|-------|---------|
| <b>Water Quality Storage Requirement</b>  | <b>90.0</b> | -      | -     | cu.m/ha |
| <b>Permanent Pool Volume Required</b>     | <b>50.0</b> | -      | -     | cu.m/ha |
|                                           | <b>96</b>   | -      | -     | cu.m    |
| <b>Extended Detention Volume (40cu.m)</b> | <b>40.0</b> | -      | -     | cu.m/ha |
|                                           | <b>77</b>   | -      | -     | cu.m    |
| <b>25mm Storm Runoff Volume</b>           | <b>11.0</b> | mm     |       |         |
|                                           | <b>213</b>  | cu.m   |       |         |

#### Erosion Control Storage Requirement (Simplified Approach)

|                                        |            |         |
|----------------------------------------|------------|---------|
| FRIMP (%)                              | 18         |         |
| Soils Group                            | A/B        |         |
| Source Control                         | 0          |         |
| Active Storage Volume Requirement      | 110        | cu.m/ha |
| <b>Erosion Control Volume Required</b> | <b>212</b> | cu.m    |

|                                           |            |             |                 |                      |
|-------------------------------------------|------------|-------------|-----------------|----------------------|
| <b>Required Extended Detention Volume</b> | <b>289</b> | <b>cu.m</b> |                 |                      |
| <b>Permanent Pool Volume Provided</b>     | <b>128</b> | <b>cu.m</b> | <b>Provided</b> | <b>&gt; Required</b> |
| <b>Extended Detention Volume Provided</b> | <b>302</b> | <b>cu.m</b> | <b>Provided</b> | <b>&gt; Required</b> |



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers  
Collingwood Bracebridge Orillia Barrie

Project: Monterra Phase II

Date: September 18, 2017

File No.: 115185

Designed By: AO

Subject: Water Quality Requirements East Wetland

Checked By:

### Stormwater Management Facility Water Quality Storage Requirements

#### Contributing Areas

|           |     |                   |            |           |                    |           |
|-----------|-----|-------------------|------------|-----------|--------------------|-----------|
| Catchment | 202 | Area              | 1.1        | ha        | %Impervious        | 39        |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
| Catchment |     | Area              |            | ha        | %Impervious        |           |
|           |     | <b>TOTAL AREA</b> | <b>1.1</b> | <b>ha</b> | <b>%Impervious</b> | <b>39</b> |

Required Level of Treatment 80 % Enhanced Level  
SWM Facility Type 2 (1-Infiltration, 2-Wetlands, 3-Hybrid Wet Pond/Wetland, 4-Wet Pond, 5-Dry Pond)

|                                           | Enhanced    | Normal | Basic |         |
|-------------------------------------------|-------------|--------|-------|---------|
| <b>Water Quality Storage Requirement</b>  | <b>85.0</b> | -      | -     | cu.m/ha |
| <b>Permanent Pool Volume Required</b>     | <b>45.0</b> | -      | -     | cu.m/ha |
|                                           | <b>51</b>   | -      | -     | cu.m    |
| <b>Extended Detention Volume (40cu.m)</b> | <b>40.0</b> | -      | -     | cu.m/ha |
|                                           | <b>45</b>   | -      | -     | cu.m    |
| <b>25mm Storm Runoff Volume</b>           | <b>10.3</b> | mm     |       |         |
|                                           | <b>117</b>  | cu.m   |       |         |

#### Erosion Control Storage Requirement (Simplified Approach)

FRIMP (%) 17  
Soils Group A/B  
Source Control 0  
Active Storage Volume Requirement 110 cu.m/ha

**Erosion Control Volume Required 125 cu.m**

**Required Extended Detention Volume 170 cu.m**

**Permanent Pool Volume Provided 125 cu.m Provided > Required**

**Extended Detention Volume Provided 703 cu.m Provided > Required**

**MONTERRA PHASE II**  
**FILE No. 115185**

**DRAWDOWN TIME FOR POND - EXTENDED DETENTION**  
(Using the falling head orifice equation)

**NORTH WETLAND SWM FACILITY**

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} (h_1^{0.5} - h_2^{0.5})$$

Value

where t = drawdown time in seconds

|                                                                                                               |                         |                |
|---------------------------------------------------------------------------------------------------------------|-------------------------|----------------|
| $A_p$ = surface area of pond (m <sup>2</sup> ) average area of extended detention stages filled by 25mm event | 1289 m <sup>2</sup>     |                |
| C = discharge coefficient (typically 0.63)                                                                    | 0.63                    |                |
| $A_o$ = cross-sectional area of orifice (m <sup>2</sup> )                                                     | 0.002827 m <sup>2</sup> | 60 mm diameter |
| g = gravitational acceleration constant (9.81 m/s <sup>2</sup> )                                              | 9.81 m/s <sup>2</sup>   |                |
| $h_1$ = starting water elevation above the orifice (m)                                                        | 0.17 m                  |                |
| $h_2$ = ending water elevation above the orifice (m)                                                          | 0.00 m                  |                |

$$t = \frac{2 * 2717}{0.63 * 0.01131 * (2 * 9.81)^{0.5}} (0.39^{0.5} - 0^{0.5})$$

$$t = 134,717.79 \text{ seconds}$$

$$t = 37.42 \text{ hours}$$



**MONTERRA PHASE II**  
**FILE No. 115185**

**DRAWDOWN TIME FOR POND - EXTENDED DETENTION**  
(Using the falling head orifice equation)

**EAST WETLAND SWM FACILITY**

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} (h_1^{0.5} - h_2^{0.5})$$

Value

where t = drawdown time in seconds

$A_p$  = surface area of pond ( $m^2$ ) at extended detention

1108  $m^2$

C = discharge coefficient (typically 0.63)

0.63

$A_o$  = cross-sectional area of orifice ( $m^2$ )

0.002827  $m^2$

60 mm diameter

g = gravitational acceleration constant ( $9.81 m/s^2$ )

9.81  $m/s^2$

$h_1$  = starting water elevation above the orifice (m)

0.10 m

$h_2$  = ending water elevation above the orifice (m)

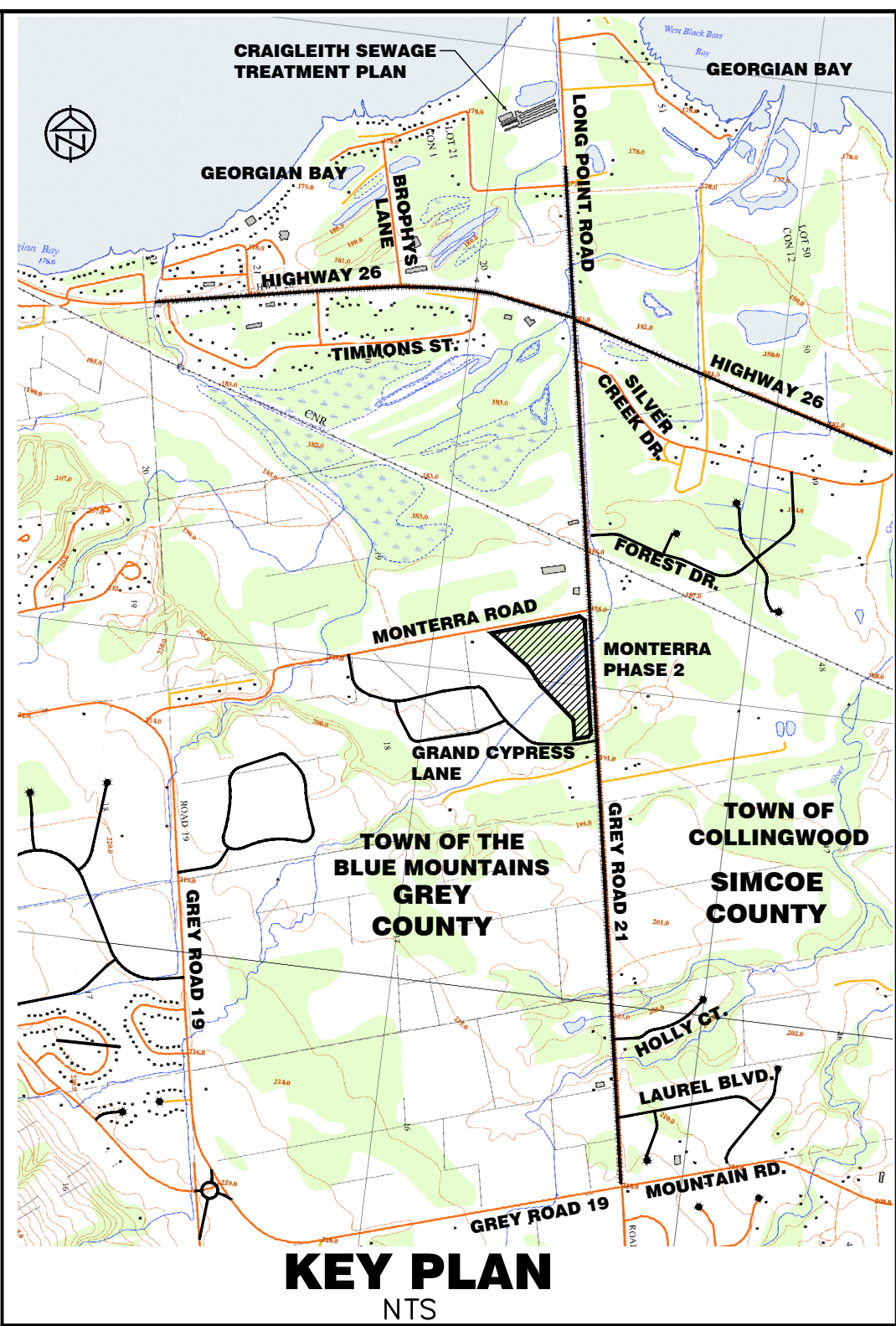
0.00 m

$$t = \frac{2 * 2717}{0.63 * 0.01131 * (2 * 9.81)^{0.5}} (0.39^{0.5} - 0^{0.5})$$

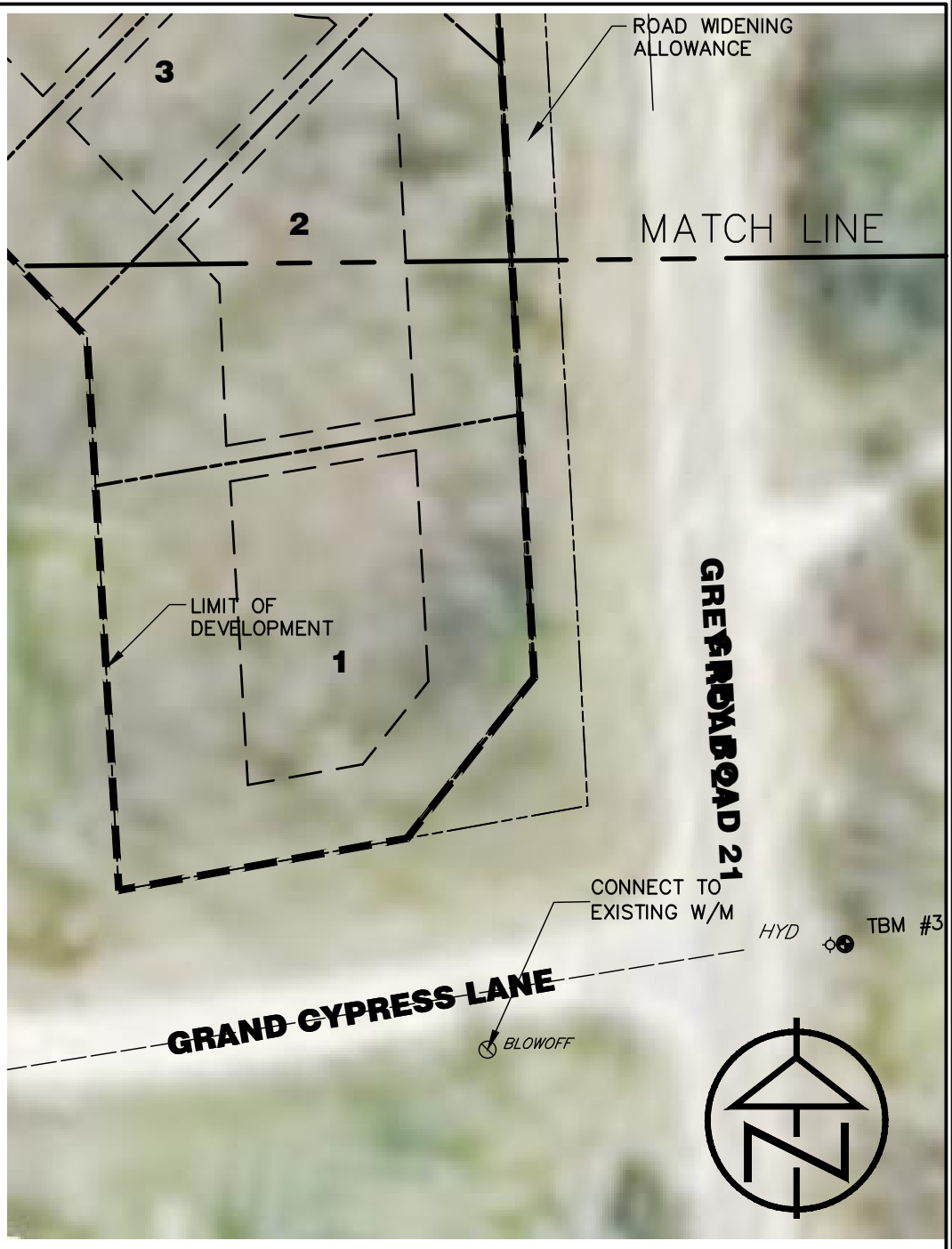
t = 88,815.21 seconds

t = 24.67 hours





| LEGEND                 |     |
|------------------------|-----|
| LIMIT OF DEVELOPMENT   | --- |
| EROSION HAZARD LIMIT   | --- |
| MEANDER BELT ALLOWANCE | --- |
| EX. PROPERTY LINE      | --- |
| CONCEPTUAL LOT LINE    | --- |
| CONCEPTUAL LOT NUMBER  | 24  |

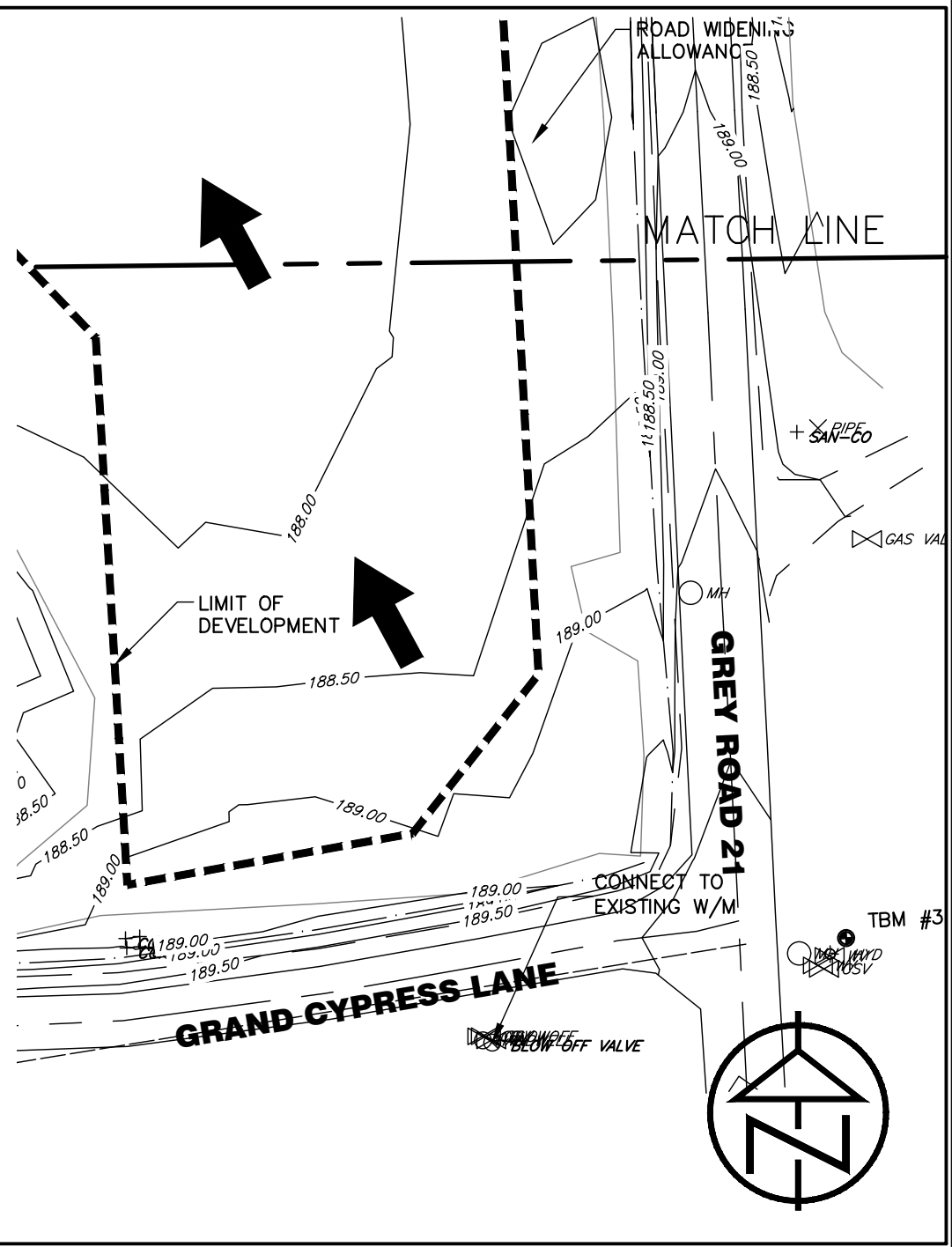
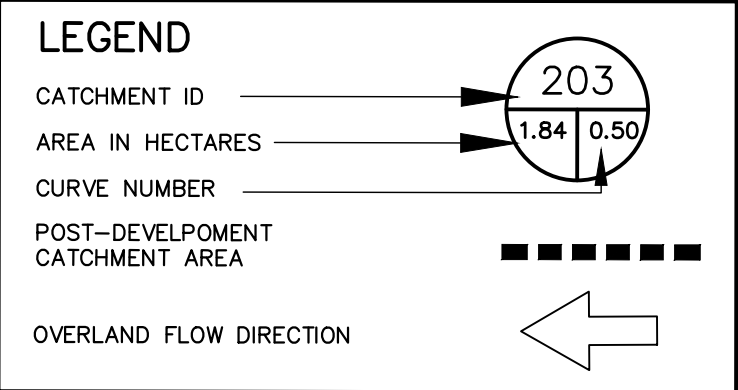
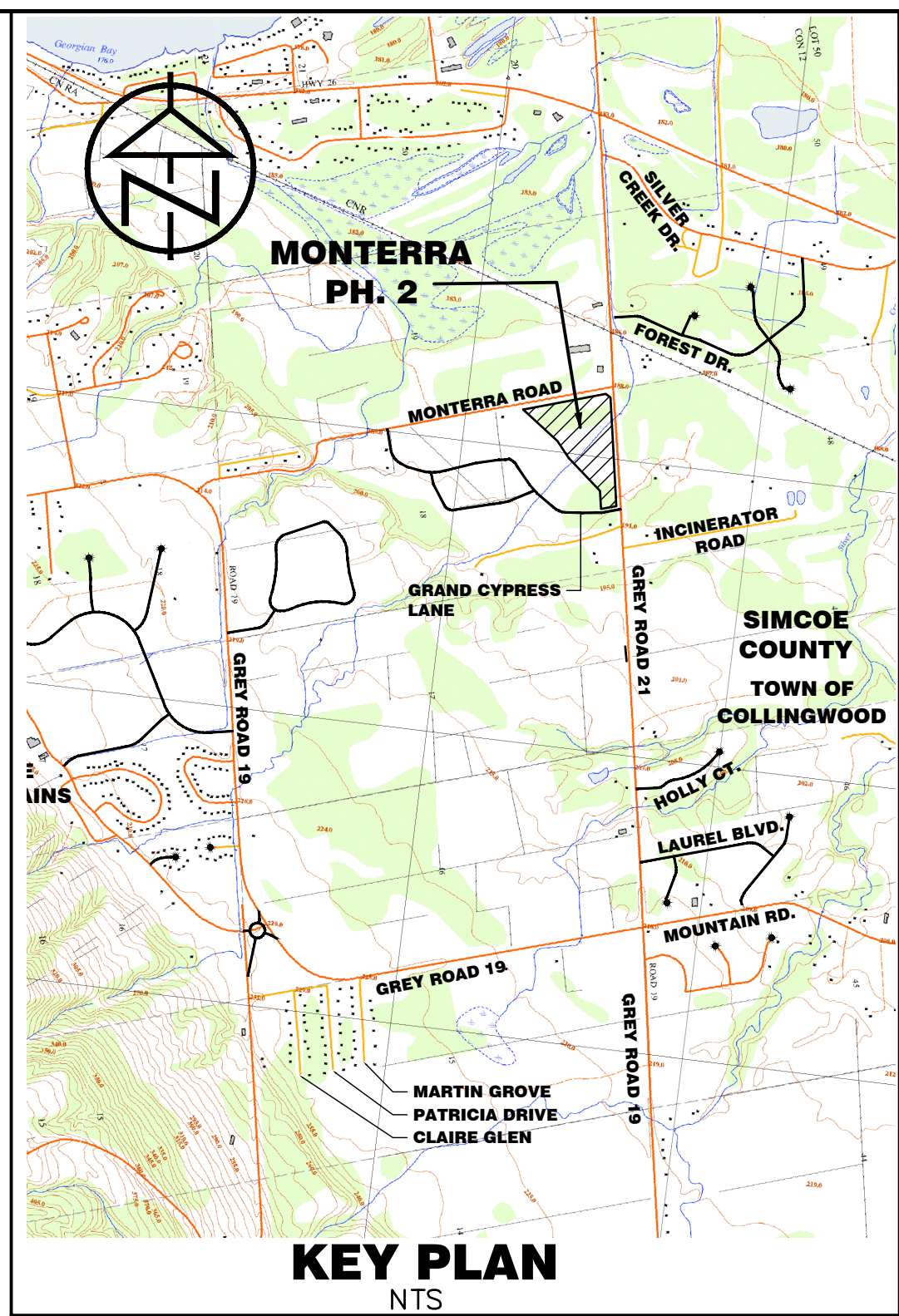
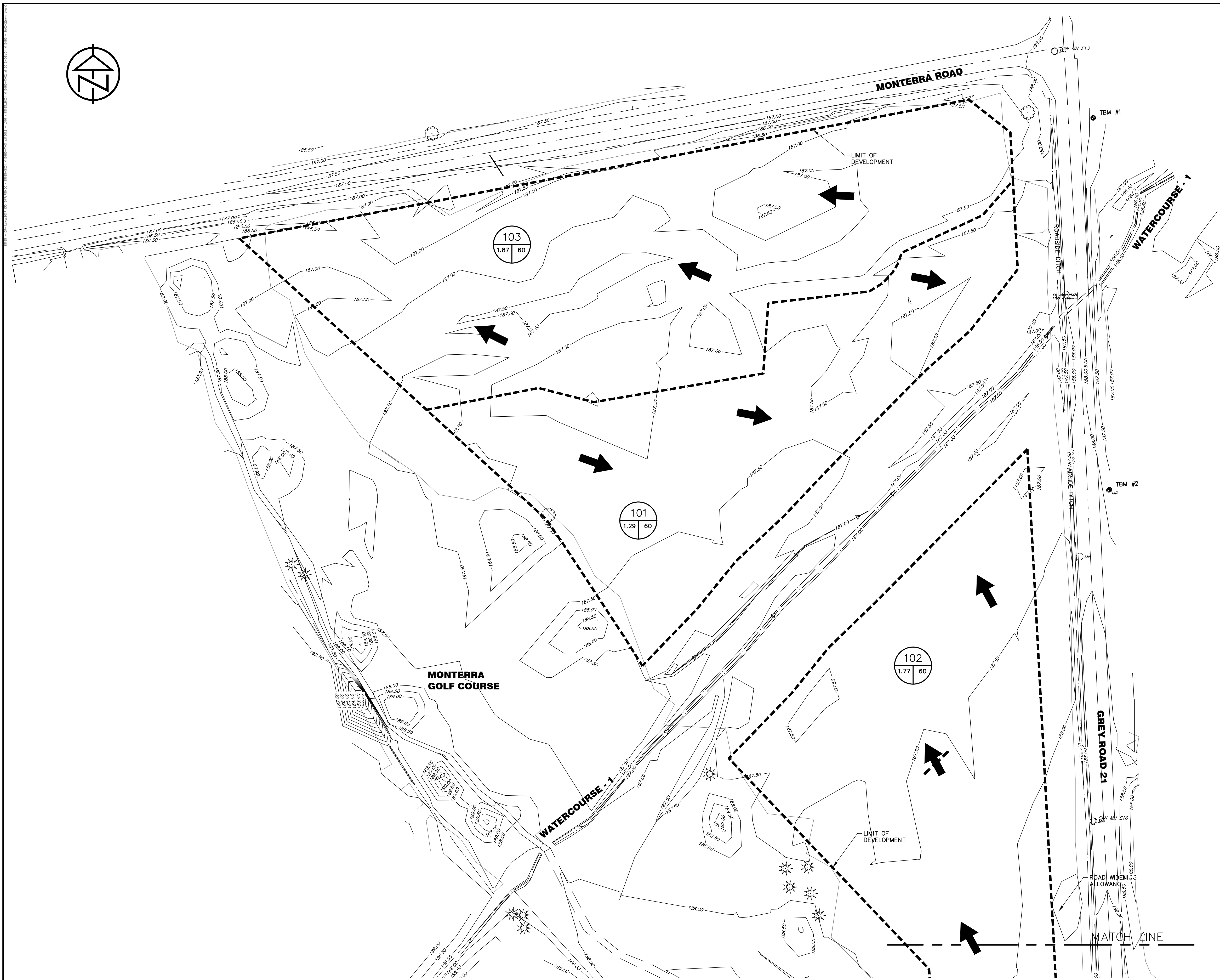


FOR CONTINUATION SEE DETAIL 'A'

DETAIL 'A'

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                       |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                                             |  |  |  |                                 |  |  |  |                                                                             |  |  |  |                                                                                                                                                                                               |  |  |  |                       |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|---------------------------------|--|--|--|-----------------------------------------------------------------------------|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|-----------------------|--|--|--|
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                       |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                                             |  |  |  | <div>NATURAL HAZARD PLAN</div>  |  |  |  | <div>SCALE: 1:750</div>                                                     |  |  |  | <div>JOB NO. 115185</div>                                                                                                                                                                     |  |  |  |                       |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                       |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                                             |  |  |  |                                 |  |  |  | <div>DESIGN: DRT</div>                                                      |  |  |  | <div>CHECKED: DRT</div>                                                                                                                                                                       |  |  |  | <div>DWG. HAZ-1</div> |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                       |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                                             |  |  |  |                                 |  |  |  | <div>DRAWN: DEP</div>                                                       |  |  |  | <div>DATE: DEC./15</div>                                                                                                                                                                      |  |  |  |                       |  |  |  |





|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                                                                                                                                                                   |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                      |  |  |  |                                                                   |  |  |  |                                                                                                                                                                                                                                          |  |  |  |                      |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|----------------------------------------------------------------------------------------------------------------------|--|--|--|-------------------------------------------------------------------|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|----------------------|--|--|--|
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                                                                                                                                                                   |  |  |  |                                                                                                                                                      |  |  |  | <div>PRE-DEVELOPMENT DRAINAGE PLAN</div>                                                                             |  |  |  | <div>SCALE: 1:750</div>                                           |  |  |  | <div>JOB NO. 115185</div>                                                                                                                                                                                                                |  |  |  |                      |  |  |  |
| <div>NO.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  | <div>REVISIONS</div>                                                                                                                                                                                                                                                                              |  |  |  | <div>DATE</div>                                                                                                                                      |  |  |  | <div>INITIAL</div>                                                                                                   |  |  |  | <div>DESIGN: AO</div>                                             |  |  |  | <div>CHECKED: DRT</div>                                                                                                                                                                                                                  |  |  |  | <div>DWG. DP-1</div> |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |                                                                                                                                                                                                                                                                                                   |  |  |  |                                                                                                                                                      |  |  |  |                                                                                                                      |  |  |  | <div>DRAWN: DEP</div>                                             |  |  |  | <div>DATE: DEC./15</div>                                                                                                                                                                                                                 |  |  |  |                      |  |  |  |



