

MONTERRA PHASE II DEVELOPMENT

Town of the Blue Mountains

Stormwater Management Report

prepared by:

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Skyline Blue Mountain Development Inc.

November, 2017

CCTA File 115185

Table of Contents

1	Introdu	uction	1
1.1	Site De	escription	1
1.2	Objecti	ives	1
1.3	Backgr	round and Guidelines	3
1.4	Propos	sed Land Use	3
2	Natura	al Hazard Assessment	4
2.1	Natura	l Hazard Assessment Findings	4
2.2	Natura	I Hazard Assessment Recommendations	5
3	Existin	ng Drainage Conditions	6
3.1	Backgr	round	6
3.2	Subjec	et Site Drainage Outlets	6
4	Storm	water Management Plan	8
4.1	Design	n Criteria	8
4.2	Propos	sed Drainage Conditions	8
4.3	Water	Quantity	8
	4.3.1	North Wetland SWMF	9
	4.3.2	East Wetland SWMF	9
	4.3.3	Post Development Hydrologic Analysis	9
4.4	Water (Quality Control	12
5	Siltatio	on and Frosion Control	14

6 Conclusions 15

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Δ	n	n	ρ	n	M	П	ſ	ρ	C
A	r	r	U				•	U	•

Appendix A: Natural Hazard Letter	
Appendix B: Existing Conditions Hydrologic Analysis	
Appendix C: Proposed Conditions Hydrologic Analysis	
Appendix D: Stage-Storage-Discharge Tables	
Appendix E: Water Quality Calculations	
List of Tables	
Table 1: Pre-Development Hydrologic Analysis Results Summary	7
Table 2: Post-Development Hydrologic Analysis Results Summary	10
Table 3: North Wetland SWMF Summary	11
Table 4: East Wetland SWMF Summary	12
List of Figures	
Figure 1: Site Location Plan	2
List of Drawings	
Natural Hazard Assessment Plan (Drawing Haz-1)	
Pre-Development Drainage Plan (Drawing DP-1)	
Post-Development Drainage Plan (Drawing DP-2)	

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.

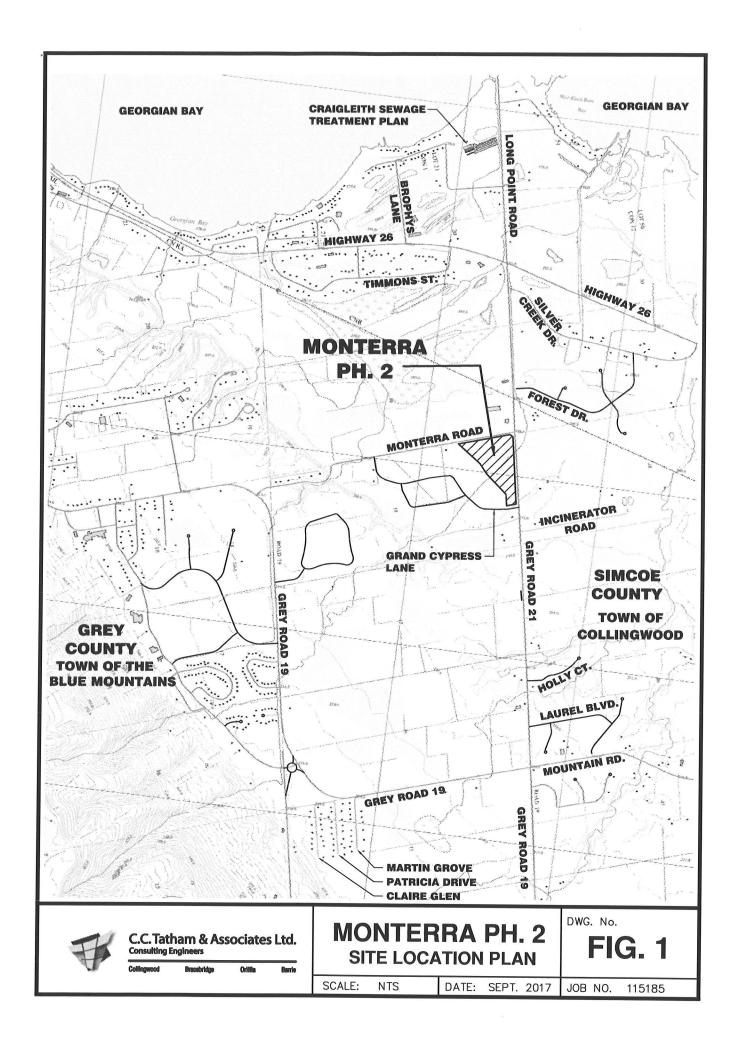
1.1 Site Description

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.



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);
- <u>Craigleith-Camperdown Subwatershed Study</u>. 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 m³/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 overtops Monterra Road at an elevation of 187.41 m when the capacity of the driveway culvert is exceeded.
- 2. The existing 800 mm \times 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 3 /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 m³/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:

- 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 \times 4100 mm concrete box culvert). Watercourse 1 then drains north under Highway 26 (1520 mm \times 3660 mm concrete box culvert) and east under Long Point Road (1050 mm \times 1350 mm CSP arch and 1170 mm \times 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

		Peak Flow	Rates (cms)	
Storm Event	Chicago De	esign Storm	SCS Desi	gn 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 predevelopment 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.

- 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 m³ of active storage, including approximately 302 m³ 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 m³ 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 quantity 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

		Peak Flow	Rates (cms)	
Storm Event	Chicago De	esign Storm	SCS Desi	ign Storm
Event	Watercourse 1	Monterra Road Roadside Ditch	Watercourse 1	Monterra Road Roadside Ditch
25 mm	0.008	0.008	_	_
20 11111	(0.007)	(0.005)		
2 Year	0.014	0.017	0.018	0.022
z rear	(0.018)	(0.012)	(0.028)	(0.020)
5 Year	0.029	0.032	0.046	0.035
3 Teal	(0.036)	(0.026)	(0.049)	(0.036)
10 Year	0.051	0.042	0.069	0.052
io real	(0.051)	(0.037)	(0.067)	(0.048)
25 Year	0.081	0.063	0.094	0.067
25 Teal	(0.073)	(0.053)	(0.090)	(0.065)
50 Year	0.099	0.076	0.104	0.079
ou real	(0.093)	(0.067)	(0.110)	(0.079)
100 Year	0.108	0.091	0.115	0.091
100 real	(0.113)	(0.081)	(0.130)	(0.093)
Regional	0.300	0.050		
(Timmins)	(0.186)	(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	Stag	e (m)	Storaç	ge (m³)	Discharç	ge (m³/s)
Storm Event	СНІ	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	Elevati	on (m)	Storaç	ge (m³)	Dischar	ge (m³/s)
Storm Event	СНІ	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 m³ and 125 m³ 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 m³ and 703 m³, 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

via e-mail (paulm@skylineinvestments.com) CCTA File 115185

Paul Mondell

Senior Vice President, Development Skyline Investments 90 Eglinton Avenue East, Suite 800 Toronto, ON M4P 2Y3

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 \times 4100 mm concrete box culvert). Watercourse 1 then drains north under Highway 26 (1520 mm \times 3660 mm concrete box culvert) and east under Long Point Road (1050 mm \times 1350 mm CSP arch and 1170 mm \times 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 \times 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 I	Flow (m³/s)
Study	100 Year	Regional (Timmins)
Craigleith Camperdown Subwatershed Study	8.7 1	-
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 m³/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 m³/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 m³/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 m³/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 m³/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 m³/s thorough the subject property.
- 2) 14.9 m³/s continues to spill north across the golf course.

- 3) 4.1 m³/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:

Paul Mondell Skyline Investments

- 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

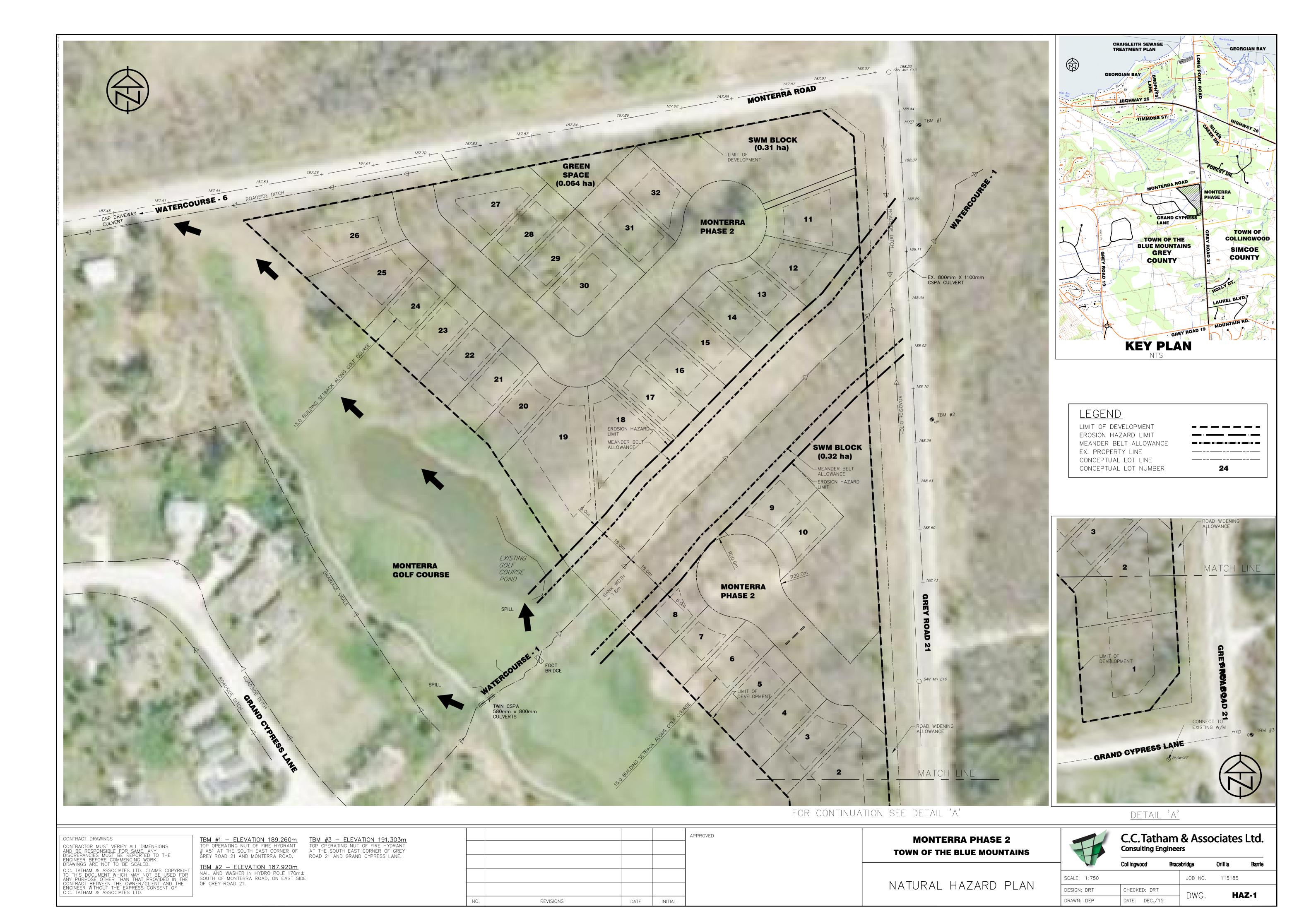
DRT:rlh Encl. Dan Hurley, B.A.Sc., P.Eng., LEED AP

In Huly

Vice President,

Manager - Water Resources Engineering

I:\2015 Projects\115185 - Monterra Phase 2 Natural Hazard Assessment\Documents\Letters\L001 - Natural Hazards Assessment - November 27, 2017.docx

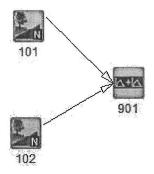


Appendix B: Existing Conditions Hydrologic Analysis

Existing Conditions OTTHYMO Model Schematic



103





Orillia

	Project:	Monterra Phase II
	File No.:	115185
_td.	Date:	September 8, 2017
	Designed By: AO	AO
Barrie	Checked By:	
	Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISTING CONDITIONS

Catchment

Area 101

1.29 ha

	Average CN for Soll		50 60	0	0	0	0	D 08
	Wetland/Lakes/SWMF	Percent CN	0 5	#N/A	#N/A	#N/A	#N/A	000
	Wetland/I	Area Pe	0	0	0	0	0	0.00
		NO	100	#N/A	#N/A	#N/A	#N/A	
	Impervious	Percent	0					000
	-	Area	0	0	0	0	0	00.0
		CN	74	W/N#	#N/A	#N/A	#N/A	
	Cultivated	Percent	0					000
		Area	0	0	0	0	0	000
		S	65	#N/A	#N/A	#N/A	#N/A	
	Meadows	Percent	o					000
		Area	0	0	0	0	0	0.00
		CN	69	W/A#	#N/A	#N/A	#N/A	
IN VALUE	Pasture/Lawns	Percent	0					00.0
WEIGHTED CN	G.	Area	0	0	0	0	0	000
WEIG	pu	CS	09	#N/A	#N/A	#N/A	#N/A	
	Forest/Woodland	Percent	1					100
	Fore	Area	1.29	0	0	0	0	1 29
	t Soil	Percent	-					1 00
	Catchment Soil Characteristics	Area	1.29	0	0	0	0	1 29
	Runoff	Туре	2	W/N#	#N/A	W/N#	W/N#	Totals
	Sail Texture		Sand Loam	#N/A	#N/A	#N/A	#N/A	
	Hydrologic Soil Group	1	œ	#N/A	#N/A	#N/A	#N/A	
	Soil Series		GRANBY	#N/A	#N/A	#N/A	#N/A	
	Soil Series		Ğ					

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

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

188.04 m 186.53 m 118 m 1.29 ha

188.04 m 186.53 m 118 m 1% 1.29 ha

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area 6.24 0.10 0.07

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

27.75 0.46 0.31

ForestWoodland
Cultivated
Pasture/Lawn
Impervious
Wetland/Lake/SWMF
Meadows
Soil Series Total Landuse Type

10.0 mm



C.C. Tatham & Associates Ltd. Consulting Engineers

Barrie Orillia Bracebridge

Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By:	АО
Checked By:	
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

Catchment

Area 102

1.77 ha

	Aver		20	8	8	0	d	
	Wetland/Lakes/SWMF	CS		#N/A	W/N#	#N/A	#N/A	
	nd/Lake	Percen						
	Wetla	Area Percent	0	o	0	0	0	
		S	100	#N/A	#N/A	#N/A	#N/A	
	Impervious		_					
	Imi	Area Percent	0	0	0	0	0	
		NO	74	#N/A	#N/A	#N/A	#N/A	
	Cullivated	roent	0	#	#	+#	##	
	Cul	Area Percent	0	0	0	0	0	
		CN	65	#N/A	#N/A	#N/A	#N/A	
	ows	ent C		#	#	#	#	The second second
	Meadows	Percent	0	0	0	0	0	-
		Area P	69					
띡	, us	S	9	W/N#	W/N#	W/A#	W/V#	
WEIGHTED ON VALUE	Pasture/Lawns	Area Percent						AND DESCRIPTION OF THE PERSON NAMED IN
HTED	Pa	Area	0	0	0	0	0	
WEIG	ם	O	9	#N/A	W/N#	#N/A	#N/A	
	ForestWoodland	eroent	-					
	Forest	Area Percent	1.77	0	0	0	0	Andreas de la constante de la
		883	-					The second
	Catchment Soil Characteristics	Percent		_			_	
	Catchi	Area	1.77					
	Runoff	2	#N/A	#N/A	#N/A	#N/A		
	Runoff Coefficient Type			#	#	#	#	
	Soil Texture	E	#N/A	#N/A	#N/A	#N/A		
	Soil 1	Sand Loam	#	#	#	#		
	Hydrologia	S	#N/A	#N/A	#N/A	#N/A		
	Hydr	8	#	#	#	#		
	Soil Series	BY	#N/A	#N/A	#N/A	#N/A		
	So	GRANBY	**	_	-	-		
	Soil Series				2			***************************************
	Boil		5					

Average CN for Soil

- Indianianiani	SHOUTE INDUSTRICT		
On the state of th			
100	b		

For Runoff Coefficients greater than 0.4

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation Minimum Catchment Elevation

Bransby-Williams Formula

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

189.43 m 187.04 m 230 m 1% 1.77 ha

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

0.46 hrs

Time to Peak

Time of Concentration (Minutes)
Time of Concentration (Hours)
Time to Peak (2/3 x Time of Concentration) Catchment length Catchment Slope Catchment Area

41.50 0.69 0.46

Landuse Type

189.43 m 187.04 m 230 m 1% 1.77 ha

Runoff Coefficient 0.25

Meadows
Cultivated
Lawns
Impervious

10.0 mm

Initial Abstraction

Forest/Woodland
Cultivated
Pasture/Lawn
Impervious
Wetland/Lake/SWMF
Meadows
Soil Series Total



September 8, 2	Date:	nam & Associates Ltd.
115185	File No.:	
Monterra Phas	Project:	

Barrie

Orillia

Bracebridge

Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By: AO	AO
Checked By:	
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

103 Catchment

Area

1.87 ha

	Average CN for Soil	Type	09	0	0	0	0	0.08
	VMF	NO	20	#N/A	#N/A	W/A#	#N/A	
	Vetland/Lakes/SWM	Percent	0					00'0
	Wetland	Area P	0	0	0	0	0	00'0
		NO	100	#N/A	#N/A	#N/A	#N/A	
	Impervious	Percent	-	#	#	#	#	0.00
	Impo	Area Pe	0	0	0	0	0	0.00
		ON NO	74	#N/A	#N/A	#N/A	#N/A	
	Cultivated	100	0	#	#	#	#	0.00
	Culti	a Percent	0	0	0	0	0	00.0
		CN Area	65	.X	Ä	×	Ä	
	N.S			#N/A	#N/A	#N/A	#N/A	00.0
	Meadows	Percent						
		Area	0	0	0	0	0	0.00
WEIGHTED ON VALUE		CN	69	W/V#	#N/A	W/V#	#N/A	
	Pasture/Lawns	Percent						0.00
	Pas	Area	0	0	0	0	0	00.0
	ForestiWoodland	NO	09	#N/A	#N/A	#N/A	#N/A	
		Percent	7					1.00
		Area Pe	1.87	0	0	0	0	1,87
			-	_			-	1.00
	Gatchment Soil Characteristics	Percent					0	
	Catchr	Area	1.87	U		C	U	1.87
	Runoff	Type	2	I/A	#N/A	I/A	I/A	
	Run		W/N#	\# 	W/N#	#N/A	Totals	
	Soil Texture		E	#N/A	#N/A	#N/A	#N/A	
State of the same	Soil T		Sand Loam	₩	\#	\#	₩	
	Hydrologia Soil Group		S	#N/A	#N/A	#N/A	#N/A	
	Hydr		8	#	J#	#	₩	
	Soil Series		ВУ	#N/A	#N/A	#N/A	#N/A	
STATE			GRANBY	*	*			
	Soil Series			Caracalatacacacacacacacacacacacacacacacacac				
	Boil		Ğ					

For Runoff Coefficients greater than 0.4 Time of Concentration Calculations

Bransby-Williams Formula

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

187.82 m 187.01 m 55.4 m 1% 1.87 ha

Time of Concentration (Minutes)
Time of Concentration (Hours)
Time to Peak (2/3 x Time of Concentration) Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

0.05

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

Time to Peak

187.82 m 187.01 m 55.4 m 1% 1.87 ha 18.19 0.30 0.20

Soil Series

10.0 mm

Initial Abstraction

Forest/Woodland
Cultivated
Pasture/Lawn
Impervious
Wetland/Lake/SVMF
Meadows
Soil Series Total Landuse Type

Chicago - Pre

SSSSS U IJ A U U AA L I U AAAAA L V V SS U T SS U U A A L V V I A LLLLL SSSSS UUUUU A 000 TTTTT. TTTTT Y M M H Y Y MM MM O O 0 0 T \mathbf{T} H T T Y M M O O 0 H H 000 \mathbf{T} \mathbf{T} H H Y Μ Μ 000

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***** DETAILED OUTPUT *****

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

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

			T	RANSFORMED	HYETOG	GRAPH	-		
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr	1	hrs	mm/hr
.083	1.29	1	1.083	2.81	2.083	13.05	1	3.08	2.04
.167	1.35	1	1.167	3.14	2.167	9.36	1	3.17	1.92
.250	1.41	1	1.250	3.55	2.250	7.10	1	3.25	1.81
.333	1.48	1	1.333	4.08	2.333	5.69	1	3.33	1.72
.417	1.55	1	1.417	4.79	2.417	4.74	1	3.42	1.63
.500	1.63	1	1.500	5.77	2.500	4.06	1	3.50	1.55
.583	1.75	1	1.583	7.86	2.583	3.47	1	3.58	1.46
.667	1.86	1	1.667	11.39	2.667	3.12	1	3.67	1.40
.750	1.99	1	1.750	20.61	2.750	2.83	1	3.75	1.35
.833	2.14	1	1.833	44.73	2.833	2.59	1	3.83	1.30
. 917	2.31	1	1.917	63.46	2.917	2.39	1	3.92	1.25

. .

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.198
     Unit Hyd Qpeak (cms)=
                       (cms) = .005 (i)
      PEAK FLOW
     TIME TO PEAK (hrs) = 2.417
RUNOFF VOLUME (mm) = 1.215
TOTAL RAINFALL (mm) = 24.971
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| CALIB
Unit Hyd Qpeak (cms)=
                                 .128
     PEAK FLOW (cms) = .004
TIME TO PEAK (hrs) = 2.667
RUNOFF VOLUME (mm) = 1.215
TOTAL RAINFALL (mm) = 24.971
      PEAK FLOW
                        (cms) =
                                  .004 (i)
     RUNOFF COEFFICIENT =
      (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
                        (cms) = .004 (i)
     PEAK FLOW
     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) |
                             AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
1.77 .004 2.67 1.22
1.29 .004 2.33 1.22
 1 + 2 = 3
                                                              (mm)
          ID1= 1 (0102):
         + ID2= 2 (0101):
           3.06 .007 2.50
           ID = 3 (0901):
     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
                                       \verb|\Design\Hydrology\115185| vo2\STORMS\OSCHI2.4H|
                         Comments: OWEN SOUND 2 YEAR 4 HOUR DURATION CHICAG
| Ptotal= 33.75 mm |
                            RAIN | TIME RAIN | TIME
                                                              RAIN |
                                                                         TIME
                                                                                  RAIN
                                                              mm/hr |
                                     hrs mm/hr | hrs
1.10 3.80 | 2.10
                           mm/hr |
                                                                          hrs
                                                                                 mm/hr
                    hrs
                     .10
                            1.75 |
                                     1.10
                                                               17.64 I
                                                                         3.10
                                                                                 2.75
                    .20
                            1.84 | 1.20 4.35 | 2.20
                                                              11.41 | 3.20
                                                                                 2.38
                            1.95 | 1.30 | 5.09 | 2.30
2.07 | 1.40 | 6.16 | 2.40
2.21 | 1.50 | 7.80 | 2.50
                                                              8.39 | 3.30
6.63 | 3.40
                    .30
                     .40
                                                              5.49 | 3.50
                     .50
                                                              4.69 | 3.60
4.10 | 3.70
                                                                                1.98

    2.37 | 1.60
    10.63 | 2.60

    2.56 | 1.70
    16.59 | 2.70

    2.78 | 1.80
    35.38 | 2.80

                     .60
                     .70
                                                              3.65 | 3.80
                                                                                 1.78
                    .80
                                                              3.29 | 3.90
                            3.05 | 1.90 98.09 | 2.90
                                                                                 1.70
```

3.38 | 2.00 36.45 | 3.00

2.99 | 4.00

.90

1.00

1.000 2.50 | 2.000 26.96 | 3.000 2.22 | 4.00 1.20

```
I CALTB
| 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
                                                                                            mm/hr
                       hrs
                                                                                            2.75
                      .083
                                                                                             2.59
                      .167
                      .250
                                                                                             2.45
                      .333
                               2.10 | 1.417 | 6.49 | 2.417
2.21 | 1.500 | 7.80 | 2.500
2.37 | 1.583 | 10.63 | 2.583
                                                                      6.40 |
5.49 |
                      .417
                                                                                   3.42
                                                                                             2.20
                                                                                   3.50
                      .500
                                                                      4.69
                                                                                   3.58
                      .583
                             2.52 | 1.667 | 15.40 | 2.667 | 4.22 | 3.67 | 1.90 | 2.69 | 1.750 | 27.86 | 2.750 | 3.83 | 3.75 | 1.82 | 2.89 | 1.833 | 60.46 | 2.833 | 3.51 | 3.83 | 1.75 | 3.12 | 1.917 | 85.76 | 2.917 | 3.23 | 3.92 | 1.69 | 3.38 | 2.000 | 36.45 | 3.000 | 2.99 | 4.00 | 1.63
                      .667
                      .750
                      .833
                      .917
                     1.000
      Unit Hyd Qpeak (cms) =
                                        .198
                                        .012(i)
      PEAK FLOW
                           (cms) =
      TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 2.922
TOTAL RAINFALL (mm)= 33.755
      RUNOFF COEFFICIENT =
       (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| 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
                           (cms) =
                                       .009 (i)
      PEAK FLOW
      TIME TO PEAK (hrs)= 2.583
RUNOFF VOLUME (mm)= 2.922
TOTAL RAINFALL (mm)= 33.755
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| CALIB |
| NASHYD (0101) |
                           Area (ha) = 1.29 Curve Number (CN) = 60.0 Ia (mm) = 10.00 # of Linear Res.(N) = 3.00
|ID= 1 DT= 5.0 min |
                           U.H. Tp(hrs) = .31
                                       .159
     Unit Hyd Qpeak (cms)=
                          (cms) = .009 (i)

(hrs) = 2.250
      PEAK FLOW
      TIME TO PEAK
      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) |
                                  AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm)
1 + 2 = 3
                                                           (hrs) (hrs) 2.92
          TD1= 1 (0102): 1.77 .009 2.58
+ ID2= 2 (0101): 1.29 .009 2.25
                                                           2.25 2.92
            2.92
            ID = 3 (0901):
                                    3.06 .018
                                                       2.42
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Unit Hyd Qpeak (cms)=

```
Filename: I:\2015 Projects\115
                       185 - Monterra Phase 2 Natural Hazard Assessm
\Design\Hydrology\115185 vo2\STORMS\OSCHI5.4H
| Ptotal= 44.07 mm | Comments: OWEN SOUND 5 YEAR 4 HOUR DURATION CHICAG
                                          RAIN | TIME
                                                            RAIN | TIME
                  TIME
                          RAIN | TIME
                        mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
2.16 | 1.10 | 4.86 | 2.10 | 23.63 | 3.10 | 3.47
                   hrs

    2.16 | 1.10
    4.86 | 2.10

    2.29 | 1.20
    5.59 | 2.20

    2.42 | 1.30
    6.58 | 2.30

                   .10
                                                           15.14 | 3.20
                                                                             3.21
                   .20
                                                           11.03 | 3.30
                                                                           2.98
                   .30
                          8.65 | 3.40
7.11 | 3.50
                                                                              2.78
                   .40
                   .50
                                                                             2.61
                                                           6.04 | 3.60
                                                                             2.46
                   .60
                          5.25 | 3.70
4.65 | 3.80
                                                                             2.33
                   .70
                                                                              2.21
                   .80
                                                           4.17 | 3.90
                                                                             2.11
                    .90
                                                           3.79 | 4.00
                        4.30 | 2.00 48.87 | 3.00
                                                                             2.01
                  1.00
| NASHYD (0103) |
                       Area (ha) = 1.87
Ia (mm) = 10.00
                                                Curve Number (CN) = 60.0
                                                \# of Linear Res.(N)= 3.00
                                 (mm) = 10.00
|ID= 1 DT= 5.0 min |
                        U.H. Tp(hrs)=
                                         .36
         NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                 --- TRANSFORMED HYETOGRAPH ----
                        RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs
                  TIME
                                                           RAIN | TIME
                                                   hrs mm/hr | hrs
                   hrs

    2.16 | 1.083
    4.86 | 2.083
    23.63 | 3.08

    2.26 | 1.167
    5.44 | 2.167
    16.84 | 3.17

                  .083
                                                                              3.26
                  .167
                           2.37 | 1.250 6.18 | 2.250
                                                           12.67 | 3.25
                                                                              3.07
                  .250
                          10.08 | 3.33
8.34 | 3.42
                                                                              2.90
                  .333
                                                                              2.75
                  .417
                           2.76 | 1.500 | 10.23 | 2.500
                                                             7.11 | 3.50
                                                                              2.61
                  .500
                                                           6.04 | 3.58
5.41 | 3.67

    2.97 | 1.583
    14.08 | 2.583

    3.17 | 1.667
    20.58 | 2.667

                                                                              2.46
                  .583
                                                                              2.36
                  .667
                           3.39 | 1.750 37.34 | 2.750
                                                           4.89 | 3.75
                                                                              2.26
                  .750
                          4.46 | 3.83
4.09 | 3.92
                                                                              2.17
                  .833
                                                                              2.09
                   .917
                                                          3.79 | 4.00
                           4.30 | 2.000
                                         48.87 | 3.000
                                                                            2.01
                 1.000
     Unit Hyd Qpeak (cms)=
                               .198
                      (hrs) = .026
(hrs) = 2.333
(mm) = 5.705
                                 .026(i)
     PEAK FLOW
                     (cms) =
     TIME TO PEAK
     RUNOFF VOLUME
     TOTAL RAINFALL (mm) = 44.068
     RUNOFF COEFFICIENT =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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
Curve Number (CN) = 60.0
                                                \# of Linear Res.(N)= 3.00
                                         .31
```

```
PEAK FLOW (cms) = .020 (i)
TIME TO PEAK (hrs) = 2.250
RUNOFF VOLUME (mm) = 5.704
TOTAL RAINFALL (mm) = 44.068
     RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
        1 + 2 = 3
           _____
          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\115
                         185 - Monterra Phase 2 Natural Hazard Assessm
                                     \Design\Hydrology\115185 vo2\STORMS\OSchi10.4
                         Comments: OWEN SOUND 10 YEAR 4 HOUR DURATION CHICA
 Ptotal= 50.59 mm |
                                                             RAIN | TIME
                          RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs 2.37 | 1.10 5.44 | 2.10
                                                                               RAIN
                  TIME
                                                             mm/hr |
                                                                        hrs
                                                                               mm/hr
                   hrs
                                                            27.54 |
                    .10
                           17.50 | 3.20
12.66 | 3.30
9.86 | 3.40
                    .20
                    .30
                    .40
                           2.87
                    .50
                                                                                2.70
                    .60
                    .70
                                                                               2.42
                           .80

    4.29 | 1.90 | 146.69 | 2.90

    4.80 | 2.00 | 57.21 | 3.00

                                                                                2.30
                    .90
                                                            4.21 | 4.00
                   1.00
| CALIB | NASHYD (0103) |
                                  (ha) = 1.87 Curve Number (CN) = 60.0
                       Area (ha)= 1.87 Curve Number (CN)= 60.0
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
----- U.H. Tp(hrs)=
                                          .36
         NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                  --- TRANSFORMED HYETOGRAPH ----
                          RAIN | TIME RAIN | TIME RAIN |
                                                                       TIME
                   TIME
                          mm/hr | hrs mm/hr | hrs mm/hr | hrs 2.37 | 1.083 | 5.44 | 2.083 | 27.54 | 3.08
                    hrs
                                                                             mm/hr
                   .083

    2.47 | 1.167
    6.11 | 2.167
    19.51 | 3.17

    2.60 | 1.250
    6.98 | 2.250
    14.60 | 3.25

    2.73 | 1.333
    8.10 | 2.333
    11.54 | 3.33

                                                                                3.60
                   .167
                                                                               3.39
                   .250
                                                                               3.20
                   .333

      2.88 | 1.417
      9.62 | 2.417
      9.50 | 3.42

      3.04 | 1.500
      11.71 | 2.500
      8.06 | 3.50

      3.28 | 1.583
      16.26 | 2.583
      6.81 | 3.58

                                                                                3.02
                   .417
                                                                                2.87
                   .500
                                                                               2.70
                   .583
                           3.50 | 1.667 | 23.93 | 2.667 | 6.07 | 3.67
                                                                               2.58
                   .667
                         .750
                                                                               2.37
                   .833
                            4.39 | 1.917 | 128.79 | 2.917 | 4.56 | 3.92
                                                                               2.28
                   917
                            4.80 | 2.000 57.21 | 3.000
                                                             4.21 | 4.00
                  1.000
     Unit Hyd Qpeak (cms)=
                                  .198
                      (cms) =
                                .037 (i)
     PEAK FLOW
                       (hrs) = 2.333
     TIME TO PEAK
     RUNOFF VOLUME (mm) = 7.846
TOTAL RAINFALL (mm) = 50.590
     RUNOFF COEFFICIENT =
                                .155
```

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

```
Area (ha) = 1.77
                                                    Curve Number (CN) = 60.0
| NASHYD (0102) |
|ID= 1 DT= 5.0 min |
                                    (mm) = 10.00
                                                     \# of Linear Res.(N)= 3.00
                          Ia
   ______
                          U.H. Tp(hrs)=
                                            .53
                                  .128
     Unit Hyd Qpeak (cms)=
                        (cms) =
                                    .026(i)
     PEAK FLOW
     (hrs)= 2.500
CHOFF VOLUME (mm)= 7.847
TOTAL RAINFALL (mm)=
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
CALIB
NASHYD (0101)
    SHYD (0101) | Area (ha)= 1.29

1 DT= 5.0 min | Ia (mm)= 10.00

U.H. Tp(hrs)= .31
                                                    Curve Number (CN) = 60.0
                                                   # of Linear Res.(N) = 3.00
|ID= 1 DT= 5.0 min |
     Unit Hyd Qpeak (cms)=
                                    .159
     TIME TO PEAK (hre)-
                                  .028 (i)
     PEAK FLOW (cms) = .028
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) |
                               AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 1.77 .026 2.50 7.85 1.29 .028 2.25 7.85
1 + 2 = 3
          ID1=1 (0102):
         + ID2= 2 (0101): 1.29 .028 2.25
           ID = 3 (0901): 3.06 .051 2.33
                                                               7.85
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
  ** SIMULATION NUMBER: 5 **
  *******
  READ STORM | 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
| Ptotal= 59.08 mm |
                            RAIN | TIME RAIN | TIME RAIN | TIME
                   TIME
                            mm/hr | hrs mm/hr | hrs mm/hr |
2.69 | 1.10 6.28 | 2.10 32.51 |
                                                                           hrs mm/hr
                     hrs
                            2.69 | 1.10 | 6.28 | 2.10 | 32.51 | 3.10 | 3.03 | 1.30 | 8.63 | 2.30 | 14.82 | 3.30 | 3.24 | 1.40 | 10.61 | 2.40 | 11.50 | 3.40 | 3.47 | 1.50 | 13.69 | 2.50 | 9.37 | 3.50
                     .10
                     .20
                                                                                   3.76
                     .30
                     .40
                     .50

    3.75 | 1.60
    19.10 | 2.60
    7.89 | 3.60

    4.07 | 1.70
    30.50 | 2.70
    6.82 | 3.70

    4.46 | 1.80
    65.56 | 2.80
    6.00 | 3.80

                                                                                    3.08
                     .60
                     .70
                                                                                     2.91
                                                                                     2.76
                     .80
                          4.94 | 1.90 170.99 | 2.90 5.35 | 3.90
                     .90
                                                                                   2.62
                           5.53 | 2.00 67.54 | 3.00
                                                                4.84 | 4.00
                    1.00
| CALIB | | NASHYD (0103) |
                                 (ha) = 1.87

(mm) = 10.00
                                                    Curve Number (CN) = 60.0
                          Area
                         Ia (mm) =
U.H. Tp(hrs) =
                                                    \# of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
                                            .36
          NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
```

--- TRANSFORMED HYETOGRAPH ----

TIME

hrs

mm/hr | hrs

RAIN | TIME RAIN | TIME RAIN | TIME RAIN | mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr

```
2.69 | 1.083 | 6.28 | 2.083
                                                              32.51 | 3.08
                   .083

      2.82 | 1.167
      7.07 | 2.167

      2.96 | 1.250
      8.09 | 2.250

      3.11 | 1.333
      9.42 | 2.333

                   .167
                                                              22.97 | 3.17
                                                                                  4.13
                                                              17.12 | 3.25
13.49 | 3.33
                    .250
                                                                                  3.66
                   .333
                            3.29 | 1.417 | 11.23 | 2.417
3.47 | 1.500 | 13.69 | 2.500
3.75 | 1.583 | 19.10 | 2.583
                   .417
                                                              11.07 | 3.42
                                                                                  3.46
                                                              9.37 | 3.50
7.89 | 3.58
                    .500
                    .583
                                                                                  3.08
                            4.01 | 1.667 28.22 | 2.667
                                                              7.03 | 3.67
                   .667
                            4.30 | 1.750 | 51.54 | 2.750
4.65 | 1.833 | 107.73 | 2.833
                                                              6.33 | 3.75
5.74 | 3.83
5.25 | 3.92
                    .750
                                                                                   2.82
                    .833
                                                                                   2.70
                            5.06 | 1.917 | 150.30 | 2.917
                   .917
                                                                                 2.60
                            5.53 | 2.000 | 67.54 | 3.000
                                                              4.84 | 4.00
                                                                                 2.50
                  1.000
     Unit Hyd Qpeak (cms) = .198
                        (cms) =
                                   .053 (i)
      PEAK FLOW
                       (hrs) = 2.333
     TIME TO PEAK
     RUNOFF VOLUME (mm) = 11.025
TOTAL RAINFALL (mm) = 59.076
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| 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
                        (cms) =
                                   .038 (i)
     PEAK FLOW
     TIME TO PEAK (hrs) = 2.500
                       (mm) = 11.026

(mm) = 59.076
     RUNOFF VOLUME
     TOTAL RAINFALL
     RUNOFF COEFFICIENT = .187
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
Curve Number (CN) = 60.0
                                                   # of Linear Res.(N) = 3.00
     Unit Hyd Qpeak (cms)=
                                   .159
     PEAK FLOW (cms)= .040
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 11.023
TOTAL RAINFALL (mm)= 59.076
                                 .040 (i)
     RUNOFF COEFFICIENT = .187
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
                               AREA QPEAK TPEAK R.V.
 1 + 2 = 3
                               (ha) (cms) (hrs) (mm)
1.77 .038 2.50 11.03
        ID1= 1 (0102): 1.77 .038 2.50 11.03
+ ID2= 2 (0101): 1.29 .040 2.25 11.02
           ID = 3 (0901): 3.06 .073 2.33 11.02
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
  ********
  ** SIMULATION NUMBER: 6 **
    READ STORM | Filename: I:\2015 Projects\115
                                      185 - Monterra Phase 2 Natural Hazard Assessm
                                       \Design\Hydrology\115185 vo2\STORMS\OSchi50.4
                          Comments: OWEN SOUND 50 YEAR 4 HOUR DURATION CHICA
 Ptotal= 65.65 mm |
                            RAIN | TIME
                                             RAIN | TIME
                                                               RAIN | TIME
                   TIME
```

hrs

mm/hr |

hrs

mm/hr |

hrs

2.87 | 1.10 | 6.88 | 2.10 | 36.93 | 3.10 | 4.78

mm/hr |

hrs

| CALIB

I CALIB

```
8.01 | 2.20 23.25 | 3.20
                           3.04 | 1.20
                    .20
                           4.05
                    .30
                                                                               3.76
                    .40
                                                                               3.52
                    .50
                           4.04 | 1.60 | 21.55 | 2.60

4.40 | 1.70 | 34.62 | 2.70

4.84 | 1.80 | 74.20 | 2.80

5.37 | 1.90 | 187.94 | 2.90
                                                           8.71 | 3.60
7.49 | 3.70
6.56 | 3.80
                                                                               3.30
                    .60
                    .70
                                                                               3.11
                                                                               2.94
                    .80
                                                            5.84 | 3.90
                                                                               2.79
                    .90
                           6.03 | 2.00
                                          76.42 | 3.00
                                                             5.26 | 4.00
                   1.00
                        Area (ha) = 1.87
Ia (mm) = 10.00
                                                 Curve Number (CN) = 60.0
| NASHYD (0103) |
|ID= 1 DT= 5.0 min |
                                                  \# 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 hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs
                   TIME
                                                                               RATN
                                                                              mm/hr
                         2.87 | 1.083 | 6.88 | 2.083 | 36.93 | 3.08
3.01 | 1.167 | 7.78 | 2.167 | 25.99 | 3.17
                   .083
                                                                               4.47
                   .167
                           4.19
                   .250
                           3.33 | 1.333 | 10.45 | 2.333
3.52 | 1.417 | 12.52 | 2.417
                                                             15.12 | 3.33
12.34 | 3.42
                                                                               3.93
                   .333
                                                                               3.71
                   .417
                           3.73 | 1.500 | 15.34 | 2.500
                                                             10.39 | 3.50
                                                                               3.52
                   .500
                           4.04 | 1.583 | 21.55 | 2.583
4.33 | 1.667 | 32.01 | 2.667
                                                            8.71 | 3.58
7.73 | 3.67
                                                                               3.30
                   .583
                   .667
                           4.33 | 1.667
                                            32.01 | 2.667
                                                                               3.15
                           4.66 | 1.750 | 58.37 | 2.750
                                                            6.93 | 3.75
                   .750
                                                            6.27 | 3.83
5.72 | 3.92
                           5.05 | 1.833 | 119.70 | 2.833
                                                                               2.88
                   .833
                           5.50 | 1.917 | 165.64 | 2.917
6.03 | 2.000 | 76.42 | 3.000
                                                                               2.76
                   .917
                                                            5.26 | 4.00
                                                                               2.65
                           6.03 | 2.000
                  1.000
     Unit Hyd Qpeak (cms) = .198
                               .067 (i)
     PEAK FLOW
                       (cms) =
     TIME TO PEAK (hrs) = 2.333
RUNOFF VOLUME (mm) = 13.764
TOTAL RAINFALL (mm) = 65.654
     RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| CALIB |
| NASHYD (0102) |
                       Area (ha) = 1.77 Curve Number (CN) = 60.0
Ia (mm) = 10.00 # of Linear Res.(N) = 3.00
                                                 Curve Number (CN) = 60.0
|ID= 1 DT= 5.0 min |
---- U.H. Tp(hrs)= .53
     Unit Hyd Qpeak (cms)=
                       (cms) = .048 (i)
     PEAK FLOW
                      (hrs) = 2.500
     TIME TO PEAK
                      (mm) = 13.766

(mm) = 65.654
     RUNOFF VOLUME
     TOTAL RAINFALL
                                .210
     RUNOFF COEFFICIENT =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| CALIB |
| NASHYD (0101) |
Unit Hyd Qpeak (cms)=
                                  .159
                       (cms) = .051
(hrs) = 2.250
                                  .051 (i)
     PEAK FLOW
     TIME TO PEAK
                       (mm) = 13.762

(mm) = 65.654
     RUNOFF VOLUME
     TOTAL RAINFALL
     RUNOFF COEFFICIENT = .210
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

| ADD HYD (0901) |

```
| \cdot | 1 + 2 = 3 | AREA
                                                                                    TPEAK R.V.
                                                                  OPEAK
                                                                  (cms) (hrs)
                                                      (ha)
                                                                  .048
               ID1= 1 (0102):
                                                   1.77
1.29
                                                                                                       13.77
                                                                                        2.50
                                                                                                   13.76
               + ID2= 2 (0101):
                                                                       .051
                                                                                        2.25
                   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\115
                                                                 185 - Monterra Phase 2 Natural Hazard Assessm
                                                                  \Design\Hydrology\115185 vo2\STORMS\OSCHI100.
                                              Comments: OWEN SOUND 100 YEAR 4 HOUR DURATION CHIC
| Ptotal= 71.77 mm |
  ______
                                                                           RAIN | TIME
                                               RAIN | TIME
                                                                                                            RAIN |
                                                                                                                            TIME
                                 TIME
                                               mm/hr | hrs mm/hr | hrs mm/hr | 3.08 | 1.10 7.44 | 2.10 40.41 |
                                                                                                                             hrs
                                                                                                                                       mm/hr
                                  hrs
                                              mm/hr |
                                                                                                                            3.10 5.16
                                   .10

    3.27 | 1.20
    8.67 | 2.20
    25.38 | 3.20

    3.49 | 1.30
    10.36 | 2.30
    18.12 | 3.30

    3.73 | 1.40
    12.83 | 2.40
    13.95 | 3.40

                                                                                                                                         4.73
4.37
                                   .20
                                   .30
                                   . 40
                                                                                                                                         3.79
                                               .50
                                                                                                                                            3.55
                                    .60
                                                                                                         8.10 | 3.70
                                   .70
                                                                                                                                         3.16
                                               7.09 | 3.80
6.31 | 3.90
                                   .80
                                   .90
                                                                                                                                             3.00
                                                                                                          5.67 | 4.00
                                 1.00
CALIB
| NASHYD (0103) |
                                                            (ha) = 1.87 Curve Number (CN) = 60.0
                                           Area
                                         Area (ha)= 1.87 Curve Number (CN)= 60.0
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
 U.H. Tp(hrs) = .36
                 NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                                           --- TRANSFORMED HYETOGRAPH ----
                                             RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs 3.08 | 1.083 | 7.44 | 2.083 | 40.41 | 3.08 | 3.23 | 1.167 | 8.42 | 2.167 | 28.39 | 3.17 | 3.40 | 1.250 | 9.68 | 2.250 | 21.02 | 3.25 | 3.59 | 1.333 | 11.35 | 2.333 | 16.45 | 3.33 | 3.35 | 1.35 | 2.333 | 16.45 | 3.33 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 | 3.35 |
                                 TIME
                                                                                                                                          mm/hr
                                   hrs
                                                                                                                                            5.16
                                  .083
                                  .167
                                  .250
                                                                                                                                           4.24
                                  . 333
                                               3.79 | 1.417 | 13.60 | 2.417
4.02 | 1.500 | 16.70 | 2.500
                                                                                                        13.42 | 3.42
11.28 | 3.50
                                                                                                                                            4.00
                                  .417
                                                                                                                                             3.79
                                  .500
                                               4.35 | 1.583 | 23.51 | 2.583
                                                                                                        9.44 | 3.58
                                                                                                                                           3.55
                                  .583
                                                                                                         8.37 | 3.67
7.49 | 3.75

      4.67 | 1.667
      35.01 | 2.667

      5.03 | 1.750
      64.03 | 2.750

                                                                                                                                             3.39
                                  .667
                                                                                                                                             3.24
                                  .750
                                                5.45 | 1.833 | 131.65 | 2.833
                                                                                                        6.78 | 3.83
                                  .833
                                               5.94 | 1.917 | 182.32 | 2.917 | 6.18 | 3.92 | 6.52 | 2.000 | 83.92 | 3.000 | 5.67 | 4.00
                                                                                                                                            2.97
                                             6.52 | 2.000 | 83.92 | 3.000
                                                                                                                                            2.85
                               1.000
         Unit Hyd Qpeak (cms) = .198
                                        (cms) = .081 (i)
          PEAK FLOW
         TIME TO PEAK (hrs) = 2.333
                                        (mm) = 16.506

(mm) = 71.769
          RUNOFF VOLUME
          TOTAL RAINFALL
                                                        .230
         RUNOFF COEFFICIENT =
          (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
_____
| CALIB |
| NASHYD (0102) |
                                                           (ha)= 1.77 Curve Number (CN)= 60.0
                                           Area
                                                          (mm) = 10.00
                                                                                     \# of Linear Res.(N) = 3.00
|ID= 1 DT= 5.0 min | Ia
----- U.H.
                                           U.H. Tp(hrs) = .53
         Unit Hyd Qpeak (cms)=
                                                            .128
                                                           .058 (i)
          PEAK FLOW
                                         (cms) =
                                        (hrs) = 2.500
         TIME TO PEAK
```

RUNOFF VOLUME (mm) = 16.508 TOTAL RAINFALL (mm) = 71.769 RUNOFF COEFFICIENT = .230

```
I CALTB
 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
                      _____
                                                            3.06 .113 2.33 16.51
                      ID = 3 (0901):
           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
   ______

        RAIN | TIME
        RAIN | TIME

                                       hrs
                                      1.00
                                      2.00
                                      3.00
NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
```

			TR	ANSFORMED	HYETOG	RAPH			
TIME	RAIN	ı	TIME	RAIN I	TIME	RAIN	ı	TIME	RAIN
hrs	mm/hr	i	hrs	mm/hr	hrs	mm/hr	1	hrs	mm/hr
.083	15.00	i	3.083	3.00	6.083	43.00	ĺ	9.08	13.00
.167	15.00	i	3.167	3.00	6.167	43.00	1	9.17	13.00
.250	15.00	i	3.250	3.00	6.250	43.00	1	9.25	13.00
.333	15.00	i	3.333	3.00	6.333	43.00	1	9.33	13.00
.417	15.00	1	3.417	3.00	6.417	43.00	1	9.42	13.00
.500	15.00	1	3.500	3.00	6.500	43.00	1	9.50	13.00
.583	15.00	1	3.583	3.00	6.583	43.00	1	9.58	13.00
.667	15.00	1	3.667	3.00	6.667	43.00	I	9.67	13.00
.750	15.00	1	3.750	3.00	6.750	43.00	1	9.75	13.00
.833	15.00	1	3.833	3.00	6.833	43.00	1	9.83	13.00
.917	15.00	1	3.917	3.00	6.917	43.00	1	9.92	13.00
1.000	15.00	1	4.000	3.00	7.000	43.00		10.00	13.00
1.083	20.00	1	4.083	5.00	7.083	20.00	1	10.08	13.00
1.167	20.00	1	4.167	5.00	7.167	20.00	1	10.17	13.00
1.250	20.00	1	4.250	5.00	7.250	20.00		10.25	13.00
1.333	20.00	1	4.333	5.00	7.333	20.00	1	10.33	13.00
1.417	20.00	1	4.417	5.00	7.417	20.00	1	10.42	13.00
1.500	20.00	١	4.500	5.00	7.500	20.00		10.50	13.00
1.583	20.00	1	4.583	5.00	7.583	20.00	١	10.58	13.00
1.667	20.00	1	4.667	5.00	7.667	20.00	1	10.67	13.00

```
20.00 | 10.75
                                                                       13.00
                1.750
                        20.00 | 4.833 5.00 | 7.833
                                                       20.00 | 10.83
                                                                       13.00
                1.833
                        20.00 | 4.917 | 5.00 | 7.917
                                                       20.00 | 10.92
                                                                       13.00
                1.917
                                                       20.00 | 11.00
                                         5.00 | 8.000
                                                                       13.00
                2.000
                        20.00 | 5.000
                       10.00 | 5.083 | 20.00 | 8.083
                                                       23.00 | 11.08
                                                                        8.00
                2.083
                                       20.00 | 8.167
                                                       23.00 | 11.17
                                                                        8.00
                       10.00 | 5.167
                2.167
                                                       23.00 | 11.25
                       10.00 | 5.250
                                       20.00 | 8.250
                                                                        8.00
                2.250
                       10.00 | 5.333 | 20.00 | 8.333
                                                       23.00 | 11.33
                                                                        8.00
                2.333
                                      20.00 | 8.417
                                                       23.00 | 11.42
                                                                        8.00
                2.417
                      10.00 | 5.417
                       10.00 | 5.500
                                       20.00 | 8.500
                                                       23.00 | 11.50
                                                                        8.00
                2.500
                                       20.00 | 8.583
                                                       23.00 | 11.58
                                                                        8.00
                       10.00 | 5.583
                2.583
                                       20.00 | 8.667
                                                       23.00 | 11.67
                                                                        8.00
                2.667
                      10.00 | 5.667
                      10.00 | 5.750
10.00 | 5.833
                                       20.00 | 8.750
                                                       23.00 | 11.75
                                                                        8.00
                2.750
                                                       23.00 | 11.83
                                                                        8.00
                                       20.00 | 8.833
                2.833
                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)=
                    (cms) = .121 (i)

(hrs) = 7.083
     PEAK FLOW
     TIME TO PEAK
     RUNOFF VOLUME (mm) = 95.031
TOTAL RAINFALL (mm) = 193.000
     RUNOFF COEFFICIENT = .492
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
Area (ha) = 1.77
Ia (mm) = 10.00
                                            Curve Number (CN) = 60.0
                     \# of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
                                      .53
                              .128
     Unit Hyd Qpeak (cms) =
    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.
                      Area (ha) = 1.29
Ia (mm) = 10.00
                                             Curve Number (CN) = 60.0
          (0101)
| ID= 1 DT= 5.0 min | Ia
                                            \# of Linear Res.(N)= 3.00
  ----- U.H. Tp(hrs)=
                                      .31
    Unit Hyd Qpeak (cms) =
                              .159
                               .086(i)
     PEAK FLOW
                     (cms) =
                     (hrs) = 7.000
     TIME TO PEAK
     RUNOFF VOLUME (mm) = 95.016
TOTAL RAINFALL (mm) = 193.000
     RUNOFF COEFFICIENT =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
                                                    R.V.
1 + 2 = 3
                           AREA QPEAK TPEAK
                                     (cms) (hrs) (mm)
.103 7.25 95.04
.086 7.00 95.02
       ID1= 1 (0102): 1.77 .103
+ ID2= 2 (0101): 1.29 .086
                                                       (mm)
         ID = 3 (0901): 3.06 .186 7.08 95.03
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

FINISH ______

| NASHYD

U A U A A SSSSS U U L SS U SS U U AAAAA L SS U U A A L SSSSS UUUUU A A LLLLL V V I V V I OOO TTTTT TTTTT H H Y Y M M H H Y Y MM MM O O
H H Y M M O O 0 0 \mathbf{T} T T T 000 H H

SCS - Pre

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***** DETAILED OUTPUT *****

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:

| 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

		m TN/F		DATM		m TMD		DATM		m TMT	DATM
	1				1				1		RAIN
	1				1				1		mm/hr
	1				I				1		.78
.39	1	6.50			1				1		.97
.58	1	6.75		.97	1	12.75		3.51	1	18.75	.78
.58	1	7.00		.97	1	13.00		2.73	1	19.00	.97
.58	1	7.25		1.17	1	13.25		2.53	1	19.25	.78
.39	Ī	7.50		.97	1	13.50		2.14	1	19.50	.97
.58	i	7.75		1.17	1	13.75		1.95	1	19.75	.78
	i	8.00		1.17	ì	14.00		1.56	1	20.00	.58
.78	Ĺ	8.25		1.36	İ	14.25		1.36	1	20.25	.58
	i				Ĩ	14.50		1.56	1	20.50	.58
	í.				i			1.36	1	20.75	.58
	i	9.00		1.56	i	15.00		1.56	1	21.00	.58
	i				i				i	21.25	.58
	í				i				i		.58
	i				i				i		.58
	i				i				i		.58
	1				i				i		.58
	1				i				ì		.58
	1				1				1		.58
	!				1				1		
	1								1		.58
	1				1				1		.58
	1				1				1		.58
.78	1								1	23.75	.58
.78	1	12.00		7.01	1	18.00		. 97	1		
	.58 .58 .39 .58 .78 .58 .58 .78 .58 .78 .78 .78 .78 .78	mm/hr .58 .39 .58 .58 .58 .58 .58 .58 .58 .58 .58 .58 .58 .58 .58 .58 .78 .58 .78	mm/hr hrs .58 6.25 .39 6.50 .58 7.00 .58 7.25 .39 7.50 .58 7.75 .58 8.00 .78 8.25 .58 8.75 .58 9.00 .78 9.25 .58 9.50 .58 9.75 .78 10.00 .78 10.25 .78 10.50 .78 10.50 .78 11.50 .78 11.55 .78 11.55	mm/hr hrs .58 6.25 .39 6.50 .58 6.75 .58 7.00 .58 7.25 .39 7.50 .58 7.75 .58 8.00 .78 8.25 .58 8.50 .58 8.75 .58 9.00 .78 9.25 .58 9.50 .58 9.75 .78 10.00 .78 10.25 .78 10.50 .78 10.50 .78 11.50 .78 11.50 .78 11.50 .78 11.50 .78 11.50 .78 11.75	mm/hr hrs mm/hr 58 6.25 .97 .39 6.50 .78 .58 6.75 .97 .58 7.00 .97 .58 7.50 .97 .58 7.50 .97 .58 7.75 1.17 .58 8.00 1.17 .78 8.25 1.36 .58 8.50 1.36 .58 8.75 1.36 .58 9.00 1.56 .78 9.25 1.56 .58 9.50 1.75 .58 9.75 1.75 .78 10.00 2.14 .78 10.25 2.34 .78 10.50 2.92 .78 10.75 .312 .78 11.00 4.68 .78 11.25 4.68 .78 11.50 14.42 .78 11.50 14.42 .78 11.50 14.42 .78 11.50 14.42 .78 11.50 14.42 .78 11.50 .78 .75 .78 .75 .78 .75 .78 .75 .75 .75 .75 .75 .78 11.50 .75	mm/hr hrs mm/hr .58 6.25	mm/hr hrs mm/hr hrs .58 6.25 .97 12.25 .39 6.50 .78 12.50 .58 6.75 .97 12.75 .58 7.00 .97 13.00 .58 7.25 1.17 13.25 .39 7.50 .97 13.50 .58 7.75 1.17 13.75 .58 8.00 1.17 14.00 .78 8.25 1.36 14.25 .58 8.75 1.36 14.75 .58 9.00 1.56 15.00 .78 9.25 1.56 15.50 .58 9.75 1.75 15.75 .78 10.00 2.14 16.00 .78 10.50 2.92 16.50 .78 10.75 3.12 16.75 .78 11.00 4.68 17.05 .78 11.	mm/hr hrs mm/hr hrs .58 6.25 .97 12.25 .39 6.50 .78 12.50 .58 6.75 .97 12.75 .58 7.00 .97 13.00 .58 7.25 1.17 13.25 .39 7.50 .97 13.50 .58 7.75 1.17 13.75 .58 8.00 1.17 14.00 .78 8.25 1.36 14.25 .58 8.75 1.36 14.50 .58 9.00 1.56 15.00 .78 9.25 1.56 15.00 .78 9.50 1.75 15.50 .58 9.75 1.75 15.50 .58 9.75 1.75 15.50 .78 10.00 2.14 16.00 .78 10.50 2.92 16.50 .78 10.75 3.12 16.75 .78 11.00 4.68 17.05 .78 11.50 4.68 17.25 .78 11.50 14.42 17.50 .78 11.50 59.61 17.75	mm/hr hrs nm/hr hrs n.70 .21 .58 6.75 1.00 .97 13.50 2.14 1.36	mm/hr hrs noll noll	mm/hr hrs mm/hr hrs mm/hr hrs .58 6.25 .97 12.25 7.01 18.25 .39 6.50 .78 12.50 3.70 18.50 .58 6.75 .97 12.75 3.51 18.75 .58 7.00 .97 13.00 2.73 19.00 .58 7.25 1.17 13.25 2.53 19.25 .39 7.50 .97 13.50 2.14 19.50 .58 7.75 1.17 13.75 1.95 19.75 .58 8.00 1.17 14.00 1.56 20.00 .78 8.25 1.36 14.25 1.36 20.25 .58 8.50 1.36 14.50 1.56 20.50 .58 8.75 1.36 14.75 1.36 20.75 .58 9.00 1.56 15.00 1.56 21.00 .78 9.25 1.56

| 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

The brain			TR	ANSFORME	D HYETOG	RAPH		
167 58 6.083 97 12.083 7.01 18.08 78	TIME	RAIN			TIME			
167			(A)					
1.50					· Paramondo and the			
1.333 3.9 6.333 .78 12.333 3.70 18.33 .97			CO NO. IN PROCESS NAME OF COLUMN 1					
1.500			The second second second			3.70		
1.583			50 Fig. 1995 D 1995		S reconstruction to the second control			
1.667			Si ann commercia					
1.750					· Marian Control of the Control			
1.000								
1000								
1.683			T 101 101 10110		A			
1.167						1945 W. D. 1851 F.		
1.250					8 10 9 10 0 10 10 10			
1.417	1.250					DOG 05 000 NO. 0		
1.500					D representation of recovering			
1.583			1					
1.667								
1.833							1000000 100.000000	
1.917			*C 1/20 25 500000000					
2.000 .58 8.000 1.17 14.000 1.56 20.00 .58 2.083 .78 8.167 1.36 14.083 1.36 12.008 .58 2.167 .78 8.157 1.36 14.167 1.36 20.25 .58 2.250 .78 8.250 1.36 14.250 1.36 20.25 .58 2.333 .58 8.333 1.36 14.417 1.56 20.42 .58 2.417 .58 8.417 1.36 14.407 1.56 20.50 .58 2.580 .58 8.583 1.36 14.467 1.36 20.58 .58 2.583 .58 8.667 1.36 14.467 1.36 20.67 .58 2.667 .58 8.667 1.36 14.4750 1.36 20.67 .58 2.833 .58 8.917 1.56 14.917 1.56 20.02 .58 2.833 .58 8.917 1.56 15.000 1.56 20.07 .58 2.833 .58 9.000 1.56 15.083 1.36 21.08 .58 3.083 .78 9.083 1.56 15.067 1.36 21.17 .58 3.083 .78 9.5			A contract of the contract of					
2.083								
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 14.407 1.56 20.42 .58 2.500 .58 8.500 1.36 14.500 1.56 20.50 .58 2.583 .58 8.667 1.36 14.667 1.36 20.67 .58 2.667 .58 8.667 1.36 14.750 1.36 20.67 .58 2.750 .58 8.833 1.56 14.833 1.56 20.08 .58 2.833 .58 8.937 1.56 14.917 1.56 20.09 .58 2.833 .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 9.167 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 15.417 1.56 21.50 .58 3.583 .58 9.583			8.083				•	
2.333								
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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								
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 .97 5.917 .78 11.917 7.01 17.917 .97 .97 6.000 .78 12.000 7.01 18.000 .97								
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	5.333	.78	111.333	14.41	117.333	.97		
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 .97 5.917 .78 11.917 7.01 17.917 .97 .97 6.000 .78 12.000 7.01 18.000 .97							•	
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 .97 5.917 .78 11.917 7.01 17.917 .97 .97 6.000 .78 12.000 7.01 18.000 .97								
5.750 .78 11.750 59.61 17.750 .78 23.75 .58 5.833 .78 11.833 7.02 17.833 .97 .97 5.917 .78 11.917 7.01 17.917 .97 .97 6.000 .78 12.000 7.01 18.000 .97								
5.917 .78 11.917 7.01 17.917 .97 6.000 .78 12.000 7.01 18.000 .97	5.750	.78	111.750	59.61	117.750	.78		.58
6.000 .78 12.000 7.01 18.000 .97								
			100	a mata	and the same of th		-	

Unit Hyd Qpeak (cms)= PEAK FLOW (cms)= .020 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 7.148
TOTAL RAINFALL (mm)= 48.554
RUNOFF COEFFICIENT = .147

.198

1 1

```
CALIB
                                           (ha) = 1.29 Curve Number (CN) = 60.0 (mm) = 10.00 # of Linear Res. (N) = 3.00
| NASHYD (0101) |
                                 Area
|ID= 1 DT= 5.0 min | Ia
----- U.H.
                                 U.H. Tp(hrs) = .31
       Unit Hyd Qpeak (cms)=
                                              .159
                               (cms) =
                                           .015 (i)
       PEAK FLOW
       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.
LCALTB
 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
Unit Hyd Qpeak (cms)=
                                              .128
                                             .014 (i)
       PEAK FLOW
                               (cms) =
       TIME TO PEAK
                               (hrs) = 12.250
       RUNOFF VOLUME (mm) = 7.149
TOTAL RAINFALL (mm) = 48.554
                                             7.149
       RUNOFF COEFFICIENT =
        (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
1 + 2 = 3
                                          AREA QPEAK TPEAK R.V.
           TD1= 1 (0101): 1.29 .015 11.92 7.15
+ ID2= 2 (0102): 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.
   ********
   ** SIMULATION NUMBER: 2 **
                                   Filename: I:\2015 Projects\115
MASS STORM
                                                   185 - Monterra Phase 2 Natural Hazard Assessm
                                                   \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
                                   Comments: SCS Type II 24 HR MASS CURVE
| Ptotal= 62.00 mm |
                                    Duration of storm = 23.75 \text{ hrs}
                                    Mass curve time step = 15.00 min
                                    RAIN | TIME RAIN | TIME RAIN | TIME RAIN mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
                          TIME

        mm/nr
        l
        hrs
        mm/hr
        l
        hrs
        mm/hr
        l
        hrs
        mm/hr
        l
        hrs

        .74
        l
        6.25
        1.24
        l
        12.25
        8.93
        l
        18.25

        .50
        l
        6.50
        .99
        l
        12.50
        4.71
        l
        18:50

        .74
        l
        6.75
        1.24
        l
        12.75
        4.46
        l
        18.75

        .74
        l
        7.25
        1.49
        l
        13.25
        3.22
        l
        19.00

        .74
        l
        7.50
        1.24
        l
        13.50
        2.73
        l
        19.50

        .74
        l
        7.75
        1.49
        l
        13.75
        2.48
        l
        19.75

                           hrs
                                                                                                             .99
                           .25
                           .50
                                                                                                             1.24
                            .75
                          1.00
                                                                                                             1.24
                          1.25
                                                                                                           1.24
                          1.50
                                                                                                             .99
                          1.75
                                                             1.49 | 14.00 | 1.98 | 20.00
                                                                                                             .74
                          2.00
                                      .74 | 8.00
                                      .99 | 8.25
.74 | 8.50
                                                              1.74 | 14.25
                                                                                     1.74 | 20.25
                                                                                                               .74
                          2.25
                                                                                                              .74
                                                             1.74 | 14.50 1.98 | 20.50
                          2.50
                                                          1.74 | 14.75 | 1.74 | 20.75
1.98 | 15.00 | 1.98 | 21.00
1.98 | 15.25 | 1.74 | 21.25
                                                                                                             .74
                          2.75
                                      .74 | 8.75
                                      .74 | 9.00
.99 | 9.25
                                                                                                               .74
                          3.00
                          3.25
                                                                                                             .74
                                       .74 | 9.50
                                                              3.50
                                      .74 | 9.75

    2.23 | 15.75
    1.74 | 21.75

    2.73 | 16.00
    1.24 | 22.00

                                                                                                               .74
                          3.75
                                                                                                               .74
                                       .99 | 10.00
                          4.00
                                                                                                              .74
                                       .99 | 10.25
                                                              2.98 | 16.25
                                                                                    .99 | 22.25
```

.74

.74

4.25

4.50

4.75

5.00

.99 | 10.50

.99 | 10.75

.99 | 11.00

```
      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 |
      .74
```

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

		mp:	NODODME	D HYEMOCI	74 DII		
TIME	RAIN	TIME		D HYETOGI	RAIN		RAIN
hrs		hrs		hrs	mm/hr		mm/hr
.083		6.083	1.24	12.083	8.93	18.08	.99
.167		6.167	1.24	112.167	8.93		.99
.250		6.250	1.24	112.250	8.93		.99
.333		6.333		112.333	4.71		$1.24 \\ 1.24$
.417		6.417 6.500		12.417 12.500	4.71 4.71		1.24
.500 .583		6.583		112.583	4.46		.99
.667		6.667	1.24	112.667	4.46		.99
.750		6.750		112.750	4.46		.99
.833	.74	6.833	1.24	12.833	3.47		1.24
.917		6.917		112.917	3.47		1.24
1.000		7.000	1.24	113.000	3.47		1.24
1.083		7.083		113.083	3.22 3.22		.99 .99
1.167 1.250		7.167		13.167 13.250	3.22 3.22		.99
1.333		7.230		113.230	2.73		1.24
1.417		7.417		13.417	2.73		1.24
1.500		7.500	1.24	113.500	2.73		1.24
1.583	.74	1 7.583	1.49	113.583	2.48	19.58	.99
1.667		7.667	1.49	13.667	2.48		.99
1.750		7.750	1.49	113.750	2.48		.99
1.833		7.833		13.833 13.917	1.98 1.98		.74 .74
1.917 2.000		7.917 8.000	$1.49 \\ 1.49$	114.000	1.98 1.98		.74
2.083		8.083	1.74	114.083	1.74		.74
2.167		8.167	1.74	114.167	1.74		.74
2.250		8.250		114.250	1.74	20.25	.74
2.333		8.333		114.333	1.98		.74
2.417		8.417	1.74	114.417	1.98		.74
2.500		8.500	1.74	114.500	1.98		.74 .74
2.583 2.667		8.583	$1.74 \\ 1.74$	14.583 14.667	1.74 1.74		.74
2.750		8.750	1.74	114.750	1.74		.74
2.833		8.833	1.98	14.833		20.83	.74
2.917		8.917	1.98	114.917	1.98	20.92	.74
3.000	.74	9.000	1.98	15.000		21.00	.74
3.083		9.083	1.98	115.083	1.74		.74
3.167		9.167		115.167		21.17	.74
3.250		9.250	1.98 2.23	15.250 15.333	1.74 1.98	21.25	.74 .74
3.333 3.417		9.333	2.23	115.417	1.98		.74
3.500		9.500	2.23	115.500		21.50	.74
3.583		9.583	2.23	115.583	1.74		.74
3.667	.74	9.667	2.23	15.667	1.74		.74
3.750		9.750	2.23	115.750	1.74		.74
3.833		9.833		115.833	1.24		.74
3.917		9.917		115.917	1.24	name and	.74 .74
4.000 4.083		10.000 10.083		16.000 16.083	1.24 .99		.74
4.167		110.167		116.167	.99		.74
4.250		110.250		116.250	.99	The Contract Contract	.74
4.333		110.333		116.333	1.24		.74
4.417		110.417		16.417	1.24		.74
4.500		110.500		116.500		22.50	.74
4.583		110.583		116.583	.99		.74
4.667		110.667		16.667 16.750	.99		.74 .74
4.750		110.750		116.750	.99 1.24		.74
4.833 4.917		10.833 10.917		116.917	$1.24 \mid 1.24 \mid$.74
5.000		111.000		117.000	1.24		.74
5.083	.99	111.083		117.083	.99		.74
5.167		111.167	5.95	117.167	.99	23.17	.74
5.250		111.250		117.250	.99		.74
5.333		111.333		117.333	1.24		.74
5.417		111.417		117.417	1.24		.74 .74
5.500 5.583		11.500 11.583	18.35 75.88	17.500 17.583	1.24	23.50	.74
5.563	. 99	111.000	13.00	111.000	. 22	23.30	. / 4

```
5.667
              5.750
                     .99 |11.833 8.94 |17.833
.99 |11.917 8.93 |17.917
              5.833
              5.917
                      .99 |12.000
                                  8.93 | 18.000
                                                1.24 |
              6.000
    Unit Hyd Qpeak (cms) = .198
                           .036 (i)
    PEAK FLOW
                  (cms) =
    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.
----- U.H. Tp(hrs)= .31
    Unit Hyd Qpeak (cms)=
                           .159
                         .027 (i)
    PEAK FLOW
                  (cms) =
    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
Unit Hyd Qpeak (cms)=
                           .128
                  (cms) = .025 (i)
    PEAK FLOW
    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) |
                        AREA QPEAK TPEAK R.V.
1 + 2 = 3
                        (ha) (cms) (hrs)
                                                 (mm)
       ID1= 1 (0101): 1.29 .027 11.92 12.14
+ ID2= 2 (0102): 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 **
 ********
                     Filename: I:\2015 Projects\115
I MASS STORM
                              185 - Monterra Phase 2 Natural Hazard Assessm
                              \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS
                     Comments: SCS Type II 24 HR MASS CURVE
| Ptotal= 70.90 mm |
                     Duration of storm
                                      = 23.75 \text{ hrs}
                     Mass curve time step = 15.00 min
                     RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs .85 | 6.25 | 1.42 | 12.25 | 10.21 | 18.25 .57 | 6.50 | 1.13 | 12.50 | 5.39 | 18.50
               TIME
                                                         hrs mm/hr
                hrs
                                                                1.13
                .25
                                                               1.42
                .50
                      1.13
1.42
                .75
               1.00
                                                               1.13
```

1.25

1.50

.57 | 7.50

1.42 | 13.50 3.12 | 19.50

1.42

1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 4.75 5.00 5.25 5.50 5.75 6.00	.85 7.75 .85 8.00 1.13 8.25 .85 8.50 .85 8.75 .85 9.00 1.13 9.25 .85 9.50 .85 9.75 1.13 10.25 1.13 10.50 1.13 10.75 1.13 11.00 1.13 11.25 1.13 11.50 1.13 11.50 1.13 11.75 1.13 12.00	1.70 13.75 1.70 14.00 1.99 14.25 1.99 14.50 1.99 14.75 2.27 15.00 2.27 15.25 2.55 15.50 2.55 16.00 3.40 16.25 4.25 16.50 4.54 16.75 6.81 17.00 6.81 17.25 20.99 17.50 86.78 17.75 10.21 18.00	2.84 19.75 2.27 20.00 1.99 20.25 2.27 20.50 1.99 20.75 2.27 21.00 1.99 21.25 2.27 21.50 1.99 21.75 1.42 22.00 1.13 22.25 1.42 22.50 1.13 22.75 1.42 23.00 1.13 23.25 1.42 23.50 1.13 23.75 1.42	1.13 .85 .85 .85 .85 .85 .85 .85 .85 .85 .85
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NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TR	ANSFORME	D HYETOG	RAPH	-	
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	112.083	10.21		1.13
.167	.85	6.167	1.42	112.167	10.21		1.13
.250	.85	6.250	1.42	112.250	10.21		1.13
.333	.57	6.333	1.13	112.333	5.39		1.42
.417	.57	6.417	1.13	112.417	5.39		1.42
.500	.57	6.500	1.13	112.500	5.39	telescope appropriate section	1.42
.583		6.583	1.42	112.583	5.10	Access to the second se	1.13
. 667	.85	1 6.667	1.42	112.667	5.10		1.13
.750	.85	6.750	1.42	112.750	5.10		1.13
.833	.85	6.833	1.42	112.833	3.97		1.42
.917	.85	6.917	1.42	112.917		18.92	1.42 1.42
1.000	.85	7.000	1.42	113.000		19.00	1.42
1.083	.85	7.083	1.70	113.083		19.08 19.17	1.13
1.167	.85	7.167	1.70 1.70	113.167		19.25	1.13
1.250	.85 .57	7.250 7.333	1.42	13.250 13.333		19.33	1.42
1.333	.57	Frank Names and	1.42	13.333		19.42	1.42
1.417 1.500	.57	7.417	1.42	113.417		19.50	1.42
1.583	.85	7.583	1.70	113.583		19.58	1.13
1.667	.85	7.667	1.70	13.667		19.67	1.13
1.750	.85	7.750	1.70	13.750		19.75	1.13
1.833	.85	7.833	1.70	113.833		19.83	.85
1.917	.85	7.917	1.70	113.917		19.92	.85
2.000	.85	8.000	1.70	14.000		20.00	.85
2.083	1.13	8.083	1.99	114.083	1.99	20.08	.85
2.167	1.13	8.167	1.99	114.167	1.99	20.17	.85
2.250	1.13	8.250	1.99	114.250	1.99	20.25	.85
2.333	.85	8.333	1.99	114.333	2.27	20.33	.85
2.417	.85	8.417	1.99	114.417	2.27	20.42	.85
2.500	.85	8.500	1.99	114.500	2.27	20.50	.85
2.583	.85	8.583	1.99	114.583		20.58	.85
2.667	.85	8.667	1.99	114.667		20.67	.85
2.750	.85	8.750	1.99	114.750		20.75	.85
2.833	.85	8.833	2.27	114.833		20.83	.85
2.917	.85	8.917	2.27	114.917		20.92	.85
3.000	.85	1 9.000	2.27	115.000		21.00	.85
3.083	1.13	9.083	2.27	115.083		21.08	.85
3.167	1.13	9.167	2.27	115.167		21.17	.85 .85
3.250	1.13	9.250	2.27	15.250		21.25	.85
3.333	.85	9.333	2.55	115.333		21.33	.85
3.417	.85	9.417	2.55	115.417		· Committee to topological	.85
3.500	:85	9.500	2.55	115.500		1 2 3 4 5 5	.85
3.583	.85	9.583	2.55 2.55	15.583 15.667		21.58	.85
3.667	.85	9.667	2.55	115.750		21.75	.85
3.750	.85	9.750	3.12	115.833		21.73	.85
3.833	1.13 1.13	9.833	3.12	115.917		21.92	.85
3.917	1.13	10.000	3.12	116.000		22.00	.85
4.000 4.083	1.13	110.000	3.40	116.083		22.08	.85
4.063	1.13	110.167	3.40	116.167		22.17	.85
4.250	1.13	110.250	3.40	116.250		22.25	.85
4.230	1.13	110.333	4.25	116.333		22.33	.85
4.333	1.13	110.417	4.25	116.417		22.42	.85
7.411	1.10	120.327		'		5 51-5	ese di

```
.85
                                       4.25 | 16.500
                                                        1.42 | 22.50
                4.500
                         1.13 | 10.500
                         1.13 | 22.58
                4.583
                                                        1.13 | 22.67
                                                                           .85
                         1.13 | 10.667
                                         4.54 | 16.667
                4.667
                         1.13 | 10.750 4.54 | 16.750
                                                        1.13 | 22.75
                                                                           .85
                4.750
                                                        1.42 | 22.83
1.42 | 22.92
                         1.13 |10.833 6.81 |16.833
                                                                           .85
                4.833
                                                                           .85
                                         6.81 | 16.917
                4.917
                         1.13 | 10.917
                         1.13 | 11.000 6.81 | 17.000
                                                        1.42 | 23.00
                5.000
                        1.13 | 23.08
                                                                           .85
                5.083
                                                         1.13 | 23.17
                                                                           .85
                5.167
                                                         1.13 | 23.25
                5.250
                                                                           .85
                                                        1.42 | 23.33
                         1.13 | 11.333 20.99 | 17.333
                5.333
                         1.13 | 11.417 | 20.99 | 17.417
1.13 | 11.500 | 20.99 | 17.500
                                                         1.42 | 23.42
                                                                           .85
                         1.13 | 11.417
                5.417
                                                        1.42 | 23.50
                5.500
                                                                           . 85
                         1.13 | 11.583 86.78 | 17.583
                                                        1.13 | 23.58
                                                                          .85
                5.583
                                       86.78 | 17.667
86.78 | 17.750
                                                         1.13 | 23.67
                                                                           .85
                5.667
                        1.13 |11.667
                                                         1.13 | 23.75
                                                                           .85
                5.750
                         1.13 | 11.750
                                       10.22 | 17.833
                                                        1.42 |
                         1.13 |11.833
                5.833
                                                        1.42 |
1.42 |
                                       10.21 | 17.917
10.21 | 18.000
                5.917
                         1.13 | 11.917
                       1.13 | 12.000
                6.000
     Unit Hyd Qpeak (cms) =
                             .198
                     (cms) =
     PEAK FLOW
                               .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.
                      Area (ha) = 1.29
Ia (mm) = 10.00
                                             Curve Number (CN) = 60.0 # of Linear Res.(N) = 3.00
 NASHYD (0101)
|ID= 1 DT= 5.0 min |
                     U.H. Tp(hrs) = .31
______
                              .159
     Unit Hyd Qpeak (cms) =
     PEAK FLOW
                      (cms) =
                               .037 (i)
     TIME TO PEAK (hrs) = 11.917
RUNOFF VOLUME (mm) = 16.005
TOTAL RAINFALL (mm) = 70.687
     RUNOFF COEFFICIENT =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
I 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
 CALIB | NASHYD (0102) |
     Unit Hyd Qpeak (cms)=
                               .128
                      (cms) = .034 (i)
     PEAK FLOW
     TIME TO PEAK
                     (hrs) = 12.250
                     (mm) = 16.010

(mm) = 70.687
     RUNOFF VOLUME
     TOTAL RAINFALL
     RUNOFF COEFFICIENT =
                              .226
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
       1 + 2 = 3
          12.00 16.01
                            3.06 .067
          ID = 3 (0901):
     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 Duration of storm = 23.75 hrs Mass curve time step = 15.00 min

m T. (D	DATM		m TMP	DATM		OL T ME	RAIN	ī	TIME	RAIN
TIME	RAIN	1	TIME	RAIN	1	TIME	0.00	1	hrs	mm/hr
hrs	mm/hr	!	hrs	mm/hr	1	hrs	mm/hr	1		1.31
. 25	. 98	1	6.25	1.64	1	12.25	11.81	1	18.25	
.50	.66	1	6.50	1.31	1	12.50	6.23	1	18.50	1.64
.75	. 98	1	6.75	1.64	1	12.75	5.90	ļ	18.75	1.31
1.00	. 98	1	7.00	1.64	1	13.00	4.59	1	19.00	1.64
1.25	. 98	1	7.25	1.97	1	13.25	4.26	1	19.25	1.31
1.50	. 66	1	7.50	1.64		13.50	3.61	1	19.50	1.64
1.75	.98	1	7.75	1.97	1	13.75	3.28	١	19.75	1.31
2.00	. 98	1	8.00	1.97	1	14.00	2.62	1	20.00	. 98
2.25	1.31	1	8.25	2.30	1	14.25	2.30	1	20.25	. 98
2.50	.98	1	8.50	2.30	1	14.50	2.62		20.50	.98
2.75	.98	1	8.75	2.30	1	14.75	2.30	1	20.75	.98
3.00	.98	1	9.00	2.62	1	15.00	2.62	1	21.00	.98
3.25	1.31	1	9.25	2.62	1	15.25	2.30		21.25	.98
3.50	. 98	1	9.50	2.95	1	15.50	2.62	1	21.50	.98
3.75	. 98	1	9.75	2.95	1	15.75	2.30	1	21.75	.98
4.00	1.31	i	10.00	3.61	1	16.00	1.64	1	22.00	.98
4.25	1.31	i	10.25	3.94	Î	16.25	1.31	1	22.25	.98
4.50	1.31	i	10.50	4.92	i	16.50	1.64	1	22.50	.98
4.75	1.31	i	10.75	5.25	i	16.75	1.31	1	22.75	.98
5.00	1.31	i	11.00	7.87	i	17.00	1.64	i	23.00	.98
5.25	1.31	i	11.25	7.87	i	17.25	1.31	i	23.25	.98
5.50	1.31	ì	11.50	24.27	i	17.50	1.64	i	23.50	.98
5.75	1.31	ì	11.75	100.37	i	17.75	1.31	i	23.75	.98
6.00	1.31	1	12.00	11.81	ì	18.00	1.64	i		• • • •
0.00	1.01	ı	12.00	11.01		20.00	1.01	•		

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

		ФЪ	V NIC EUDME	ים אעדיים	RAPH	_	
TIME	RAIN			I TIME	RAIN		RAIN
hrs		hrs	mm/hr	hrs		hrs	mm/hr
.083	.98	6.083	1.64	112.083	11.81	1 18.08	1.31
.167		6.167	1.64	112.167		1 18.17	1.31
.250		6.250	1.64	112.250		18.25	1.31
.333		6.333	1.31	112.333		18.33	1.64
.417	.66	6.417	1.31	112.417		18.42	1.64
.500	.66	6.500	1.31	112.500	6.23		1.64
.583		6.583	1.64	112.583	5.90		1.31
.667	.98	6.667	1.64	112.667		1 18.67	1.31
.750	.98	6.750	1.64	112.750		18.75	1.31
.833		1 6.833	1.64	112.833	4.59		1.64
.917	Date of the last o	6.917	1.64	112.917		18.92	1.64
1.000		7.000	1.64	113.000		19.00	1.64
1.083	.98	7.083	1.97	113.083	4.26		1.31
1.167		7.167	1.97	13.167	4.26		1.31
1.250		7.250	1.97	113.250	4.26		1.31
1.333		7.333	1.64	113.333		1 19.33	1.64
1.417		7.417	1.64	13.417		19.42	1.64
1.500		7.500	1.64	113.500		19.50	1.64
1.583		7.583	1.97	113.583		1 19.58	1.31
1.667		7.667	1.97	113.667	3.28	1 19.67	1.31
1.750		1 7.750	1.97	113.750	3.28	1 19.75	1.31
1.833		7.833	1.97	113.833	2.62	19.83	. 98
1.917		7.917	1.97	113.917	2.62	1 19.92	. 98
2.000	.98	8.000	1.97	114.000	2.62	1 20.00	.98
2.083	1.31	8.083	2.30	114.083	2.30	1 20.08	.98
2.167	1.31	8.167	2.30	114.167	2.30	20.17	.98
2.250	1.31	8.250	2.30	114.250	2.30	20.25	.98
2.333	.98	8.333	2.30	114.333	2.62	1 20.33	. 98
2.417	.98	8.417	2.30	114.417	2.62	20.42	.98
2.500	.98	8.500	2.30	114.500	2.62	20.50	.98
2.583	.98	8.583	2.30	114.583	2.30	20.58	.98
2.667	.98	8.667	2.30	114.667	2.30	20.67	.98
2.750	.98	8.750	2.30	114.750	2.30	20.75	.98
2.833	.98	8.833	2.62	114.833		20.83	.98
2.917	.98	8.917	2.62	114.917	2.62	20.92	.98
3.000	.98	9.000	2.62	115.000		21.00	.98
3.083	1.31	9.083	2.62	115.083	2.30	21.08	. 98
3.167	1.31	9.167	2.62	115.167		21.17	.98
3.250	1.31	9.250	2.62	115.250	2.30	21.25	. 98

```
.98 | 9.333
                                      2.95 | 15.333
                                                     2.62 | 21.33
                                                                       .98
                3.333
                                                       2.62 | 21.42
                                                                       .98
                                       2.95 | 15.417
                3.417
                         .98 | 9.417
                3.500
                         .98 | 9.500
                                       2.95 | 15.500
                                                       2.62 | 21.50
                                                                       .98
                         .98 | 9.583
                                                       2.30 | 21.58
                                     2.95 | 15.583
                3.583
                                                                       .98
                3.667
                         .98 | 9.667
                                      2.95 | 15.667
                                                      2.30 | 21.67
                                                       2.30 | 21.75
                         .98 | 9.750
                                       2.95 | 15.750
                                                                       .98
                3.750
                        1.31 | 9.833
                                     3.61 | 15.833
                                                       1.64 | 21.83
                3.833
                        .98
                3.917
                                                      1.64 | 21.92
                                                       1.64 | 22.00
                                                                       .98
                4.000
                                                      1.31 | 22.08
                                                                       .98
                4.083
                        1.31 | 10.083
                                                                       .98
                        1.31 | 10.167
                                     3.94 | 16.167
                                                      1.31 | 22.17
                4.167
                        1.31 |10.250 3.94 |16.250
1.31 |10.333 4.92 |16.333
                4.250
                                                      1.31 | 22.25
                                                                       .98
                                                       1.64 | 22.33
                4.333
                        1.64 | 22.42
                                                                       .98
                4.417
                        1.64 | 22.50
                                                                       .98
                4.500
                                                                       .98
                                                       1.31 | 22.58
                4.583
                                                                       .98
                                                      1.31 | 22.67
                4.667
                        1.31 | 10.750 5.25 | 16.750 1.31 | 10.833 7.87 | 16.833
                                                      1.31 | 22.75
                                                                       .98
                4.750
                                                       1.64 | 22.83
                                                                       .98
                4.833
                        1.64 | 22.92
                4.917
                                                     1.64 | 23.00
                                                                       .98
                5.000
                        1.31 | 11.000 7.87 | 17.000
                        1.31 | 23.08
                                                                       .98
                5.083
                                                       1.31 | 23.17
                5.167
                                                                       .98
                        1.31 | 11.250 7.87 | 17.250
                                                     1.31 | 23.25
                5.250
                        1.64 | 23.33
                                                                       .98
                5.333
                                      24.27 | 17.417
                                                      1.64 | 23.42
                5.417
                        1.31 | 11.417
                                                     1.64 | 23.50
                        1.31 | 11.500
                                     24.27 | 17.500
                                                                       .98
                5.500
                        1.31 | 23.58
                                                                       .98
                5.583
                                                                       .98
                5.667
                        1.31 | 11.667
                                                       1.31 | 23.67
                                                     1.31 | 23.75
                        1.31 | 11.750 100.37 | 17.750
                                                                       .98
                5.750
                                     11.82 | 17.833
                                                       1.64 |
                5.833
                        1.31 |11.833
                                      11.81 | 17.917
                5.917
                        1.31 | 11.917
                                                       1.64
                                     11.81 | 18.000
                                                     1.64 |
                6.000
                        1.31 | 12.000
     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 =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
 NASHYD (0101)
| NASHYD (0101) | Area (ha) = 1.29
|ID= 1 DT= 5.0 min | Ia (mm) = 10.00
                                           Curve Number (CN) = 60.0
                                           \# of Linear Res.(N)= 3.00
                     U.H. Tp(hrs)=
    Unit Hyd Qpeak (cms)=
                            .159
                     (cms) = .050 (i)
     PEAK FLOW
                    (hrs) = 11.917
     TIME TO PEAK
                    (mm) = 21.348

(mm) = 81.754
     RUNOFF VOLUME
     TOTAL RAINFALL
     RUNOFF COEFFICIENT =
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
                    Area (ha) = 1.77
Ia (mm) = 10.00
                                           Curve Number (CN) = 60.0
| NASHYD (0102) |
\# of Linear Res.(N)= 3.00
                                     .53
    Unit Hyd Qpeak (cms)=
                             .128
    PEAK FLOW
                    (cms) =
                              .046(i)
                    (hrs) = 12.167

(mm) = 21.354
    TIME TO PEAK
     RUNOFF VOLUME
                     (mm) = 81.754
    TOTAL RAINFALL
    RUNOFF COEFFICIENT
                              .261
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| ADD HYD (0901) |
                                           TPEAK
| 1 + 2 = 3 |
                            AREA
                                    QPEAK
```

(hrs)

11.92

(mm)

21.35

(ha)

1.29

ID1 = 1 (0101):

(cms)

.050

I CALTB

| CALIB

```
+ 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

Comments: SCS Type II 24 HR MASS CURVE | Ptotal= 90.30 mm |

> Duration of storm = 23.75 hrsMass curve time step = 15.00 min

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	5.50	1.44	11.50	26.73	hrs 12.25 12.50 12.75 13.00 13.25 13.50 13.75 14.00 14.25 14.50 14.75 15.00 15.25 15.50 16.75 16.00 16.25 16.75 17.00 17.25 17.50	1.81		23.50	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 1.08	5.75	1.44	11.75	110.53	17.75	1.44	1		

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.

	_	TR	ANSFORME	ED HYETOG	RAPH		
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	112.083	13.00	18.08	1.44
.167	1.08	6.167	1.81	112.167	13.00	18.17	1.44
.250	1.08	6.250	1.81	112.250	13.00	18.25	1.44
.333	.72	6.333	1.44	112.333	6.86	18.33	1.81
.417	.72	6.417	1.44	112.417	6.86	18.42	1.81
.500	.72	6.500	1.44	112.500	6.86	18.50	1.81
.583	1.08	6.583	1.81	112.583	6.50	18.58	1.44
.667	1.08	6.667	1.81	112.667	6.50	18.67	1.44
.750	1.08	6.750	1.81	112.750	6.50	18.75	1.44
.833	1.08	6.833	1.81	112.833	5.06	18.83	1.81
.917	1.08	6.917	1.81	112.917	5.06	18.92	1.81
1.000	1.08	7.000	1.81	113.000	5.06	19.00	1.81
1.083	1.08	7.083	2.17	113.083	4.70	19.08	1.44
1.167	1.08	7.167	2.17				
1.250	1.08	7.250	2.17				
1.333	.72	7.333	1.81				
1.417	.72	7.417	1.81	113.417	3.97	19.42	
1.500	.72	7.500	1.81	113.500	3.97		
1.583	1.08	7.583	2.17	113.583	3.61	19.58	
1.667	1.08	7.667	2.17	113.667	3.61	19.67	
1.750	1.08	7.750	2.17	113.750	3.61		
1.833	1.08	7.833	2.17	13.833	2.89	19.83	
1.917	1.08	7.917	2.17	113.917	2.89	19.92	
2.000	1.08	8.000	2.17	114.000	2.89	20.00	1.08
2.083	1.44	8.083	2.53	114.083	2.53	20.08	1.08
1.167 1.250 1.333 1.417 1.500 1.583 1.667 1.750 1.833 1.917 2.000	1.08 1.08 .72 .72 .72 .72 1.08 1.08 1.08 1.08 1.08	7.167 7.250 7.333 7.417 7.500 7.583 7.667 7.750 7.833 7.917 8.000	2.17 2.17 1.81 1.81 2.17 2.17 2.17 2.17 2.17 2.17	13.167 13.250 13.333 13.417 13.500 13.583 13.667 13.750 13.833 13.917 14.000	4.70 4.70 3.97 3.97 3.97 3.61 3.61 2.89 2.89	19.17 19.25 19.33 19.42 19.50 19.58 19.67 19.75 19.83 19.92 20.00	1.44 1.81 1.81 1.81 1.44 1.44 1.08 1.08

```
2.53 | 20.17
                                                                         1.08
                2.167
                         1.44 | 8.167
                                         2.53 | 14.167
                         1.44 | 8.250
                                                         2.53 | 20.25
                                         2.53 | 14.250
                                                                          1.08
                2.250
                                                        2.89 | 20.33
                                         2.53 | 14.333
                                                                         1.08
                2.333
                         1.08 | 8.333
                                       2.53 | 14.417
                                                        2.89 | 20.42
                                                                         1.08
                2.417
                         1.08 | 8.417
                                         2.53 |14.500
                                                         2.89 | 20.50
                                                                          1.08
                2.500
                         1.08 | 8.500
                                                         2.53 | 20.58
                                                                          1.08
                2.583
                         1.08 | 8.583
                                         2.53 | 14.583
                                       2.53 | 14.667
                                                         2.53 | 20.67
                                                                          1.08
                2.667
                         1.08 | 8.667
                                       2.53 |14.750
                                                         2.53 | 20.75
                                                                          1.08
                2.750
                         1.08 | 8.750
                         1.08 | 8.833
                                         2.89 | 14.833
                                                          2.89 | 20.83
                                                                          1.08
                2.833
                                       2.89 |14.917
                         1.08 | 8.917
                                                          2.89 | 20.92
                                                                          1.08
                2.917
                                       2.89 | 15.000
                                                         2.89 | 21.00
                                                                          1.08
                3.000
                         1.08 | 9.000
                                         2.89 | 15.083
                                                          2.53 | 21.08
                                                                          1.08
                3.083
                         1.44 | 9.083
                                       2.89 | 15.167
                                                          2.53 | 21.17
                                                                          1.08
                3.167
                         1.44 | 9.167
                3.250
                                                                          1.08
                         1.44 | 9.250
                                       2.89 | 15.250
                                                          2.53 | 21.25
                3.333
                                                          2.89 | 21.33
                                                                          1.08
                         1.08 | 9.333
                                         3.25 | 15.333
                                         3.25 | 15.417
                                                          2.89 | 21.42
                                                                          1.08
                3.417
                         1.08 \mid 9.417
                         1.08 | 9.500 3.25 | 15.500
                                                         2.89 | 21.50
                                                                          1.08
                3.500
                                       3.25 | 15.583
                         1.08 | 9.583
                                                         2.53 | 21.58
                                                                          1.08
                3.583
                                                         2.53 | 21.67
                3.667
                                         3.25 | 15.667
                                                                          1.08
                         1.08 | 9.667
                         1.08 | 9.750 3.25 | 15.750
                                                         2.53 | 21.75
                                                                          1.08
                3.750
                         1.44 | 9.833 | 3.97 | 15.833
                                                         1.81 | 21.83
                                                                          1.08
                3.833
                                                         1.81 | 21.92
                         1.44 | 9.917
                                         3.97 | 15.917
                                                                          1.08
                3.917
                         1.44 | 10.000 3.97 | 16.000
                                                        1.81 | 22.00
                                                                          1.08
                4.000
                                                        1.44 | 22.08
                         1.08
                4.083
                                                         1.44 | 22.17
                                         4.33 | 16.167
                                                                          1.08
                4.167
                         1.44 | 10.167
                         1.44 | 10.250 4.33 | 16.250
                                                        1.44 | 22.25
                                                                          1.08
                4.250
                                                                          1.08
                         1.44 | 10.333 | 5.42 | 16.333
                                                        1.81 | 22.33
                4.333
                                         5.42 | 16.417
                                                         1.81 | 22.42
                                                                          1.08
                4.417
                         1.44 | 10.417
                                       5.42 | 16.500
                         1.44 | 10.500
                                                         1.81 | 22.50
                                                                          1.08
                4.500
                         1.44 | 10.583 5.78 | 16.583
                                                        1.44 | 22.58
                                                                          1.08
                4.583
                4.667
                         1.44 | 10.667
                                         5.78 | 16.667
                                                         1.44 | 22.67
                                                                          1.08
                                       5.78 |16.750
                                                        1.44 | 22.75
                                                                          1.08
                         1.44 | 10.750
                4.750
                4.833
                                                                          1.08
                         1.44 | 10.833 8.67 | 16.833
                                                        1.81 | 22.83
                                                         1.81 | 22.92
                                                                          1.08
                4.917
                         1.44 | 10.917
                                         8.67 | 16.917
                         1.44 | 10.917 | 8.67 | 16.917 | 1.44 | 11.000 | 8.67 | 17.000
                                                         1.81 | 23.00
                                                                          1.08
                5.000
                                                        1.44 | 23.08
                                                                          1.08
                5.083
                         1.44 | 11.083 8.67 | 17.083
                5.167
                                         8.67 | 17.167
                                                         1.44 | 23.17
                         1.44 | 11.167
                                       8.67 | 17.250
                                                         1.44 | 23.25
                                                                          1.08
                5.250
                         1.44 | 11.250
                5.333
                         1.44 | 11.333
                                       26.73 | 17.333
                                                        1.81 | 23.33
                                                                          1.08
                         1.44 | 11.417
                                                                          1.08
                                        26.73 | 17.417
                                                         1.81 | 23.42
                5.417
                                        26.73 | 17.500
                                                         1.81 | 23.50
                                                                          1.08
                5.500
                         1.44 | 11.500
                         1.44 | 11.583 | 110.52 | 17.583
                                                        1.44 | 23.58
                                                                         1.08
                5.583
                                       110.53 | 17.667
                                                         1.44 | 23.67
                                                                          1.08
                5.667
                         1.44 | 11.667
                         1.44 | 11.750 | 110.53 | 17.750
                                                          1.44 | 23.75
                                                                         1.08
                5.750
                                       13.01 | 17.833
                                                        1.81 |
                5.833
                         1.44 | 11.833
                                        13.00 | 17.917
                                                          1.81
                5.917
                         1.44 | 11.917
                                       13.00 | 18.000
                6.000
                         1.44 | 12.000
                                                         1.81
                               .198
     Unit Hyd Qpeak (cms)=
                               .079 (i)
                     (cms) =
                     (hrs) = 12.000
     TIME TO PEAK
                     (mm) = 25.679
(mm) = 90.029
     RUNOFF VOLUME
     TOTAL RAINFALL
     RUNOFF COEFFICIENT =
                               .285
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| CALIB |
| NASHYD (0101) |
                      Area (ha) = 1.29
Ia (mm) = 10.00
                                              Curve Number (CN) = 60.0
                                              \# of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
                      U.H. Tp(hrs) =
                                      .31
     Unit Hyd Qpeak (cms)=
                               .159
                             .061 (i)
     PEAK FLOW
                     (cms) =
                     (hrs) = 11.917
     TIME TO PEAK
     RUNOFF VOLUME
                      (mm) = 25.675
     TOTAL RAINFALL (mm) = 90.029
     RUNOFF COEFFICIENT =
```

```
(0102) I
                     Area (ha) = 1.77
Ia (mm) = 10.00
                                             Curve Number (CN) = 60.0
INASHYD
                                           \# of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |
                     U.H. Tp(hrs) =
                                      .53
    Unit Hyd Qpeak (cms)=
                              .128
                  (cms) =
                              .056(i)
    PEAK FLOW
```

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

PEAK FLOW

```
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.

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| MASS STORM | F

Filename: I:\2015 Projects\115
185 - Monterra Phase 2 Natural Hazard Assessm
\Design\Hydrology\115185 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	1	TIME	RAIN	1	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	ĺ	hrs	mm/hr	1	hrs	mm/hr	1	hrs	mm/hr
.25	1.18	Ī	6.25	1.97	1	12.25	14.18	1	18.25	1.58
.50	.79	1	6.50	1.58	1	12.50	7.49	1	18.50	1.97
.75	1.18	İ	6.75	1.97	1	12.75	7.09	1	18.75	1.58
1.00	1.18	1	7.00	1.97	1	13.00	5.52	1	19.00	1.97
1.25	1.18	i	7.25	2.36	1	13.25	5.12	1	19.25	1.58
1.50	.79	1	7.50	1.97	1	13.50	4.33	1	19.50	1.97
1.75	1.18	i	7.75	2.36	1	13.75	3.94	1	19.75	1.58
2.00	1.18	İ	8.00	2.36	1	14.00	3.15	1	20.00	1.18
2.25	1.58	1	8.25	2.76	1	14.25	2.76	1	20.25	1.18
2.50	1.18	1	8.50	2.76	1	14.50	3.15	1	20.50	1.18
2.75	1.18	1	8.75	2.76	1	14.75	2.76	1	20.75	1.18
3.00	1.18	Í	9.00	3.15	1	15.00	3.15	1	21.00	1.18
3.25	1.58	ĺ	9.25	3.15	1	15.25	2.76	1	21.25	1.18
3.50	1.18	1	9.50	3.55	1	15.50	3.15	1	21.50	1.18
3.75	1.18	1	9.75	3.55	1	15.75	2.76	1	21.75	1.18
4.00	1.58	i	10.00	4.33	1	16.00	1.97	1	22.00	1.18
4.25	1.58	i	10.25	4.73	1	16.25	1.58	1	22.25	1.18
4.50	1.58	1	10.50	5.91	1	16.50	1.97	1	22.50	1.18
4.75	1.58	i	10.75	6.30	1	16.75	1.58	1	22.75	1.18
5.00	1.58	Ī	11.00	9.46	1	17.00	1.97	1	23.00	1.18
5.25	1.58	1	11.25	9.46	١	17.25	1.58	1	23.25	1.18
5.50	1.58	1	11.50	29.16	1	17.50	1.97	1	23.50	1.18
5.75	1.58	i	11.75	120.56	ĺ	17.75	1.58	1	23.75	1.18
6.00	1.58	1	12.00	14.18	İ	18.00	1.97	1		

U.H. Tp(hrs) = .36

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

		15	TF	RANSFORME	ED HYETOG	GRAPH		
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.083	1.18	1	6.083	1.97	112.083	14.18	18.08	1.58
.167	1.18	1	6.167	1.97	112.167	14.18	18.17	1.58
.250	1.18	1	6.250	1.97	112.250	14.18	18.25	1.58
.333	.79	1	6.333	1.58	112.333	7.49	18.33	1.97
.417	.79	ĺ	6.417	1.58	112.417	7.49	18.42	1.97
.500	.79	ĺ	6.500	1.58	112.500	7.49	18.50	1.97
.583	1.18	ĺ	6.583	1.97	112.583	7.09	18.58	1.58
.667	1.18	1	6.667	1.97	112.667	7.09	18.67	1.58
.750	1.18	Ī	6.750	1.97	112.750	7.09	18.75	1.58
.833	1.18	1	6.833	1.97	112.833	5.52	18.83	1.97
.917	1.18	Ī	6.917	1.97	112.917	5.52	18.92	1.97

```
5.52 | 19.00
1.000
         1.18 | 7.000
                          1.97 | 13.000
                                                           1.97
                          2.36 | 13.083
                                          5.12 | 19.08
1.083
        1.18 | 7.083
         1.18 | 7.167
                          2.36 | 13.167
                                           5.12 | 19.17
                                                           1.58
1.167
                                           5.12 | 19.25
1.250
         1.18 | 7.250
                          2.36 | 13.250
                                                           1.58
         .79 | 7.333
                                           4.33 | 19.33
1.333
                          1.97 | 13.333
                                                           1.97
          .79 | 7.417
                          1.97 | 13.417
                                          4.33 | 19.42
                                                            1.97
1.417
1.500
          .79 | 7.500
                          1.97 | 13.500
                                           4.33 | 19.50
                                                            1.97
         1.18 | 7.583
                          2.36 | 13.583
                                           3.94 | 19.58
                                                           1.58
1.583
                                           3.94 | 19.67
                                                           1.58
1.667
         1.18 | 7.667
                          2.36 | 13.667
                                           3.94 | 19.75
1.750
         1.18 | 7.750
                          2.36 | 13.750
         1.18 | 7.833
                          2.36 | 13.833
                                           3.15 | 19.83
                                                           1.18
1.833
1.917
         1.18 | 7.917
                          2.36 | 13.917
                                           3.15 | 19.92
                                                           1.18
         1.18 | 8.000
2.000
                          2.36 | 14.000
                                           3.15 | 20.00
                                                            1.18
                          2.76 | 14.083
                                           2.76 | 20.08
                                                           1.18
2.083
         1.58 | 8.083
                          2.76 | 14.167
                                           2.76 | 20.17
2.167
         1.58 | 8.167
                                                           1.18
2.250
         1.58 | 8.250
                          2.76 |14.250
                                           2.76 | 20.25
                                                           1.18
                                           3.15 | 20.33
2.333
         1.18 | 8.333
                          2.76 | 14.333
                                                           1.18
                          2.76 | 14.417
2.417
         1.18 | 8.417
                                           3.15 | 20.42
                                                           1.18
                          2.76 |14.500
                                           3.15 | 20.50
         1.18 | 8.500
                                                           1.18
2.500
         1.18 | 8.583
                          2.76 | 14.583
                                           2.76 | 20.58
                                                            1.18
2.583
         1.18 | 8.667
                          2.76 | 14.667
                                           2.76 | 20.67
                                                           1.18
2.667
                                           2.76 | 20.75
2.750
         1.18 | 8.750
                          2.76 | 14.750
                                                           1.18
                          3.15 | 14.833
                                           3.15 | 20.83
2.833
         1.18 | 8.833
         1.18 | 8.917
                          3.15 | 14.917
                                           3.15 | 20.92
                                                           1.18
2.917
                                                          1.18
                                           3.15 | 21.00
3.000
         1.18 | 9.000
                          3.15 | 15.000
                          3.15 | 15.083
                                           2.76 | 21.08
3.083
         1.58 | 9.083
                                                            1.18
                          3.15 | 15.167
                                           2.76 | 21.17
                                                          1.18
         1.58 | 9.167
3.167
         1.58 | 9.250
3.250
                          3.15 | 15.250
                                           2.76 | 21.25
                                                           1.18
         1.18 | 9.333
3.333
                          3.55 | 15.333
                                           3.15 | 21.33
                                                            1.18
                          3.55 | 15.417
                                           3.15 | 21.42
                                                           1.18
3.417
         1.18 | 9.417
         1.18 | 9.500
                          3.55 | 15.500
                                           3.15 | 21.50
3.500
                                                          1.18
         1.18 | 9.583
3.583
                          3.55 | 15.583
                                           2.76 | 21.58
                                                            1.18
                                                           1.18
                                           2.76 | 21.67
3.667
         1.18 | 9.667
                          3.55 | 15.667
         1.18 | 9.750
                          3.55 | 15.750
                                           2.76 | 21.75
3.750
         1.58 | 9.833
                          4.33 | 15.833
                                           1.97 | 21.83
3.833
                                                            1.18
                                           1.97 | 21.92
                                                           1.18
         1.58 | 9.917
3.917
                          4.33 | 15.917
                          4.33 | 16.000
                                          1.97 | 22.00
4.000
         1.58 | 10.000
         1.58 | 10.083
                          4.73 | 16.083
                                           1.58 | 22.08
                                                            1.18
4.083
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
                                           1.97 | 22.33
                          5.91 | 16.333
         1.58 | 10.333
                                                            1.18
4.333
                                           1.97 | 22.42
         1.58 | 10.417
                          5.91 | 16.417
                                                            1.18
4.417
         1.58 | 10.500
                          5.91 | 16.500
                                          1.97 | 22.50
                                                           1.18
4.500
                                           1.58 | 22.58
         1.58 | 10.583
                          6.30 | 16.583
                                                            1.18
4.583
         1.58 | 10.667
                          6.30 | 16.667
                                           1.58 | 22.67
                                                            1.18
4.667
         1.58 | 10.750
                          6.30 | 16.750
                                          1.58 | 22.75
                                                           1.18
4.750
                                          1.97 | 22.83
         1.58 | 10.833
                          9.46 | 16.833
                                                            1.18
4.833
4.917
         1.58 | 10.917
                          9.46 | 16.917
                                           1.97 | 22.92
                                                            1.18
         1.58 | 11.000
                          9.46 | 17.000
                                          1.97 | 23.00
                                                           1.18
5.000
                          9.46 | 17.083
                                           1.58 | 23.08
5.083
         1.58 | 11.083
                                                            1.18
5.167
         1.58 | 11.167
                          9.46 | 17.167
                                           1.58 | 23.17
                                                            1.18
                          9.46 | 17.250
                                           1.58 | 23.25
                                                           1.18
         1.58 | 11.250
5.250
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
                         29.16 | 17.500
                                          1.97 | 23.50
                                                            1.18
         1.58 | 11.500
5.500
                                          1.58 | 23.58
5.583
         1.58 | 11.583 | 120.56 | 17.583
                                                           1.18
         1.58 | 11.667
                        120.56 | 17.667
                                           1.58 | 23.67
                                                            1.18
5.667
         1.58 | 11.750
                        120.56 | 17.750
                                          1.58 | 23.75
                                                           1.18
5.750
5.833
         1.58 | 11.833
                        14.20 | 17.833
                                          1.97 |
         1.58 | 11.917
                         14.18 | 17.917
                                           1.97 |
5.917
                        14.18 | 18.000
                                          1.97 |
6.000
         1.58 | 12.000
               .198
```

```
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

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

.308

```
(ha) = 1.29 Curve Number (CN) = 60.0
| NASHYD (0101) |
                     Area
|ID= 1 DT= 5.0 min |
                     Ia
                             (mm) = 10.00
                                          \# of Linear Res.(N)= 3.00
                                   .31
                     U.H. Tp(hrs) =
______
                             .159
    Unit Hyd Qpeak (cms)=
                             .072(i)
    PEAK FLOW
                    (cms) =
                    (hrs) = 11.917
    TIME TO PEAK
    RUNOFF VOLUME
                    (mm) =
                           30.199
    TOTAL RAINFALL
                   (mm) =
                           98.205
```

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

CALIB | NASHYD (0102) | Curve Number (CN) = 60.0# of Linear Res.(N)= 3.00 Unit Hyd Qpeak (cms)= .128 (cms) = .066 (i)PEAK FLOW TIME TO PEAK (hrs) = 12.167RUNOFF VOLUME (mm) = 30.207 TOTAL RAINFALL (mm) = 98.205 RUNOFF VOLUME RUNOFF COEFFICIENT = .308 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

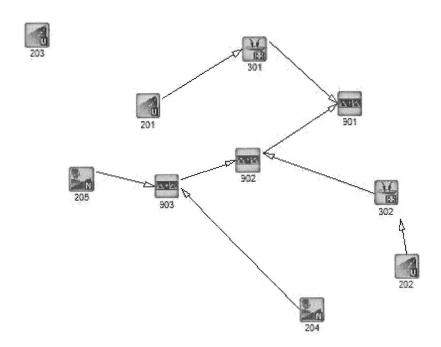
```
| ADD HYD (0901) |
1 + 2 = 3
  ______
   ID = 3 (0901): 3.06 .130 12.00 30.20
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

Appendix C: Proposed Conditions Hydrologic Analysis

Proposed Conditions OTTHYMO Model Schematic





Project:	Monterra Phase 2	Date:	Sept 11, 2017
File No.:	115185	Designed:	AO
Subject:	% Impervious Calculator	Checked	

Approximate House Footprint Approximate Impervious Area per lc 250 m^2 330 m^2

Catchment	Area (m²)	No. Houses/ Driveways/Patio	Road Area (m²)	Total Impervious Area (m²)	% Impervious	% Directly 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					
Total	47,990					



C.C. Tatham & Associates Ltd. Consulting Engineers

Barrie

Orillia

Bracebridge

Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By:	АО
Checked By:	
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISTING CONDITIONS

201 Catchment

1.925 ha Area

	Average CN for Soil	Type	82.33	0	0	0	0	82.3
	MF	CN	20	#N/A	#N/A	#N/A	#N/A	
	Wetland/Lakes/SWMF	Percent	0					00.00
	Wetlar	Area	0	0	0	0	0	00.00
		CN	100	#N/A	#N/A	#N/A	#N/A	
	Impervious	Percent	0.43					0.43
	_	Area	0.828	0	0	0	0	0.83
		CN	74	#N/A	#N/A	#N/A	#N/A	
	Cultivated	Percent	0					00.0
	ប៊	Area Percent	0	0	0	0	0	00.00
		S	92	#N/A	#N/A	#N/A	#N/A	
	Meadows	Percent	0					0.00
	4	Area	0	0	0	0	0	0.00
_		CN	69	#N/A	#N/A	#N/A	#N/A	
WEIGHTED CN VALUE	Pasture/Lawns	Percent	0.57					0.67
SHTED C	Pas	Area	1.097	0	0	0	0	1.10
WEIC	70	CN	09	#N/A	#N/A	#N/A	#N/A	
	Forest/Woodland	Percent						00.00
	Fore	Area	0	0	0	0	0	00.0
	Soll .	Percent	-					1.00
	Catchment Soil Characteristics	Area	1.925	0	0	0	0	1.925
	Runoff	Type	2	#N/A	#N/A	#N/A	#N/A	Totals
	Soil Texture		Sand Loam	#N/A	#N/A	#N/A	#N/A	
	Hydrologic	droip iloo	8	#N/A	#N/A	#N/A	#N/A	
	Soll Series		GRANBY	#N/A	#N/A	#N/A	#N/A	
	Soil Series		Ğ					

Colonistions	Calculations	
Concentration	2	
*	5	
L		

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

For Runoff Coefficients less than 0.4

Maximum Catchment Elevation

Airport Method

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Shoe Catchment Area

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

Time to Peak

190 m 188 m 200 m 1% 1.925 ha

Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area 10.68 0.18 0.12

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

24.52 0.41 0.27

Soil Series Forest/Woodland
Cultivated
Pasture/Lawn
Impervious
Wetland/Lake/S/WMF
Meadows
Soil Series Total Landuse Type

Lawns Impervious Wetlands

Runoff Coefficient

190 m 188 m 200 m 1% 1.925 ha

3.7 mm

Initial Abstraction

C.C. Tatham & Associates Ltd. Orillia Bracebridge Consulting Engineers Collingwood

Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By:	AO
Checked By:	ž
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

Barrie

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

202 Catchment

1.136 ha

Area

Soil Series

Percent	nt Area Percent CN	Area Percent	CN Area Percent	NO
	1 0 60	0.693 0.61	0 69	65
	A/N# 0	0	0 W/W	#N/A
	0 #N/A	0	#N/A 0	#N/A
	W/N# 0	0	#N/A 0	#N/A
	0 #N/A	0	#N/A 0	#N/A
1.00	00'0 0'00 0	0.69 0.61	0.00 0.00	

Woods	Meadows	Cultivated	Lawns	Impervious	Wetlands
3.8 mm					
ostraction					

For Runoff Coefficients less than 0.4

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Time of Concentration Calculations

Maximum Catchment Elevation Minimum Catchment Elevation

Catchment length Catchment Slope Catchment Area

Airport Method

6N #N/A #N/A #N/A #N/A

#N/A #N/A #N/A

#N/A #N/A #N/A

Impervious

Cultivated

WEIGHTED ON VALUE

CN Area 74 0.443

00.0

 Runoff Coefficient 0.54			eqvT estibue		Forest/Woodland	Cultivated	Pasture/Lawn	Impervious	Wetland/Lake/SWMF	Meadows	Soil Series Total	
188.65 m	188 m	65 m	1%	1.136 ha		14.68	0.24	0.16				
Maximum Catchment Elevation	Minimum Catchment Elevation	Catchment length	Catchment Slope	Catchment Area		Time of Concentration (Minutes)	Time of Concentration (Hours)	Time to Peak (2/3 x Time of Concentration)				

3.66 0.06 0.04

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

0.04 hrs

Time to Peak

188.65 m 188 m 65 m 1.136 ha

Soil Series



Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By:	AO
Checked By:	
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

Barrie

Orillia

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

203 Catchment

0.5 ha

Area

	Average CN for Soil		75.82	0	0	0	0	75.8
	NMF	NO	20	#N/A	#N/A	#N/A	#N/A	
	Lakes/S	Percent	0					000
	Wetland/Lakes/SWMF	Area P	0	0	0	0	0	000
		888	100	#N/A	#N/A	#N/A	#N/A	
	Impervious	Percent	0.22	#	#	#	#	0 22
	lmp	Area Pı	0.11	0	0	0	0	0 44
		CN	74	#N/A	#N/A	#N/A	#N/A	
	Cultivated	Percent	0	*	**	7+	#	000
	Cu	Area P	0	0	0	0	0	000
		CN	65	#N/A	#N/A	#N/A	#N/A	
	Meadows	Percent		71-	71-	7		000
	Me	Area Pe	0	0	0	0	0	000
		CN	69	#N/A	#N/A	#N/A	#N/A	
VALUE	asture/Lawns	Percent	0.78	#	#	#	#	04.0
WEIGHTED ON VALUE	Pastu	Area Pe	0.39	0	0	0	0	200
WEIGH		CN	09	#N/A	#N/A	#N/A	#N/A	
	Forest/Woodland	Percent		7*	**	7*	17-	
	Forest	Area Pe	0	0	0	0	0	000
	= 9		-		<u> </u>			2007
	Catchment Soil Characteristics	Percent	0.5	0	0	0	0	
		Area						
	Runoff	Type	2	#N/A	#N/A	#N/A	#N/A	
	Soil Texture		Sand Loam	#N/A	A/N#	#N/A	#N/A	
	Hydrologio	dnois iloc	В	#N/A	#N/A	#N/A	#N/A	
	Soil Series		GRANBY	A/N#	#N/A	#N/A	#N/A	
	Soil Series		Gf					***************************************

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

For Runoff Coefficients less than 0.4

Airport Method

Bransby-Williams Formula

Maximum Catchment Elevation Minimum Catchment Elevation

Catchment length Catchment Slope Catchment Area

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

Time to Peak

188.6 m 188 m 30 m 2% 0.5 ha 1.60 0.03 0.02

Time of Concentration (Minutes)
Time of Concentration (Hours)
Time to Peak (2/3 x Time of Concentration) Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

9.55

188.6 m 188 m 30 m 2% 0.5 ha

Lawns Impervious Wetlands

4.3 mm

Initial Abstraction

Soil Series Forest/Woodland
Cultivated
Pasture/Lawn
Impervious
Wetland/Lake/S/WMF
Meadows
Soil Series Total Landuse Type



	Project:	Monterra Phase II
	File No.:	115185
-td.	Date:	September 8, 2017
	Designed By: AO	AO
Barrie	Checked By:	
	Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

204 Catchment

0.162 ha

Area

-	Average CN for Soil	Type	69	0	0	0	0	69.0
s/SWMF	NMF	S	20	#N/A	W/N#	W/N#	#N/A	
	Wetland/Lakes/SWMF	Percent	0					00.0
WEIGHTED CN VALUE PasturaLawns Meadows Cultivated Impervious Wetland	Wetland	Area P	0	0	0	0	0	00.00
		CN	100	#N/A	#N/A	#N/A	#N/A	
	ervions	Percent						0.00
	Imp	Area Pr	0	0	0	0	0	0.00
		CN	74	#N/A	#N/A	#N/A	#N/A	
	Itivated	Percent	0	*	71	7*	7*	0.00
	D.	Area P	0	0	0	0	0	00.0
		CN	65	#N/A	#N/A	#N/A	#N/A	
	swope	Percent			*	11-		0.00
	Me	Area Pe	0	0	0	0	0	00 0
		CN A	69	#N/A	#N/A	#N/A	#N/A	
	Lawns	Percent (1.00	#	#	#	#	1 00
	Area Per	0.162	0	0	0	0	0.16	
			60 0.1	A/	A	¥.	/A	
	nt Soil Forest/Woodland	int CN		A/N#	W/N#	A/N#	A/N#	000
		Percent	0	0	0	0	0	
		Area	1					1 00 0 000
		Percent						,
	Catchment Soil Characteristics	Area	0.162	0	0	0	0	0 162
Hydrologic Soil Taxture Coefficient		Type	2	Ą	Ą	4	Ą	
	Run	7		W/N#	W/N#	W/N#	W/N#	Totale
	Fexture		me	#N/A	#N/A	#N/A	#N/A	
		Sand Loam	#	#	#	#		
	dinois iii		#N/A	#N/A	#N/A	#N/A		
)	æ					
	Soil Series		GRANBY	A/N#	A/N#	#N/A	W/N#	
	Soil Series		٥					
	Soils		ğ					

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4 Bransby-Williams Formula

For Runoff Coefficients less than 0.4

Airport Method

189.1 m 188 m 110 m 1% 0.162 ha

189.1 m 188 m 110 m 1% 0.162 ha

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

7.52 0.13 0.08

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

Time to Peak

Time of Concentration (Minutes)
Time of Concentration (Hours)
Time to Peak (2/3 x Time of Concentration) Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

28.04 0.47 0.31

Woods
Meadows
Cultivated
Lawns
Impervious
Wetlands

5.0 mm

Initial Abstraction

		(J)	Soil Series	S	
Carl Confeed	ß	0	0	0	0
Landuse 1 ype	2	#N/A	#N/A	#N/A	#N/A
orest/Woodland	0.25	#N/A	W/N#	#N/A	#N/A
ultivated	0.35	#N/A	W/N#	#N/A	W/N#
asture/Lawn	0.28	#N/A	#N/A	#N/A	W/N#
npervious	0.95	#N/A	W/N#	#N/A	#N/A
Vetland/Lake/SWMF	0.05	W/N#	W/N#	#N/A	W/N#
feadows	0.27	#N/A	W/N#	#N/A	W/N#
oil Series Total	0.28	#N/A	W/N#	#N/A	#N/A



Project:	Monterra Phase II
File No.:	115185
Date:	September 8, 2017
Designed By:	AO
Checked By:	
Subject:	CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK

Barrie

CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

POST-DEVELOPMENT CONDITIONS

205 Catchment

0.446 ha Area

	Average CN for Soil	Type	69	0	0	0	0	69.0
		S	20	#N/A	#N/A	#N/A	#N/A	
WEIGHTED CN VALUE Pasture/Lawrs Meadows Cultivated Impervious Wetland/Lakes/SWMF	d/Lakes/SV		0					00.00
	Wetlan	Area Percent	0	0	0	0	0	00.00
		ON	100	#N/A	#N/A	#N/A	#N/A	
	pervious	Percent						0.00
	-	Area Percent	0	0	0	0	0	00.0
		CN	74	#N/A	#N/A	#N/A	#N/A	
	Sultivated	Area Percent	0					00.0
	Ü	Area	0	0	0	0	0	00.0
		CN	65	#N/A	#N/A	#N/A	#N/A	
	Aeadows	Percent						0000
	4	Area	0	0	0	0	0	00 0
		CN	69	#N/A	#N/A	#N/A	#N/A	
	ture/Lawns	Percent	1.00					1 00
HTED CI	Pas	Area	0.446	0	0	0	0	0.45
WEIG	9	S	09	#N/A	#N/A	#N/A	#N/A	
	Forest/Woodland	Percent						000
	Fores	Area	0	0	0	0	0	000
	oil	+	-					4 00
	Catchment Soil Characteristics	a Pe	446	0	0	0	0	0.448
			0.					
	Runoff	Type		#N/A	#N/A	#N/A	#N/A	Totale
	Soil Texture		Sand Loam	#N/A	#W/A	#N/A	#N/A	
	Hydrologic	dnois iloc	8	A/N#	W/N#	#N/A	#N/A	
	Soll Series		GRANBY	A/N#	#N/A	#N/A	#N/A	
	Soil Series		ğ					

For Runoff Coefficients greater than 0.4 Time of Concentration Calculations

Bransby-Williams Formula

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area

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

Time to Peak

Maximum Catchment Elevation Minimum Catchment Elevation Catchment length Catchment Slope Catchment Area 189.48 m 188 m 148 m 1% 0.446 ha 9.15

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

32.52 0.54 0.36

189.48 m 188 m 148 m 1% 0.446 ha

5.0 mm

Initial Abstraction

Soil Series Forest/Woodland
Cultivated
Pastural-Lawn
Impervious
Wetland/Lake/SWMF
Meadows
Soil Series Total Landuse Type

Chicago - Post SSSSS U SS A A U U \mathbf{L} V V U AAAAA L Т SS U V V Ι SS U U A A L SSSSS UUUUU A A LLLLL VV Ι 000 TTTTT TTTTT Η H Y Y M0 0 H Y Y MM MM O O M M M O O Τ \mathbf{T} Η Т T Η Η Y 000

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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 CHI.out Summary filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Post Development CHI.sum

DATE: 9/20/2017 TIME: 9:13:58 AM

USER:

COMMENTS:

| 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	1	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	1	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	1	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	1	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	1	3.90	1.26
1.00	2.50	2.00	26.96	3.00	2.22	1	4.00	1.20

CALIB				
STANDHYD (0203) ID= 1 DT= 5.0 min	100000000000000000000000000000000000000	,	Dir. Conn.(%)=	5.00
	-	1 1 1		

		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.

			TF	RANSFORMED	HYETOG	RAPH	-		
TIME	RAIN	1	TIME	RAIN	TIME	RAIN		TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr		hrs	mm/hr
.083	1.29	1	1.083	2.81	2.083	13.05	1	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	1.333	4.08	2.333	5.69		3.33	1.72
.417	1.55	1	1.417	4.79	2.417	4.74		3.42	1.63

```
5.77 | 2.500
7.86 | 2.583
              .500
                       1.63 | 1.500
                                                            4.06 | 3.50
                       1.75 | 1.583
                                                          3.47 | 3.58
              .583
                                                          3.12 | 3.67 1.40
2.83 | 3.75 1.35
2.59 | 3.83 1.30
                                                                              1.40
1.35
                                       11.39 | 2.667
              .667
                     1.86 | 1.667
                       1.99 | 1.750
                                        20.61 | 2.750
              .750
                                       20.61 | 2.730 44.73 | 2.833
                       2.14 | 1.833
              .833
                                                                              1.25
1.20
                     2.31 | 1.917 | 63.46 | 2.917
2.50 | 2.000 | 26.96 | 3.000
                                                           2.39 | 3.92
2.22 | 4.00
              .917
             1.000
                                               10.66
Max.Eff.Inten.(mm/hr)=
                                63.46
                             5.00
1.49 (ii)
5.00
over (min)
Storage Coeff. (min) =
                                               20.00
                                              18.77 (ii)
Unit Hyd. Tpeak (min) =
                                               20.00
Unit Hyd. peak (cms)=
                                 .33
                                                               *TOTALS*
                                  .00
                                                 .01
                                                                 .008 (iii)
PEAK FLOW
                  (cms) =
                 (hrs)=
                                              2.17 5.27
                                1.92
                                                                   2.17
TIME TO PEAK
                              23.97
24.97
RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) =
                                                                   6.18
                                               24.97
                                                                 24.97
                                 .96
                                                 .21
                                                                   .25
RUNOFF COEFFICIENT =
```

**** 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) ID= 1 DT= 5.0 min				= 17.00
Surface Area Dep. Storage Average Slope Length Mannings n	(mm) = (%) = (m) =	IMPERVIOUS .44 1.00 1.00 65.00 .013	.69 3.80 2.00 40.00	
Max.Eff.Inten.(n over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME	(min) (min) = (min) = (cms) = (cms) = (hrs) =	5.00 2.37 (iii 5.00 .30 .03 1.92	20.00 15.77 (ii) 20.00 .07	*TOTALS* .040 (iii) 1.92 10.26
TOTAL RAINFALL RUNOFF COEFFICIE			24.97	24.97

**** 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.

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

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

		-	T	RANSFORMED)	HYETOG	RAPH	-		
TIME	RAIN		TIME	RAIN		TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr		hrs	mm/hr		hrs	mm/hr
.167	1.32	I	1.167	2.97		2.167	11.21		3.17	1.98
.333	1.44	1	1.333	3.82		2.333	6.40	1	3.33	1.76
.500	1.59	١	1.500	5.28		2.500	4.40	1	3.50	1.59
.667	1.81		1.667	9.62		2.667	3.29	1	3.67	1.43
.833	2.07	1	1.833	32.67		2.833	2.71		3.83	1.32
1.000	2.40	l	2.000	45.21		3.000	2.30		4.00	1.22

```
(cms) = .003 (i)
       PEAK FLOW
       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.
                 (0204) | Area (ha)= .16 Curve Number (CN)= 69.0
0.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= .31
INASHYD
|ID= 1 DT=10.0 min |
       Unit Hyd Qpeak (cms)=
                                             .020
                                               .001 (i)
       PEAK FLOW
                              (cms) =
                              (cms) = .001

(hrs) = 2.167

(mm) = 2.956
       TIME TO PEAK
       RUNOFF VOLUME
       TOTAL RAINFALL (mm) = 24.971
       RUNOFF COEFFICIENT =
        (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
I CALTB
| STANDHYD (0201) |
                                 Area (ha) = 1.92
                                 Total Imp(%) = 43.00 Dir. Conn.(%) = 18.00
|ID= 1 DT= 5.0 min |
                                             IMPERVIOUS PERVIOUS (i)
       Dep. Storage (mm) =
Average Slope (%)
                                            .83 1.10
1.00 3.70
1.00 2.00
                               (%) =
(m) =
                                  (%) = 1.00

(m) = 200.00

= .013
       Length
                                                                     40.00
       Mannings n
             NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                               --- TRANSFORMED HYETOGRAPH ----
                                 RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs 1.29 | 1.083 | 2.81 | 2.083 | 13.05 | 3.08
                          TIME
                                                                                                           mm/hr
                          hrs
                          .083

    .167
    1.35 | 1.167
    3.14 | 2.167

    .250
    1.41 | 1.250
    3.55 | 2.250

    .333
    1.48 | 1.333
    4.08 | 2.333

                                                                                   9.36 | 3.17
7.10 | 3.25
5.69 | 3.33
                                                                                                               1.92
                                                                                                              1.81
                                   1.55 | 1.417 | 4.79 | 2.417
1.63 | 1.500 | 5.77 | 2.500
1.75 | 1.583 | 7.86 | 2.583
                                                                                    4.74 | 3.42
4.06 | 3.50
                                                                                                              1.63
1.55
                          .417
                          .500
                                                                                   3.47 | 3.58 | 1.46

3.12 | 3.67 | 1.40

2.83 | 3.75 | 1.35

2.59 | 3.83 | 1.30

2.39 | 3.92 | 1.25

2.22 | 4.00 | 1.20
                          .583
                         2.31 | 1.917 | 63.46 | 2.917
2.50 | 2.000 | 26.96 | 3.000
                          .917
                        1.000
       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

This Hyd. Toeak (come) = 22 .06
                                                                      .06
                                                    .22
       Unit Hyd. peak (cms) =
                                                                                          *TOTALS*
                                                                        .04
                                                                                            .065 (iii)
       PEAK FLOW
                                                    .05
                               (cms) =

      PEAK FLOW
      (cms) =
      .05

      TIME TO PEAK
      (hrs) =
      1.92

      RUNOFF VOLUME
      (mm) =
      23.97

      TOTAL RAINFALL
      (mm) =
      24.97

                                                                 2.17
8.20
24.97
                                                                                               1.92
                                                                                             11.04
                                                                                           24.97
       RUNOFF COEFFICIENT =
**** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
                    YOU SHOULD CONSIDER SPLITTING THE AREA.
```

Unit Hyd Qpeak (cms)=

.047

(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 |

```
STORAGE
                            OUTFLOW STORAGE | OUTFLOW
| DT= 5.0 min |
                                                        (cms)
                                                                       (ha.m.)
                               (cms)
                                          (ha.m.)
                                           .0000
                                                       .0054
                                                                       .0654
                                 .0000
                                 .0011
                                                                        .0828
                                            .0102 | .1153
                                 .0021
                                                                           .0921
                                            .0158 | .2258
.0218 | .3706
                                 .0027
                                                                           .1017
                                 .0033
                                 .0037
                                             .0281 | .5506
                                                                          .1117
                                 .0041 .0349 | .7671
.0045 .0420 | 1.0214
.0048 .0494 | 1.3149
.0051 .0572 | .0000
                                                                         .1220
                                                                           .1327
                                                                         .1438
                                                                           .0000
                                                 QPEAK TPEAK (cms) (hrs) .040 1.92 .002 4.08
                                       AREA
                                                                              (mm)
10.26
                                       (ha)
                                  1.136
1.136
                                               .040
      INFLOW : ID= 2 (0202)
      OUTFLOW: ID= 1 (0302)
                       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 QPEAK
1 + 2 = 3
                                                     TPEAK R.V.
                                                       (hrs)
                                 (ha) (cms)
                                                                   (mm)
         TD1= 1 (0205): .45 .003 2.33 2.96
+ TD2= 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) |
  IN= 2---> OUT= 1 |
                                         STORAGE | OUTFLOW STORAGE
| DT= 5.0 min |
                              OUTFLOW

        STORAGE
        OUTFLOW
        STORAGE

        (ha.m.)
        (cms)
        (ha.m.)

        .0000
        .0707
        .077

        .0052
        .1232
        .085

        .0108
        .2290
        .094

        .0233
        .3811
        .103

        .0302
        .5760
        .112

        .0376
        .8126
        .121

        .0453
        1.0915
        .130

        .0531
        1.4134
        .139

        .0611
        1.7793
        .148

        .0692
        .0000
        .0000

                               (cms)
                                                                       .0775
                                 .0000
                                 .0010
                                                                          .0944
                                 .0020
                                                                           .1031
                                 .0030
                                                                          .1120
                                 .0040
                                                                         .1210
.1301
.1394
.1488
                                 .0164
                                 .0392
                                 .0602
                                 .0639
                                 .0674
                                                                            .0000
                                               QPEAK TPEAK (cms) (hrs) .065 1.92
                                      AREA
                                                                           R.V.
                                                                           (mm)
11.04
                                       (ha)
                                                  .065
                                 1.925
     INFLOW: ID= 2 (0201)
                                    1.925
                                                                  4.25
                                                                                10.35
      OUTFLOW: ID= 1 (0301)
                              FLOW REDUCTION [Qout/Qin](%) = 4.08
                       PEAK
                       TIME SHIFT OF PEAK FLOW (min)=140.00
                       MAXIMUM STORAGE USED
                                                           (ha.m.) = .0190
| ADD HYD (0902) |
                                AREA QPEAK (ha) (cms) 1.14 .002
                                                               R.V.
(mm)
9.27
 1 + 2 = 3
                                                       TPEAK
                                                       (hrs)
                               1.14 .002
.61 .004
          ID1= 1 (0302):
                                                       4.08
         + ID2= 2 (0903):
                                                        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) |
                                                       TPEAK R.V. (hrs) (mm) 2.33 7.07
1 + 2 = 3
                                  AREA QPEAK
         TD1= 1 (0902): 1.74 .006
+ ID2= 2 (0301): 1.92 .003
                                                       4.25 10.35
            ______
           ID = 3 (0901):
                                 3.67 .008
                                                       2.33
                                                                 8.79
```

READ STORM | Filename: I:\2015 Projects\115 185 - Monterra Phase 2 Natural Hazard Assessm $\verb|\Design\Hydrology\115185| vo2\STORMS\OSCHI2.4H|$ Comments: OWEN SOUND 2 YEAR 4 HOUR DURATION CHICAG | Ptotal= 33.75 mm | TIME RAIN | TIME RAIN | TIME RAIN | TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | The state of the 17.64 | 3.10 11.41 | 3.20 8.39 | 3.30 2.75 2.55 .10 .20 2.38 .30 6.63 | 3.40 5.49 | 3.50 4.69 | 3.60 2.23 .40 .50 1.98 .60 2.56 | 1.70 | 16.59 | 2.70 2.78 | 1.80 | 35.38 | 2.80 3.05 | 1.90 | 98.09 | 2.90 3.38 | 2.00 | 36.45 | 3.00 4.10 | 3.70 1.88 3.65 | 3.80 1.78 3.29 | 3.90 1.70 1.88 .70 .80 .90 1.00 2.99 | 4.00

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.

		- TRANSFORM	ED	HYETOGI	RAPH	-	
TIME	RAIN T	IME RAIN	1	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs mm/hr		hrs	mm/hr	hrs	mm/hr
.083	1.75 1.	083 3.80	1	2.083	17.64	3.08	2.75
.167	1.82 1.	167 4.24	1	2.167	12.66	3.17	2.59
.250	1.91 1.	250 4.79	1	2.250	9.60	3.25	2.45
.333	2.00 1.	333 5.52	1	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	1	2.500	5.49	3.50	2.09
.583	2.37 1.	583 10.63	1	2.583	4.69	3.58	1.98
.667	2.52 1.	667 15.40	1	2.667	4.22	3.67	1.90
.750	2.69 1.	750 27.86	Ì	2.750	3.83	3.75	1.82
.833	2.89 1.	833 60.46	1	2.833	3.51	3.83	1.75
.917	3.12 1.	917 85.76	1	2.917	3.23	3.92	1.69
1.000	3.38 2.	000 36.45	1	3.000	2.99	4.00	1.63

Max.Eff.Inten.(r over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	(min) (min) =	85.76 5.00 1.32 5.00 .33	22.86 15.00 (ii) 14.06 15.00 .08	(ii) *TOTALS*	
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 COEFFICE	ENT =	.97	.28	.32	

***** 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.

```
| STANDHYD (0202) | Area (ha)= 1.14
|ID=x 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
|ID= 1 DT= 5.0 min |
 _____
                                           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
                                                                    .250
       Mannings n
                                                 .013
       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
       Unit Hyd. peak (cms)=
                                                  .31
                                                                                     *TOTALS*

      PEAK FLOW
      (cms) =
      .04
      .05

      TIME TO PEAK
      (hrs) =
      1.92
      2.08

      RUNOFF VOLUME
      (mm) =
      32.75
      12.82

      TOTAL RAINFALL
      (mm) =
      33.76
      33.76

      RUNOFF COEFFICIENT
      =
      .97
      38

                                                                                    .067 (iii)
1.92
                                                                                      16.21
                                                                                       33.76
***** 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.
NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.
                                             --- TRANSFORMED HYETOGRAPH ----
                        hrs mm/hr
                                                                                                           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 =
       (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)=
                              (cms) = .003 (i)
       PEAK FLOW
       TIME TO PEAK (hrs) = 2.167
RUNOFF VOLUME (mm) = 5.752
TOTAL RAINFALL (mm) = 33.755
       RUNOFF COEFFICIENT =
       (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
                               Area (ha)= 1.92
Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
```

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

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

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

		TRA	ANSFORMED H	IYETOGRAE	2H		
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs n	mm/hr	hrs	mm/hr
.083	1.75	1.083	3.80 2	2.083	17.64	3.08	2.75
.167	1.82	1.167	4.24 2	1.167	12.66	3.17	2.59
.250	1.91	1.250	4.79 2	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	2.500	5.49	3.50	2.09
.583	2.37	1.583	10.63 2	2.583	4.69	3.58	1.98
.667	2.52	1.667	15.40 2	2.667	4.22	3.67	1.90
.750	2.69	1.750	27.86 2	2.750	3.83	3.75	1.82
.833	2.89	1.833	60.46 2	2.833	3.51	3.83	1.75
.917	3.12	1.917	85.76 2	2.917	3.23	3.92	1.69
1.000	3.38	2.000	36.45 3	3.000	2.99	4.00	1.63
Max.Eff.Inten.(m		85.76	45.				
over	4	5.00	15.				
		4.12	(ii) 13.	and the second			
Unit Hyd. Tpeak		5.00	15.				
Unit Hyd. peak	(cms) =	.24		08	1	T 0 1	
					*TOTA		x.
	(cms)=	.07		08		11 (iii)
	(hrs)=	1.92		08		92	
RUNOFF VOLUME	(mm) =	32.75	13.		17.		
TOTAL RAINFALL	(mm) =	33.76	33.		33.		
RUNOFF COEFFICIE	NT =	.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.

- 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	1	OUTFLOW	STORAGE	
	(cms)	(ha.m.)		(cms)	(ha.m.)	
	.0000	.0000	1	.0054	.0654	
	.0011	.0049	1	.0393	.0739	
	.0021	.0102	1	.1153	.0828	
	.0027	.0158	1	.2258	.0921	
	.0033	.0218	1	.3706	.1017	
	.0037	.0281	1	.5506	.1117	
	.0041	.0349	1	.7671	.1220	
	.0045	.0420		1.0214	.1327	
	.0048	.0494	1	1.3149		
	.0051	.0572	1	.0000	.0000	
	P	REA	QPEAK	TPEA	K R.V.	
	(ha)	(cms)	(hrs) (mm)	
INFLOW : ID= 2 (0)	202) 1.	136	.067	1.9	2 16.21	
OUTFLOW: ID= 1 (0)	302) 1.	136	.003	4.0	8 15.22	
PEAI	K FLOW F	REDUCTION	[Qout	/Qin](%)=	4.12	
TIM	E SHIFT OF E	EAK FLOW		(min) = 13	0.00	
MAX	IMUM STORAG			(ha.m.) =		

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

```
| RESERVOIR (0301) |
 IN= 2---> OUT= 1 |
                                               (ha.m.) | (cms)

.0000 | .0707

.0052 | .1232

.0108 | .2290

.0233 | .3811

.0302 | .5760

.0376 | .8126
                                  OUTFLOW STORAGE | OUTFLOW STORAGE
| DT= 5.0 min |
                                               (ha.m.)
                                                                                (ha.m.)
                                  (cms)
                                                                                   .0775
                                     .0000
                                                                                     .0859
                                     .0010
                                                                                   .0059
.0944
.1031
.1120
.1210
                                     .0020
                                     .0030
                                     .0040
                                     .0040 .0302 | .8126
.0164 .0376 | .8126
.0392 .0453 | 1.0915
.0602 .0531 | 1.4134
.0639 .0611 | 1.7793
.0674 .0692 | .0000
                                                                                     .1394
                                                                                     .1488
                                         AREA QPEAK TPEAK (ha) (cms) (hrs) 1.925 .111 1.92
                                                                           TPEAK
                                                                                            R.V.
                                                                                            (mm)
                                                                           (hrs)
1.92
      INFLOW : ID= 2 (0201)
                                                                                            16.61
      OUTFLOW: ID= 1 (0301)
                                          1.925
                                                           .004
                                                                            4.17
                                 FLOW REDUCTION [Qout/Qin](%)= 3.58
                          PEAK
                          TIME SHIFT OF PEAK FLOW (min)=135.00
                                                                   (ha.m.) = .0301
                          MAXIMUM STORAGE USED
| ADD HYD (0902) |
          1 + 2 = 3
              ______
             ID = 3 (0902): 1.74 .011 2.33 11.92
      NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
                                       AREA QPEAK TPEAK (ha) (cms) (hrs)
                                                                         R.V. (mm)
 1 + 2 = 3
______
          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 **
  ********
                             Filename: I:\2015 Projects\115
     READ STORM |
                                               185 - Monterra Phase 2 Natural Hazard Assessm
                                               \Design\Hydrology\115185 vo2\STORMS\OSCHI5.4H
                             Comments: OWEN SOUND 5 YEAR 4 HOUR DURATION CHICAG
| Ptotal= 44.07 mm |
                                                                                                   RAIN
                                 RAIN | TIME RAIN | TIME RAIN | TIME
                       TIME

    mm/hr |
    hrs
    mm/hr |
    hrs
    mm/hr |
    hrs

    2.16 |
    1.10
    4.86 |
    2.10
    23.63 |
    3.10

    2.29 |
    1.20
    5.59 |
    2.20
    15.14 |
    3.20

    2.42 |
    1.30
    6.58 |
    2.30
    11.03 |
    3.30

    2.58 |
    1.40
    8.01 |
    2.40
    8.65 |
    3.40

    2.76 |
    1.50
    10.23 |
    2.50
    7.11 |
    3.50

    2.07 |
    1.60
    14.08 |
    2.60
    6.04 |
    3.60

                                                                                                   mm/hr
3.47
                        hrs
                        .10
                                                                                                   3.21
                        .20
                         .30
                                                                                                   2.78
                        .40
                                                                                                   2.61
                        .50

    2.76 | 1.30
    10.23 | 2.30
    7.11 | 3.30

    2.97 | 1.60
    14.08 | 2.60
    6.04 | 3.60

    3.22 | 1.70
    22.20 | 2.70
    5.25 | 3.70

    3.51 | 1.80
    47.44 | 2.80
    4.65 | 3.80

    3.86 | 1.90
    127.12 | 2.90
    4.17 | 3.90

    4.30 | 2.00
    48.87 | 3.00
    3.79 | 4.00

                                                                                                   2.46
                         .60
                        .70
                                                                                                   2.21
                        .80
                                                                                                      2.11
                        .90
                                                                                                   2.01
                       1.00
 STANDHYD (0203)
                             Area
                                         (ha) =
                                                       .50
```

Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00

|ID= 1 DT= 5.0 min |

		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.

		TRA	ANSFORM	ED HYETOGR	APH		
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			10.23		7.11	3.50	2.61
.583	2.97	1.583	14.08	• • • • • • • • • • • • • • • • • • • •	6.04	3.58	2.46
.667		5 SEE TO COM BOOKS	20.58		5.41	3.67	2.36
.750	3.39	1.750		2.750	4.89	3.75	2.26
.833			79.31		4.46	3.83	2.17
.917			111.47		4.09	3.92	2.09
1.000	4.30	1 2.000	48.87	3.000	3.79	4.00	2.01
Mari Dee Torton In	/ lo so \ _	111.47		42.83			
Max.Eff.Inten.(n		5.00		15.00			
	(min)		(ii)	11.10 (ii	1		
Storage Coeff. Unit Hyd. Tpeak		5.00	(11)	15.00	,		
Unit Hyd. Ipeak		.33		.09			
onic Hyd. peak	(CIIIS) —	. 33		.09	*ТОТА	J.S*	
PEAK FLOW	(cms)=	.01		.03		32 (iii)
TIME TO PEAK	(hrs)=	1.92		2.08		08	,
RUNOFF VOLUME	(mm) =	43.07		15.45	16.		
TOTAL RAINFALL	(mm) =	44.07		44.07	44.		
RUNOFF COEFFICIE		.98		.35		38	
302122022	15.2.5			10.00			

***** 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.

(CALTB								
STANDHYD (0202)	Area	(ha) =	1.14					
ID= 1 DT= 5.0 min		Imp(%) = 3		Dir.	Conn.(%)=	17.00	Į	
		IMPERVIOU	JS	PERVIOU:	S (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.(n	nm/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				
					T *	OTALS*		
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 COEFFICIE	ENT =	.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.

```
Area (ha)= .45 Curve Number (CN)= 69.0

Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
| ID= 1 DT=10.0 min |
                                                                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
                                                TIME

    .167
    2.21
    | 1.167
    5.15
    | 2.167
    20.23
    | 3.17

    .333
    2.43
    | 1.333
    6.67
    | 2.333
    11.38
    | 3.33

    .500
    2.69
    | 1.500
    9.34
    | 2.500
    7.73
    | 3.50

                                                                                                                                                                                                           2.99
                                             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.
| 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
                                                                                    .020
             Unit Hyd Qpeak (cms)=
              PEAK FLOW
                                                            (cms) =
                                                                                         .005 (i)
                                                        (hrs) = 2.167

(mr) = 9.909

(mm) = 44.068
              TIME TO PEAK
              RUNOFF VOLUME
              TOTAL RAINFALL
              RUNOFF COEFFICIENT =
              (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| STANDHYD (0201) | Area (ha) = 1.92
|ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
                                                                                  IMPERVIOUS PERVIOUS (i)
                                                           (ha) = .83 1.10

(mm) = 1.00 3.70

(%) = 1.00 2.00

(m) = 200.00 40.00

= .013 .250
             Surface Area (ha) = Dep. Storage (mm) = Average Slope (%) =
             Length
             Mannings n
                         NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                                                                       ---- TRANSFORMED HYETOGRAPH ----
                                                                 RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 2.16 | 1.083 | 4.86 | 2.083 | 23.63 | 3.08 | 2.26 | 1.167 | 5.44 | 2.167 | 16.84 | 3.17 | 2.37 | 1.250 | 6.18 | 2.250 | 12.67 | 3.25 | 2.48 | 1.333 | 7.15 | 2.333 | 10.08 | 3.33 | 2.62 | 1.417 | 8.45 | 2.417 | 8.34 | 3.42 | 2.76 | 1.500 | 10.23 | 2.500 | 7.11 | 3.50
                                                TIME
                                                  hrs
                                                .167
                                                 .250
                                                .333
                                                                                                                                                                                                                2.90
                                                                                                                                                            8.34 | 3.42
7.11 | 3.50

    2.62 | 1.417
    8.45 | 2.417

    2.76 | 1.500
    10.23 | 2.500

                                                                                                                                                                                                                 2.75
                                                 .417
                                                                                                                                                                                                                2.61
                                                 .500
                                                                      2.46
                                                . 583
                                                                  3.17 | 1.667 | 20.58 | 2.667 | 5.41 | 3.67 | 2.36
3.39 | 1.750 | 37.34 | 2.750 | 4.89 | 3.75 | 2.26
3.65 | 1.833 | 79.31 | 2.833 | 4.46 | 3.83 | 2.17
                                                .667
                                                .750
                                                .833
                                                                 3.95 | 1.917 | 111.47 | 2.917 | 4.09 | 3.92 | 2.09
4.30 | 2.000 | 48.87 | 3.000 | 3.79 | 4.00 | 2.01
                                                                                                                                                                                                                2.09
                                                 .917
                                             1.000
             Max.Eff.Inten.(mm/hr) = 0 111.47 71.75 0 15.00 15.00 15.00 15.00 10.00 15.00 15.00 15.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 1
                                                                                                5.00 15.00
3.71 (ii) 11.77 (ii)
                                                                                                                                   .09
                                                                                                .25
```

TOTALS

.173 (iii)

.14

.10

PEAK FLOW

(cms) =

```
TIME TO PEAK (hrs) = 1.92 2.08
RUNOFF VOLUME (mm) = 43.07 21.46
TOTAL RAINFALL (mm) = 44.07 44.07
RUNOFF COEFFICIENT = .98 .49
                                                                                                                2.00
                                                                                                             25.34
                                                                                                               44.07
                                                                                                                 .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 (D THAN THE STO (iii) PEAK FLOW DO	RAGE COEFFICIE	ENT.			
RESERVOIR (0302) IN= 2> OUT= 1 DT= 5.0 min	(cms)	STORAGE (ha.m.) .0000 .0049 .0102 .0158 .0218 .0281 .0349 .0420 .0494 .0572	OUTFLOW (cms) .0054 .0393 .1153 .2258 .3706 .5506 .7671 1.0214 1.3149 .0000	STORAGE (ha.m.) .0654 .0739 .0828 .0921 .1017 .1117 .1220 .1327 .1438 .0000	
		(cms 5 .09 5 .00 UCTION [Qou) (hrs 9 1.9 3 4.0 t/Qin](%)=) (mm) 2 23.94 8 22.95 3.48 0.00	
ADD HYD (0903) 1 + 2 = 3 ID1= 1 (0205) ID2= 2 (0204) ID = 3 (0903) NOTE: PEAK FLOWS	(ha) : .45 : .16 ====================================	.015 2	hrs) (mm .33 9.93 .17 9.91 	n) 	
RESERVOIR (0301) IN= 2> OUT= 1 DT= 5.0 min	(cms)	STORAGE (ha.m.) .0000 .0052 .0108	OUTFLOW (cms) .0707 .1232 .2290	STORAGE (ha.m.) .0775 .0859 .0944	

RESERVOIR (0301)						
IN= 2> OUT= 1						
DT= 5.0 min	OUTFLOW	STORAGE	I OUT	FLOW S	STORAGE	
DI	(cms)	(ha.m.)			ha.m.)	
	.0000	.0000		0707	.0775	
	.0010	.0052		1232	.0859	
	.0020	.0108		2290	.0944	
	.0030	.0233	1 .	3811	.1031	
	.0040	.0302	i.	5760	.1120	
	.0164	.0376	i.	8126	.1210	
	.0392	.0453	1.	0915	.1301	
	.0602	.0531	1.	4134	.1394	
	.0639	.0611	1.	7793	.1488	
	.0674	.0692	1 .	0000	.0000	
	Al	REA QP	EAK	TPEAK	R.V.	
	(]	ha) (c	ems)	(hrs)	(mm)	
INFLOW : ID= 2	(0201) 1.	925 .	173	2.00	25.34	
OUTFLOW: ID= 1	(0301) 1.	925 .	020	3.08	24.66	
Pl	EAK FLOW R	EDUCTION [Q	5 1 155	(%) = 11.		
T	IME SHIFT OF P			(min) = 65.		
M	AXIMUM STORAG	E USED	(ha	a.m.)= .	. 0387	

ADD HYD (0902) | | 1 + 2 = 3 AREA QPEAK TPEAK R.V.

```
(cms) (hrs)
                                                                                                         (mm)
                                                      (ha)
                ID1= 1 (0302):
                                                     1.14
                                                                    .003
                                                                                      4.08
                                                                                                     22.95
                                                                                      2.17
              + ID2= 2 (0903):
                                                      .61
                                                                     .015
                 1.74
                                                                     .018
                                                                                      2.33 18.40
                  ID = 3 (0902):
         NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
                                                                 QPEAK
1 + 2 = 3
                                                      AREA
                                                                                    TPEAK R.V.
                                                                (cms)
                                                                                   (hrs) (mm)
2.33 18.40
3.08 24.66
                                                                                                        (mm)
                                                     (ha)
              .020
                  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
                                                                \verb|\Design\Hydrology\115185| vo2\STORMS\OSchi10.4|
                                            Comments: OWEN SOUND 10 YEAR 4 HOUR DURATION CHICA
| Ptotal= 50.59 mm |
                                                                         RAIN | TIME
                                                                                                         RAIN | TIME
                               TIME
                                             RAIN | TIME
                                        mm/hr | hrs mm/hr | hrs 2.37 | 1.10 5.44 | 2.10 2.50 | 1.20 6.28 | 2.20
                                                                                                       mm/hr | hrs
                                                                                                                                       mm/hr
                                hrs
                                                                                                         27.54 |
                                                                                                                         3.10
                                 .10
                                                                                                       17.50 | 3.20
                                 .20
                                 .30
                                            2.66 | 1.30 7.44 | 2.30
                                                                                                       12.66 | 3.30
                                                                                                                                       3.29
                                                                       9.10 | 2.40
11.71 | 2.50
                                                                                                       9.86 | 3.40
8.06 | 3.50
                                  .40
                                           3.06
                                                                                                                                       2.87
                                 .50
                                                                                                                                       2.70
                                 .60
                                                                                                       6.81 | 3.60
                                          3.56 | 1.70 | 25.85 | 2.70
3.89 | 1.80 | 55.53 | 2.80
4.29 | 1.90 | 146.69 | 2.90
                                                                       25.85 | 2.70
55.53 | 2.80
                                                                                                       5.89 | 3.70
5.20 | 3.80
                                                                                                                                      2.55
2.42
                                 .70
                                 .80
                                                                                                        4.65 | 3.90
                                                                                                                                       2.30
                                 .90
                                                                         57.21 | 3.00
                                                                                                          4.21 | 4.00
                                             4.80 | 2.00
                                1.00
                                          Area (ha)= .50
Total Imp(%)= 22.00 Dir. Conn.(%)= 5.00
STANDHYD (0203) |
IMPERVIOUS PERVIOUS (i)
                                                      .11 .39
1.00 4.30
        Surface Area
Dep. Storage
                                        (ha) =
                                         (mm) =
        Average Slope
                                         (%)=
                                                            1.00
                                                                                      2.00
                                                         30.00
                                         (m) =
                                                                                    40.00
        Length
        Mannings n
                                                               .013
                                                                                        .250
                NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                                         ---- TRANSFORMED HYETOGRAPH ----
                                TIME RAIN | TIME RAIN | TIME RAIN | TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs
                               TIME
                                          mm/hr | hrs mm/hr | nrs mu,... | 2.37 | 1.083 | 5.44 | 2.083 | 27.54 | 3.08 | 2.47 | 1.167 | 6.11 | 2.167 | 19.51 | 3.17 | 6.98 | 2.250 | 14.60 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.2
                                .083
                                .167
                                .250
                                                                                                                                        3.20
                                            2.73 | 1.333 | 8.10 | 2.333 | 11.54 | 3.33
                                . 333
                                                                                                       9.50 | 3.42
8.06 | 3.50
                                              2.88 | 1.417
                                                                            9.62 | 2.417
                                . 417
                                              3.04 | 1.500 | 11.71 | 2.500
                                                                                                                                        2.87
                                .500
                                                                                                       6.81 | 3.58
6.07 | 3.67
5.48 | 3.75
                                            3.28 | 1.583 | 16.26 | 2.583
                                                                                                                                        2.70
                               .583
                                            3.50 | 1.667
                                                                        23.93 | 2.667
43.66 | 2.750
                                .667
                                             3.76 | 1.750
                                                                                                                                         2.47
                                .750
                                                                                                       4.98 | 3.83 2.37
                                           4.05 | 1.833
                                                                         91.99 | 2.833
                               .833
                                            4.39 | 1.917 | 128.79 | 2.917
4.80 | 2.000 | 57.21 | 3.000
                                                                                                       4.56 | 3.92
4.21 | 4.00
                                                                                                                                         2.28
                                .917
                                                                                                                                       2.20
                              1.000
                                              4.80 | 2.000
        Max.Eff.Inten.(mm/hr) = 128.79

over (min) 5.00

Storage Coeff. (min) = 1.12 (ii)
                                                                                     54.88
                                                                                    10.09 (ii)
        Unit Hyd. Tpeak (min) =
                                                            5.00
                                                                                     15.00
                                                               .34
        Unit Hyd. peak (cms)=
                                                                                         .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.

STANDHYD (0202) | Area (ha) = 1.14Total Imp(%) = 39.00 Dir. Conn.(%) = 17.00|ID= 1 DT= 5.0 min | IMPERVIOUS PERVIOUS (i) Surface Area (ha) =
Dep. Storage (mm) =
Average Slope (%) = .44 .69 1.00 3.80 3.80 1.00 1.00 3.80 1.00 2.00 65.00 40.00 Length (%) = Mannings n .013 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 .32 Unit Hyd. peak (cms)= *TOTALS* PEAK FLOW (cms) = .07 .11
TIME TO PEAK (hrs) = 1.92 2.00
RUNOFF VOLUME (mm) = 49.59 24.94
TOTAL RAINFALL (mm) = 50.59 50.59 .148 (iii) 1.92 29.13 50.59 RUNOFF COEFFICIENT = .98

***** 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.

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

		TR	ANSFORMED	HYETOG	RAPH	_		
TIME	RAIN	TIME	RAIN	TIME	RAIN	1	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	1	3.17	3.73
.333	2.66	1.333	7.54	2.333	13.07	1	3.33	3.29
.500	2.96	1.500	10.67	2.500	8.78	1	3.50	2.95
.667	3.39	1.667	20.10	2.667	6.44	1	3.67	2.64
.833	3.90	1.833	67.83	2.833	5.23	1	3.83	2.42
1.000	4.60	2.000	93.00	3.000	4.39	1	4.00	2.24

Unit Hyd Qpeak (cms) = .047

PEAK FLOW (cms) = .015 (i)
TIME TO PEAK (hrs) = 2.3333
RUNOFF VOLUME (mm) = 12.976
TOTAL RAINFALL (mm) = 50.590
RUNOFF COEFFICIENT = .256

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

```
|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
                                                  (cms) = .006 (i)

(hrs) = 2.167
            PEAK FLOW
            TIME TO PEAK
                                                   (mm) = 12.944
            RUNOFF VOLUME
            TOTAL RAINFALL (mm) = 50.590
            RUNOFF COEFFICIENT =
             (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
 CALIB
                                                    Area (ha) = 1.92
 | STANDHYD (0201) |
                                                   Total Imp(%) = 43.00 Dir. Conn.(%) = 18.00
 |ID= 1 DT= 5.0 min |
                                                                    IMPERVIOUS PERVIOUS (i)
                                                                                                    1.10
            Surface Area
                                                 (ha) =
                                                                       .83
            Dep. Storage (mm) =
                                                                       1.00 \\ 1.00
                                                                                                          3.70
2.00
                                                 (%) = 1.00
(m) = 200.00
= .013
            Average Slope
           Length
Mannings n
                                                                                                        40.00
                                                                                                           .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 | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm
                                                                                                                                                          hrs
                                                                                                                                                                         3.85
                                         .083
                                                                                                                                                                            3.60
                                         .167
                                                        2.60 | 1.250 | 6.98 | 2.250
2.73 | 1.333 | 8.10 | 2.333
2.88 | 1.417 | 9.62 | 2.417
                                         .250
                                                                                                                                                                            3.20
                                         .333
                                                                                                                                 9.50 | 3.42
                                                                                                                                                                            3.02
                                         .417

    2.00 | 1.417
    5.02 | 2.417

    3.04 | 1.500
    11.71 | 2.500

    3.28 | 1.583
    16.26 | 2.583

    3.50 | 1.667
    23.93 | 2.667

    3.76 | 1.750
    43.66 | 2.750

    4.05 | 1.833
    91.99 | 2.833

    4.30 | 1.917
    122.70 | 2.917

                                                                                                                                 8.06 | 3.50
6.81 | 3.58
                                                                                                                                                                            2.87
                                         .500
                                                                                                                                                                            2.70
                                         .583
                                         .667
                                                                                                                                 6.07 | 3.67
                                                                                                                                                                          2.58
                                                                                                                                 5.48 | 3.75
4.98 | 3.83
                                         .750
                                                                                                                                                                            2.47
                                         .833
                                                                                                                                                                            2.37
                                                                                                                                 4.56 | 3.92
                                                         4.39 | 1.917 | 128.79 | 2.917
                                                                                                                                                                        2.28
                                         . 917
                                                                                                                                 4.21 | 4.00
                                                      4.80 | 2.000 57.21 | 3.000
                                      1.000
           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
          TIME TO PEAK (hrs) = 1.1 1.8

TIME TO PEAK (hrs) = 1.92 2.08

RUNOFF VOLUME (mm) = 49.59 26.57

TOTAL RAINFALL (mm) = 50.59 50.59

RUNOFF COEFFICIENT = .98
                                                                                                                                          *TOTALS*
                                                                                                                                            .218 (iii)
                                                                                                                                                 2.00
                                                                                                                                               30.71
                                                                                                                                            50.59
**** 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)
                         TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
                         THAN THE STORAGE COEFFICIENT.
            (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
L RESERVOIR (0302) L
  IN= 2---> OUT= 1 |
| DT= 5.0 min |
                                                           OUTFLOW STORAGE | OUTFLOW STORAGE
                                                                                (ha.m.) | (cms) (ha.m.)
.0000 | .0054 .065
.0049 | .0393 .073
_____
                                                             (cms)
                                                                                                                                            .0654
.0739
.0828
.0921
.1017
.1117
                                                                .0000
                                                                .0011
                                                                                      .0102 | .1153
.0158 | .2258
.0218 | .3706
.0281 | .5506
                                                                .0021
                                                                .0027
                                                                .0033
```

.0037

.0041 .0045

.0048 .0051

AREA QPEAK TPEAK R.V.

.1438

.0000

.0349 | .7671 .0420 | 1.0214

.0494 | 1.3149 .0572 | .0000

```
(ha) (cms) (hrs)

· INFLOW: ID= 2 (0202) 1.136 .148 1.92

OUTFLOW: ID= 1 (0302) 1.136 .004 4.08
                                                                                  (mm)
29.13
                        PEAK FLOW REDUCTION [Qout/Qin](%)= 2.57
                        TIME SHIFT OF PEAK FLOW (min)=130.00
                        MAXIMUM STORAGE USED
                                                            (ha.m.) = .0300
| ADD HYD (0903) |
                                 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) .45 .015 2.33 12.98 .16 .006 2.17 12.94
  1 + 2 = 3
           ID1=1 (0205):
         + ID2= 2 (0204):
            ID = 3 (0903): .61 .021
                                                       2.17 12.97
      NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| RESERVOIR (0301) |
| IN= 2---> OUT= 1 |

        OUTFLOW
        STORAGE
        OUTFLOW
        STORAGE

        (cms)
        (ha.m.)
        (cms)
        (ha.m.)

        .0000
        .0000
        .0707
        .077

        .0010
        .0052
        1.232
        .085

                                                                        STORAGE
| DT= 5.0 min |
                                                                           .0775
                                                                           .0775
.0859
.0944
.1031
.1120
.1210
.1301
.1394
.1488
                                                            .1232
.2290
.3811
                                  .0020
                                               .0108
                                             .0233
                                  .0030
                                  .0030 .0253 | .5011
.0040 .0302 | .5760
.0164 .0376 | .8126
.0392 .0453 | 1.0915
.0602 .0531 | 1.4134
.0639 .0611 | 1.7793
.0674 .0692 | .0000
                                                                            R.V.
(mm)
      AREA QPEAK TPEAK
(ha) (cms) (hrs)
INFLOW: ID= 2 (0201) 1.925 .218 2.00
OUTFLOW: ID= 1 (0301) 1.925 .035 2.83
                                                                                   30.71
                                                      .035
                                                                     2.83
                                                                                   30.03
      OUTFLOW: ID= 1 (0301)
                                       1.925
                        PEAK FLOW REDUCTION [Qout/Qin](%) = 16.17
                        TIME SHIFT OF PEAK FLOW
                                                               (min) = 50.00
                        MAXIMUM STORAGE USED
                                                              (ha.m.) = .0440
| ADD HYD (0902) |
                                   AREA QPEAK TPEAK
(ha) (cms) (hrs)
1.14 .004 4.08
.61 .021 2.17
                                                      TPEAK R.V. (hrs) (mm)
 1 + 2 = 3
                                                        (n.c.,
4.08 28.1.
12.97
                                                                   28.14
           ID1= 1 (0302):
                                   1.14
                                     .61
         + ID2= 2 (0903):
                                              .021
            .024
           ID = 3 (0902):
                                   1.74
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
                                  AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 1.74 .024 2.25 22.84 1.92 .035 2.83 30.03
 1 + 2 = 3
           ID1= 1 (0902):
         + ID2= 2 (0301):
            ID = 3 (0901): 3.67 .051
                                                        2.58 26.61
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
  ** SIMULATION NUMBER: 5 **
```

READ STORM | Filename: I:\2015 Projects\115 | Ptotal= 59.08 mm |

185 - Monterra Phase 2 Natural Hazard Assessm

\Design\Hydrology\115185 vo2\STORMS\OSCHI25.4

Comments: OWEN SOUND 25 YEAR 4 HOUR DURATION CHICA

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

I CALIB | STANDHYD (0203) | Area (ha) = .50Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00 |ID= 1 DT= 5.0 min | _____ **IMPERVIOUS** PERVIOUS (i) .39 Surface Area (ha) =.11 1.00 Dep. Storage (mm) =4.30 1.00 2.00 Average Slope (%) = 30.00 40.00 (m) =Length .013 .250 Mannings n

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

			тг	RANSFORME	D	НҮЕТОО	CRAPH			
TIME	RAIN	ì	TIME	RAIN	Ī	TIME	RAIN	Ĭ	TIME	RAIN
hrs	mm/hr	i	hrs	mm/hr	i	hrs	mm/hr	i	hrs	mm/hr
.083	2.69	í	1.083	6.28	î.	2.083	32.51	i	3.08	4.41
.167	2.82	í	1.167	7.07	i	2.167	22.97	i	3.17	4.13
.250	2.96	i	1.250	8.09	i	2.250	17.12	i	3.25	3.88
.333	3.11	i	1.333	9.42	i	2.333	13.49	i	3.33	3.66
.417	3.29	ĺ	1.417	11.23	İ	2.417	11.07	İ	3.42	3.46
.500	3.47	i	1.500	13.69	Ĺ	2.500	9.37	Î	3.50	3.28
.583	3.75	ĺ	1.583	19.10	Ī	2.583	7.89	Ī	3.58	3.08
.667	4.01	1	1.667	28.22	1	2.667	7.03		3.67	2.94
.750	4.30	Ī	1.750	51.54	1	2.750	6.33	1	3.75	2.82
.833	4.65	1	1.833	107.73	1	2.833	5.74	1	3.83	2.70
.917	5.06		1.917	150.30		2.917	5.25	1	3.92	2.60
1.000	5.53	1	2.000	67.54	1	3.000	4.84	1	4.00	2.50
.500 .583 .667 .750 .833	3.47 3.75 4.01 4.30 4.65 5.06		1.500 1.583 1.667 1.750 1.833 1.917	13.69 19.10 28.22 51.54 107.73 150.30		2.500 2.583 2.667 2.750 2.833 2.917	9.37 7.89 7.03 6.33 5.74 5.25		3.50 3.58 3.67 3.75 3.83 3.92	3.28 3.08 2.94 2.82 2.70 2.60

Max.Eff.Inten.(mm/hr) = over (min) Storage Coeff. (min) = Unit Hyd. Tpeak (min) = Unit Hyd. peak (cms) =	150.30 5.00 1.05 (ii) 5.00 .34	71.33 10.00 9.13 (ii) 10.00 .12	
			TOTALS
PEAK FLOW (cms) =	.01	.06	.063 (iii)
TIME TO PEAK (hrs) =	1.92	2.00	2.00
RUNOFF VOLUME (mm) =	58.08	25.41	27.04
TOTAL RAINFALL (mm) =	59.08	59.08	59.08
RUNOFF COEFFICIENT =	.98	.43	.46

**** 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.

(111)							
CALIB							
STANDHYD (0202)	Area	(ha)=	1 14				
ID= 1 DT= 5.0 min				Dir	Conn.(%)=	17.00	
ID- I DI- 3.0 MIII	10041	Imp (o)	33.00	DII.	OOIIII. (0)	17.00	
		IMPERVIO	OUS	PERVIOU	S (i)		
Surface Area	(ha) =	. 44		.69			
Dep. Storage		1.00		3.80			
		1.00		2.00			
Length		65.00		40.00			
Mannings n	=	.013		.250			
Max.Eff.Inten.(m	n/hr)=	150.30)	101.86			
over	(min)	5.00		10.00			
Storage Coeff.	(min) =	1.68	3 (ii)	8.68	(ii)		
Unit Hyd. Tpeak	(min) =	5.00)	10.00			

```
.32 .12
               Unit Hyd. peak (cms)=
                                                                                                                                                                         *TOTALS*
                                                                                  .08 .15
1.92 2.00
58.08 31.66
59.08 59.08
.98
               PEAK FLOW
                                                                                                                                                                              .189 (iii)
                                                            (cms) =
               TIME TO PEAK (hrs) =
RUNOFF VOLUME (mm) =
TOTAL RAINFALL (mm) =
                                                                                                                                                                                   1.92
                                                                                                                                                                               36.14
                                                                                                                                                                            59.08
               RUNOFF COEFFICIENT =
                                                                                               .98
 ***** 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.
    NASHYD (0205) |
                                                                Area (ha) = .45 Curve Number (CN) = 69.0
Ia (mm) = 5.00 # of Linear Res.(N) = 3.00
 |ID= 1 DT=10.0 min |
                                                                 U.H. Tp(hrs) = .36
                          NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.
                                                                                        --- TRANSFORMED HYETOGRAPH ----
                                                  TIME RAIN | TIME RAIN | TIME RAIN | TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 167 2.75 | 1.167 6.68 | 2.167 27.74 | 3.17 333 3.04 | 1.333 8.75 | 2.333 15.31 | 3.33 5.50 3.38 | 1.500 12.46 | 2.500 10.22 | 3.50
                                                 TIME
                                                                                                                                                                                           hrs mm/hr
                                                  .333
                                                                                                                                                                                                                   3.77
                                                                                                                                                                                                                 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
                                                                                   .020 (i)
               PEAK FLOW
                                                         (cms) =
              TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 17.335
TOTAL RAINFALL (mm)= 59.076
                                                                                   2.333
               RUNOFF COEFFICIENT = .293
               (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
.020
              Unit Hyd Qpeak (cms)=
             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
                                                                 Area (ha) = 1.92
| STANDHYD (0201) |
|ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
                                                                                    IMPERVIOUS PERVIOUS (i)
             Surface Area (ha) = .83 1.10

\frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} = \frac{1}{100} 
                                                                                         1.00
                                                                                                                                   3.70
2.00
             Dep. Storage (mm) = Average Slope (%) =
                                                                                   200.00
                                                                 (m) =
             Length
                                                                                                                                40.00
             Mannings n
```

		15		TRANSFORME	ΞD	HYETOG	RAPH			
TIME	RAIN	1	TIM	E RAIN	1	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	1	hr	s mm/hr	1	hrs	mm/hr	1	hrs	mm/hr
.083	2.69	1	1.08	6.28		2.083	32.51	1	3.08	4.41

```
7.07 | 2.167
                 .167
                         2.82 | 1.167
                                                        22.97 | 3.17
                                                                          4.13
                 .250
                         2.96 | 1.250
3.11 | 1.333
                                         8.09 | 2.250
                                                         17.12
                                                                  3.25
                                                                          3.88
                                                         13.49 |
                                                                  3.33
                                                                          3.66
                                         9.42 | 2.333
                 .333
                 .417
                         3.29 | 1.417
                                        11.23 | 2.417
                                                         11.07 |
                                                                  3.42
                                                                          3.46
                                                          9.37 |
                 .500
                         3.47 | 1.500
                                        13.69 | 2.500
                                                                  3.50
                                                                          3.28
                         3.75 | 1.583
                                        19.10 | 2.583
                                                          7.89 |
                                                                  3.58
                                                                          3.08
                 .583
                 .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 I
                                                                  3.75
                                                                          2.82
                                       107.73 | 2.833
                                                          5.74 |
                                                                  3.83
                                                                          2.70
                 .833
                         4.65 | 1.833
                 .917
                         5.06 | 1.917
                                       150.30 | 2.917
                                                          5.25 | 3.92
                                                                          2.60
                                                          4.84 | 4.00
                                                                          2.50
                1.000
                         5.53 | 2.000
                                        67.54 | 3.000
                                              114.71
    Max.Eff.Inten.(mm/hr)=
                                150.30
                                              10.00
                                  5.00
                over (min)
     Storage Coeff. (min) =
                                  3.29 (ii)
                                               9.97 (ii)
     Unit Hyd. Tpeak (min) =
                                  5.00
                                              10.00
     Unit Hyd. peak (cms)=
                                   .27
                                                .11
                                                            *TOTALS*
                                                 .25
                                                               .329 (iii)
     PEAK FLOW
                                   .13
                     (cms) =
                                               2.00
                                                               2.00
     TIME TO PEAK
                     (hrs) =
                                  1.92
                                               33.52
                                                              37.93
     RUNOFF VOLUME
                      (mm) =
                                 58.08
                                                              59.08
                     (mm) =
                                 59.08
                                               59.08
     TOTAL RAINFALL
     RUNOFF COEFFICIENT =
                                                                .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)
           TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

RESERVOIR (0302)					in.	
IN= 2> OUT= 1						
DT= 5.0 min	OUTFLOW	STORAGE		OUTFLOW	STORAGE	
	(cms)	(ha.m.)	1	(cms)	(ha.m.)	
	.0000	.0000	1	.0054	.0654	
	.0011	.0049	ļ	.0393	.0739	
	.0021	.0102		.1153	.0828	
	.0027	.0158	!	.2258 .3706	.0921 .1017	
	.0033	.0218		.5506	.1117	
	.0041	.0349	i	.7671	.1220	
	.0045	.0420	i	1.0214		
	.0048	.0494		1.3149		
	.0051	.0572	ĺ	.0000	.0000	
						-
	AR	0.000.00	QPEAK	TPEA		
INFLOW : ID= 2 (02	Annual Control of the		(cms)	(hrs 1.9		·
OUTFLOW: ID= 1 (03				4.0		
COTTHOW. ID I (03	02) 1.1	30	.001			
PEAK	FLOW RE	DUCTION	[Qout/	Qin](%)=	2.25	94
TIME	SHIFT OF PE			(min) = 13		
MAXI	MUM STORAGE	USED		(ha.m.) =	.0376	
ADD HYD (0903)						
1 + 2 = 3	AREA	QPEAK	TPE		· .	
	(ha)	(cms)	(hr	s) (mm		
ID1 = 1 (0205)				3 17.33		
+ ID2 = 2 (0204)						
1 102- 2 (0204)		.008	2.1	7 17.29 		

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0301) IN= 2> OUT= 1	_ 					
DT= 5.0 min	OUTFLOW	STORAGE	- 1	OUTFLOW	STORAGE	
	- (cms)	(ha.m.)	1	(cms)	(ha.m.)	
	.0000	.0000	1	.0707	.0775	
	.0010	.0052	1	.1232	.0859	
	.0020	.0108	1	.2290	.0944	
	.0030	.0233	1	.3811	.1031	
	.0040	.0302	i	.5760	.1120	
	.0164	.0376	į	.8126	.1210	

```
.1301
                          .0392
                                  .0453 | 1.0915
                                  .0531 | 1.4134
.0611 | 1.7793
.0692 | .0000
                          .0602
                                                          .1488
                          .0639
                                                   TPEAK
     AREA QPEAK (ha) (cms)
INFLOW: ID= 2 (0201) 1.925 .329
OUTFLOW: ID= 1 (0301) 1.925 .056
                              AREA
                                        QPEAK
                                                            (mm)
                                                              R.V.
                                                  (hrs)
                                                    2.00
                                                              37.93
                                                   2.58
                                                              37.25
                              REDUCTION [Qout/Qin](%) = 16.91
                  PEAK FLOW
                  TIME SHIFT OF PEAK FLOW (min) = 35.00
                                              (ha.m.) = .0515
                  MAXIMUM STORAGE USED
| ADD HYD (0902) |
                                QPEAK
  1 + 2 = 3
                          AREA
                                         TPEAK
                          (ha)
                                  (cms) (hrs)
        ID1= 1 (0302): 1.14
+ ID2= 2 (0903): .61
                                .004
                                        4.08 35.15
2.17 17.32
                                                  35.15
         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.
                                 (cms) (hrs)
                           (ha)
       ID1= 1 (0902): 1.74 .032 2.17 28.93
+ ID2= 2 (0301): 1.92 .056 2.58 37.25
                                                  28.93
         ______
         ID = 3 (0901): 3.67 .081 2.42 33.29
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
  *********
  ** SIMULATION NUMBER: 6 **
                    Filename: I:\2015 Projects\115
    READ STORM
                                185 - Monterra Phase 2 Natural Hazard Assessm
                                \Design\Hydrology\115185 vo2\STORMS\OSchi50.4
 Ptotal= 65.65 mm |
                      Comments: OWEN SOUND 50 YEAR 4 HOUR DURATION CHICA
                TIME
                      RAIN | TIME RAIN | TIME
                                                    RAIN | TIME
                      mm/hr | hrs mm/hr |
                                                   mm/hr |
                                                             hrs
                                             hrs
                hrs
                      4.78
                                                   36.93 |
23.25 |
                                                            3.10
                 .10
                 .20
                                                   16.64 | 3.30
                 .30
                                                                   4.05
                                                   12.83 | 3.40
10.39 | 3.50
8.71 | 3.60
7.49 | 3.70
                                                                   3.76
                      .40
                 .50
                 .60
                                                                    3.30
                                                                   3.11
                 .70
                      4.40 | 1.70 34.62 | 2.70
                       4.84 | 1.80 74.20 | 2.80
5.37 | 1.90 187.94 | 2.90
                                                   6.56 | 3.80
5.84 | 3.90
                 .80
                                                                    2.79
                 .90
                       6.03 | 2.00
                1.00
                                    76.42 | 3.00
                                                   5.26 | 4.00
 STANDHYD (0203) |
                     Area (ha) = .50
                    Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00
|ID= 1 DT= 5.0 min |
                                         PERVIOUS (i)
                            IMPERVIOUS
    Surface Area
                           .11
                    (ha) =
                                         .39
    Dep. Storage
                    (mm) =
                               1.00
                                            4.30
                              1.00
                                           2.00
                     (%)=
    Average Slope
                     (m) =
                           30.00
    Length
                              .013
    Mannings n
        NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                             --- TRANSFORMED HYETOGRAPH ----
                     RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs
               TIME
                                                                   RATN
```

hrs mm/hr | hrs

mm/hr

```
2.87 | 1.083 | 6.88 | 2.083
3.01 | 1.167 | 7.78 | 2.167
3.16 | 1.250 | 8.93 | 2.250
                                                            36.93 | 3.08
25.99 | 3.17
               .083
                                                                                 4.78
               .167
                                                            19.28 | 3.25
              .250
                                                                                 4.19
                       3.33 | 1.333 | 10.45 | 2.333
                                                             15.12 | 3.33
12.34 | 3.42
                                                                                 3.93
               .333
               .417
                        3.52 | 1.417
                                          12.52 | 2.417
                                                                                 3.71
                                        15.34 | 2.500
                      3.73 | 1.500
                                                             10.39 | 3.50
              .500
                                                                                 3.52
                                                             8.71 | 3.58
7.73 | 3.67
6.93 | 3.75
                      4.04 | 1.583 21.55 | 2.583
              .583
                                                                                 3.30
                       4.33 | 1.667
                                          32.01 | 2.667
              .667
                                       58.37 | 2.750
                      4.66 | 1.750
              .750
                                                                                 3.01
                                                              6.27 | 3.83
              .833
                     5.05 | 1.833 | 119.70 | 2.833
                                                                                 2.88
                                                              5.72 | 3.92
5.26 | 4.00
                       5.50 | 1.917 | 165.64 | 2.917
              .917
                                                                                 2.76
                                         76.42 | 3.000
                       6.03 | 2.000
             1.000
                                                                                 2.65
Max.Eff.Inten.(mm/hr)=
                                165.64
                                                 84.80
                             5.00
1.01 (ii)
                                                10.00
             over (min)
Storage Coeff. (min) =
                                                8.55 (ii)
                                                 10.00
Unit Hyd. Tpeak (min) =
                                5.00
Unit Hyd. peak (cms)=
                                   .34
                                                  .12
                                                                *TOTALS*
                                  .01 .07
1.92 2.00
64.65 30.16
65.65 65.65
PEAK FLOW (cms) =
TIME TO PEAK (hrs) =
RUNOFF VOLUME (mm) =
TOTAL RAINFALL (mm) =
                                                                  .076 (iii)
2.00
                              1.92
64.65
                                                                  31.87
                               65.65
                                                                  65.65
RUNOFF COEFFICIENT =
                                  .98
                                                                    .49
                                                  .46
```

***** 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				
D= 1 DT= 5.0 min	Total	Imp(%)=	39.00	Dir. 0	Conn.(%)=	17.00)
		IMPERVIOU	JS	PERVIOUS	S (i)		
Surface Area	(ha) =	. 44	*	.69			
Dep. Storage		1.00		3.80			
Average Slope	(%) =	1.00		2.00			
Length	(m) =	65.00		40.00			
Mannings n	=	.013		.250			
Max.Eff.Inten.(mr	n/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	k
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 COEFFICIEN	1T =	.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.

		22	TF	RANSFORMED	HYETOG	RAPH		
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.167	2.94	1	1.167	7.33	2.167	31.46	3.17	4.62
.333	3.25	1	1.333	9.69	2.333	17.20	3.33	4.06

```
3.63 | 1.500 | 13.93 | 2.500 | 11.37 | 3.50
                      .500
                              4.18 | 1.667 | 26.78 | 2.667
4.86 | 1.833 | 89.03 | 2.833
                                                                        8.22 | 3.67
6.60 | 3.83
5.49 | 4.00
                                                                                             3.22
2.94
2.71
                      .667
                      . 833
                              5.77 | 2.000 | 121.03 | 3.000
                     1.000
                                        .047
      Unit Hyd Qpeak (cms) =
      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.
                           Area (ha)= .16 Curve Number (CN)= 69.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
               (0204)
|ID= 1 DT=10.0 min |
                           U.H. Tp(hrs) = .31
                                        .020
      Unit Hyd Qpeak (cms) =
                                        .010 (i)
                           (cms) =
                           (hrs) = 2.167
      TIME TO PEAK
                          (mm) = 20.936
      RUNOFF VOLUME
      TOTAL RAINFALL (mm) = 65.654
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| 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) =
Dep. Storage (mm) =
Average Slope (%) =
                                       .83
1.00
                                                        1.10
                            (ha) =
                                        1.00
                           (%) =
(m) =
                                                           2.00
      Average Slope
      Length
                                       200.00
                                                          40.00
      Mannings n
                                         .013
           NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                                        --- TRANSFORMED HYETOGRAPH ----
                              RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs
                     TIME

    mm/hr | hrs
    mm/hr | hrs
    mm/hr | hrs
    mm/hr | hrs

    2.87 | 1.083 | 6.88 | 2.083 | 36.93 | 3.08

    3.01 | 1.167 | 7.78 | 2.167 | 25.99 | 3.17

    3.16 | 1.250 | 8.93 | 2.250 | 19.28 | 3.25

    3.33 | 1.333 | 10.45 | 2.333 | 15.12 | 3.33

                      hrs
                                                                                              mm/hr
                      .167
                                                                                               4.47
                                                                                               4.19
                      .250
                      .333
                              3.52 | 1.417 | 12.52 | 2.417
3.73 | 1.500 | 15.34 | 2.500
                                                                        12.34 | 3.42
10.39 | 3.50
                                                                                                3.71
                      .417
                      .500
                             4.04 | 1.583 | 21.55 | 2.583
                                                                        8.71 | 3.58
                     .583
                                                                        7.73 | 3.67
6.93 | 3.75
6.27 | 3.83
                                                  32.01 | 2.667
58.37 | 2.750
                      .667
                             4.33 | 1.667
                                                                                                3.15
                     .750
                               4.66 | 1.750
                             5.05 | 1.833 | 119.70 | 2.833
                                                                                                2.88
                     .833
                                                                       5.72 | 3.92
                      .917
                             5.50 | 1.917 | 165.64 | 2.917
                               6.03 | 2.000
                                                  76.42 | 3.000
                                                                          5.26 | 4.00
                    1.000
     Max.Eff.Inten.(mm/hr) = 165.64 133.59

over (min) 5.00 10.00

Storage Coeff. (min) = 3.16 (ii) 9.45

Unit Hyd. Tpeak (min) = 5.00 10.00
                                                          10.00
9.45 (ii)
                                                          10.00
                                                             .12
                                             .27
     Unit Hyd. peak (cms) =
                                                                             *TOTALS*
                                                                               .387 (iii)
                         (cms) =
                                            .15
                                                              .30
                                        1.92
                                                          2.00
                         (hrs) =
                                                                                 2.00
     TIME TO PEAK
     RUNOFF VOLUME (mm) = 1.92

TOTAL RAINFALL (mm) = 64.65

TOTAL RAINFALL (mm) = 65.65
                                                        2.00
39.07
                                                                                43.68
                                                          65.65
                                                                              65.65
     RUNOFF COEFFICIENT =
                                            .98
```

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

| CALIB

I NASHYD

PEAK FLOW

PEAK FLOW

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 - $CN^* = 82.0$ Ia = Dep. Storage (Above)
- 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 |
                                        OUTFLOW STORAGE | OUTFLOW STORAGE
| DT= 5.0 min |
                                                                                            (ha.m.)
                                                      (ha.m.)
                                                        (ha.m.) | (cms)
.0000 | .0054
.0049 | .0393
                                          (cms)
                                                                                               .0654
.0739
.0828
.0921
                                           .0000
                                            .0011
                                           .0011 .0049 | .0393
.0021 .0102 | .1153
.0027 .0158 | .2258
.0033 .0218 | .3706
.0037 .0281 | .5506
.0041 .0349 | .7671
.0045 .0420 | 1.0214
.0048 .0494 | 1.3149
.0051 .0572 | .0000
                                                                                                .0921
.1017
.1117
.1220
.1327
                                                                                            .1438
                                                AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
1.136 .222 2.00 41.74
1.136 .005 4.08 40.75
                                                                                                        R.V.
        INFLOW : ID= 2 (0202)
        OUTFLOW: ID= 1 (0302)
                               PEAK FLOW REDUCTION [Qout/Qin](%)= 2.06
                               TIME SHIFT OF PEAK FLOW
                                                                                (min) = 125.00
                               MAXIMUM STORAGE USED
                                                                             (ha.m.) = .0437
| ADD HYD (0903) |
                                                                                    R.V. (mm)
  1 + 2 = 3
                                             AREA QPEAK TPEAK
             TD1= 1 (0205): .45 .024 2.17 20.99
+ TD2= 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) |

        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

| IN= 2---> OUT= 1 |
| DT= 5.0 min |
                                                                                               .0775
.0859
.0944
.1031
.1120
.1210
                                                                                                  .1394
                                                                                                   .0000
       AREA QPEAK (ha) (cms)
INFLOW: ID= 2 (0201) 1.925 .387
OUTFLOW: TD= 1 (0301) 1.925 .063
                                                                   QPEAK
                                                                                      TPEAK
                                                                                                          R.V.
                                                                                  (hrs)
                                                                                                     (mm)
43.68
                                                                                      2.00
        OUTFLOW: ID= 1 (0301)
                                                   1.925
                                                                     .063
                                                                                                          42.99
                               PEAK FLOW REDUCTION [Qout/Qin](%) = 16.19
                               TIME SHIFT OF PEAK FLOW (min) = 35.00
                                                                               (ha.m.) = .0586
                              MAXIMUM STORAGE USED
| ADD HYD (0902) |
                                            AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm)
| 1 + 2 = 3 |
              ID1= 1 (0302): 1.14 .005 4.08 40.75
- ID2= 2 (0903): .61 .034 2.17 20.97
            + ID2= 2 (0903):
                _____
               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
                                                          QPEAK TPEAK R.V.
                                              AREA
```

(ha)

(cms) (hrs) (mm)

* 5-45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

1.00

Filename: I:\2015 Projects\115 185 - Monterra Phase 2 Natural Hazard Assessm Comments: OWEN SOUND 100 YEAR 4 HOUR DURATION CHIC | Ptotal= 71.77 mm | RAIN | TIME RAIN | TIME RAIN | TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr 5.16 40.41 | 3.10 25.38 | 3.20 18.12 | 3.30 3.10 .10 .20 .30 4.37 3.73 | 1.40 | 12.83 | 2.40 4.02 | 1.50 | 16.70 | 2.50 4.35 | 1.60 | 23.51 | 2.60 13.95 | 3.40 11.28 | 3.50 9.44 | 3.60 4.05 .40 .50 3.79 .60 3.55
 4.75 |
 1.70 37.88 |
 2.70

 5.22 |
 1.80 81.47 |
 2.80

 5.80 |
 1.90 206.92 |
 2.90
 8.10 | 3.70 7.09 | 3.80 6.31 | 3.90 3.35 .70 .80 3.16 3.00 . 90

83.92 | 3.00

5.67 | 4.00

2.85

6.52 | 2.00

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

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

TRANSFORMED						HYETOG	GRAPH			
TIME	RAIN	1	TIME	RAIN		TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr		hrs	mm/hr	1	hrs	mm/hr
.083	3.08	1	1.083	7.44		2.083	40.41	1	3.08	5.16
.167	3.23		1.167	8.42		2.167	28.39	1	3.17	4.82
.250	3.40	1	1.250	9.68		2.250	21.02	1	3.25	4.51
.333	3.59		1.333	11.35		2.333	16.45	1	3.33	4.24
.417	3.79		1.417	13.60		2.417	13.42	1	3.42	4.00
.500	4.02	1	1.500	16.70		2.500	11.28	1	3.50	3.79
.583	4.35		1.583	23.51		2.583	9.44	1	3.58	3.55
.667	4.67	1	1.667	35.01		2.667	8.37	1	3.67	3.39
.750	5.03	1	1.750	64.03		2.750	7.49	1	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	1	3.92	2.97
1.000	6.52	1	2.000	83.92		3.000	5.67	-	4.00	2.85

<pre>Max.Eff.Inten.(mm/hr) =</pre>	182.32 5.00	98.82 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.

```
| STANDHYD (0202) |
                                                   (ha) =
                                        Area
                                                                    1.14
                                        Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
|ID= 1 DT= 5.0 min |
                                                    IMPERVIOUS PERVIOUS (i)
                                                 .44
1.00
1.00
65.00
        Surface Area (ha) = Dep. Storage (mm) =
                                                                        .69
3.80
                                                                      2.00
                                     (%) =
(m) =
        Average Slope
        Length
                                                           .013
                                                                                   .250
        Mannings n
        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. Tpeak (min) = 33
        Unit Hyd. peak (cms)=
                                                              .33
                                                                                     .13
                                                                                                          *TOTALS*

      PEAK FLOW
      (cms)=
      .10
      .21

      TIME TO PEAK
      (hrs)=
      1.92
      2.00

      RUNOFF VOLUME
      (mm)=
      70.77
      42.19

      TOTAL RAINFALL
      (mm)=
      71.77
      71.77

      RUNOFF COEFFICIENT
      90
      50

                                                                                                          .257 (iii)
2.00
                                                                                                              47.05
                                                                                                             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.

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

```
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | 167 3.16 | 1.167 7.93 | 2.167 34.40 | 3.17 4.99 3.33 3.49 | 1.333 10.52 | 2.333 18.74 | 3.33 4.38 5.50 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.

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

```
I CALIB
                       Area (ha)= 1.92
Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00
 STANDHYD (0201)
|ID= 1 DT= 5.0 min |
    _____
                             IMPERVIOUS PERVIOUS (i)
                      (ha) =
                              .83
                                           1.10
     Surface Area
     Dep. Storage
                      (mm) =
                                  1.00
                                              3.70
                                1.00
                                              2.00
                      (%)=
     Average Slope
                       (m) =
                               200.00
                                             40.00
     Length
                                .013
                                             .250
     Mannings n
         NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME RAIN | TIME RAIN | TIME RAIN | TIME
                 hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs
                                                                       mm/hr
                      .083
                                                                       5.16
                                                                        4.82
                 .167
                 .250 3.40 | 1.250 9.68 | 2.250
                                                      21.02 | 3.25
16.45 | 3.33
13.42 | 3.42
11.28 | 3.50
                                                                        4.51
                 333 3.59 | 1.333 11.35 | 2.333
.417 3.79 | 1.417 13.60 | 2.417
.500 4.02 | 1.500 16.70 | 2.500
                                                                        4.24
                                                                        4.00
                                                                        3.79
                 9.44 | 3.58
8.37 | 3.67
                                                                        3.55
                                                       7.49 | 3.75
                                                                        3.24
                                                      6.78 | 3.83 3.10
6.18 | 3.92 2.97
5.67 | 4.00 2.85
                       5.45 | 1.833 | 131.65 | 2.833
                 .833
                       .917
                1.000
                            182.32
5.00
                                            153.03
     Max.Eff.Inten.(mm/hr)=
                                             10.00
               over (min)
                                 3.05 (ii)
                                              9.00 (ii)
     Storage Coeff. (min) =
                             5.00
     Unit Hyd. Tpeak (min) =
                                             10.00
                                              .12
     Unit Hyd. peak (cms)=
                                  .27
                                                          *TOTALS*
    TIME TO PEAK (hrs) = 1.6 .35

RUNOFF VOLUME (mm) = 70.77 44.35

TOTAL RAINFALL (mm) = 71.77

RUNOFF COEFFICIENT = 90
                                                            .445 (iii)
                                                              2.00
                                                            49.11
                                                            71.77
                                                              .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:
```

3.39

- $CN^* = 82.0$ 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		substitute of the second substitute				
DT = 5.0 min	OUTFLOW	STORAGE		OUTFLOW	STORAGE	
	All the second of the second	(ha.m.)	1	(cms)	i	
	.0000	.0000	1	.0054	.065	
	.0011	.0049	1	.0393	.073	
	.0021	.0102	1	.1153	.082	
		.0158	1	.2258	2 10 0 10	
2	.0033	.0218	1	.3706	.101	
	.0037	.0281	1	.5506	.111	
	.0011	.0349	1	.7671		
	.0045	.0420	1	1.0214	.132	
	.0048	.0494	1	1.3149		
	.0051	.0572	1	.0000	.000	0
	į	AREA QI	PEAK	TPE	AK	R.V.
		(ha) (d	cms)	(hr	s)	(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) = 1	25.00	
	MAXIMUM STORA	GE USED		(ha.m.) =	.0495	

| ADD HYD (0903) | 1 + 2 = 3 AREA OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm)

```
ID = 3 (0903):
                                        .61 .041
        NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 | RESERVOIR (0301) |
   IN= 2---> OUT= 1 |
                                                   STORAGE | OUTFLOW STORAGE (ha.m.) | (cms) (ha.m.) .0000 | .0707
| DT= 5.0 min |
                                    OUTFLOW

        UTFLOW (cms)
        STORAGE (ha.m.)
        OUTFLOW (cms)

        .0000
        .0000
        .0707

        .0010
        .0052
        | .1232

        .0020
        .0108
        | .2290

        .0030
        .0233
        | .3811

        .0040
        .0302
        | .5760

        .0164
        .0376
        | .8126

        .0392
        .0453
        | 1.0915

        .0602
        .0531
        | 1.4134

        .0639
        .0611
        | 1.7793

        .0674
        .0692
        | .0000

                                    (cms)
                                                                                    .0775
                                                                                       .0859
                                                                                     .1031
.1120
.1210
.1301
.1394
.1488
                                                       QPEAK TPEAK (cms) (hrs) .445 2.00 .066 2.58
                                                                                          R.V.
(mm)
49.11
                                              AREA
                                              (ha)
                                       1.925
       INFLOW : ID= 2 (0201)
       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.) = .06
                                                                      (ha.m.) = .0663
| ADD HYD (0902) |
                                    AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 1.14 .005 4.08 46.05 .61 .041 2.17 24.56
   1 + 2 = 3
     _____
              ID1= 1 (0302):
           + ID2= 2 (0903):
                         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 QPEAK TPEAK R.V.
           ID1= 1 (0902): 1.74 .045 2.17 38.56
+ ID2= 2 (0301): 1.92 .066 2.58 48.42
                                                                               (mm)
              ______
              ID = 3 (0901): 3.67 .108 2.33 43.73
       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
                                 Comments: REGIONAL STORM TIMMINS - 12 hour storm
 Ptotal=193.00 mm |
                                  RAIN | TIME mm/hr | hrs
                                                                     TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr
                                                         RAIN | TIME
                        TIME
                                                       mm/hr |
                         hrs
                                                       3.00 | 7.00 | 43.00 | 10.00

5.00 | 8.00 | 20.00 | 11.00

20.00 | 9.00 | 23.00 | 12.00
                                 15.00 | 4.00
20.00 | 5.00
10.00 | 6.00
                                                                                                     13.00
                        1.00
                                                                                                      13.00
                        2.00
                        3.00
I CALTB
| STANDHYD (0203) |
|ID= 1 DT= 5.0 min |
                                         (ha) = .50
                                Area
                                Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00
                                          IMPERVIOUS PERVIOUS (i)
```

.45 .029 2.17 24.57 .16 .012 2.17 24.52

ID1= 1 (0205): + ID2= 2 (0204):

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

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

		TRA	NSFORME	D HYETOG	RAPH	_	
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs		hrs		hrs	mm/hr		mm/hr
.083		3.083	200 20 2	1 6.083	43.00		13.00
.167		3.167		6.167	43.00		13.00
.250		3.250		6.250	43.00		13.00
.333		3.333		6.333	43.00		13.00
.417		3.417		6.417	43.00		13.00 13.00
.500		3.500 3.583		6.500 6.583	43.00 43.00		13.00
.583		3.583 3.667		1 6.667	43.00	The same and the s	13.00
.750		3.750		1 6.750	43.00		13.00
.833		3.833		6.833	43.00	The same and the s	13.00
.917		3.917		6.917	43.00	The same of the sa	13.00
1.000	15.00			7.000	43.00	10.00	13.00
1.083		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		4.333	5.00	7.333		10.33	13.00
1.417		4.417		7.417	20.00		13.00
1.500		1 4.500		7.500	20.00		13.00
1.583		4.583		7.583	20.00	and the second second	13.00
1.667		4.667		7.667	20.00	The same and and and	13.00 13.00
1.750		4.750 4.833		7.750 7.833	20.00	10.73	13.00
1.833 1.917		4.833		7.033	20.00	10.92	13.00
2.000		5.000		8.000		11.00	13.00
2.083		5.083	20.00	8.083		11.08	8.00
2.167		5.167		8.167		11.17	8.00
2.250		5.250	70 707 70 101	8.250	23.00	11.25	8.00
2.333		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		8.500	23.00		8.00
2.583		5.583		8.583		11.58	8.00
2.667		5.667		8.667		11.67	8.00
2.750		1 5.750		8.750	23.00		8.00
2.833		5.833		8.833		11.83	8.00
2.917		5.917		8.917	23.00		8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	0.00
Max.Eff.Inten.(mm	(hr)=	43.00		44.93			
over (5.00		15.00			
	min) =	1.74	(ii)	11.46 (i	i)		
Unit Hyd. Tpeak ((5)	5.00	,	15.00			
	cms)=	.32		.09			
						TALS*	
the months of the contract of	cms)=	.00		.05		.050 (ii	i)
Control of the Contro	hrs)=	6.42		7.00		7.00	
RUNOFF VOLUME	(mm) =	192.00		40.60		3.15	
TOTAL RAINFALL	(mm) =	193.00	1	.93.00	19	3.00	
RUNOFF COEFFICIEN	IT =	.99		.73		. / 4	

**** 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.

ST	LIB ANDHYD (0202) 1 DT= 5.0 min	Area Total	(ha)= Imp(%)=	1.14 39.00	Dir.	Conn.(%)=	17.00
			TMPERVI	OUS	PERVIO	JS (i)	
	Surface Area	(ha) =	. 4	4	.6	MATERIAL TO A STATE OF THE STAT	
	Dep. Storage	(mm) =	1.0	0	3.8	0	
	Average Slope	(%)=	1.0	0	2.0	0	
	Length	(m) =	65.0	0	40.0	0	
	Mannings n	=	.01	3	.25	0	
عنية الاراء والراء	Max.Eff.Inten.(m	m/hr)=	43.0	0	53.7	4	

```
      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

     → Storage Coeff. (min) =
                                                                                *TOTALS*
       TIME TO PEAK (hrs) = .02 .10

RUNOFF VOLUME (mm) = 192.00 154.61

TOTAL RAINFALL (mm) = 193.00 193.00

RUNOFF COEFFICIENT = .99 .80
                                                                .10
                                                                               .125 (iii)
7.00
                                                                               160.96
193.00
 **** 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.
                                                              Curve Number (CN) = 69.0
                               Area (ha)= .45 Curve Number (CN)= 69.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
 I NASHYD
                (0205)
                              Ia
|ID= 1 DT=10.0 min |
                              U.H. Tp(hrs) = .36
            NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.
                                          ---- TRANSFORMED HYETOGRAPH ----
                       TIME RAIN | TIME RAIN | TIME RAIN | TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs .167 15.00 | 3.167 3.00 | 6.167 43.00 | 9.17 .333 15.00 | 3.333 3.00 | 6.333 43.00 | 9.33 .500 15.00 | 3.500 3.00 | 6.500 43.00 | 9.50 .667 15.00 | 3.667 3.00 | 6.667 43.00 | 9.67
                                                                                                  RATN
                                                                                                  13.00
                                                                                                   13.00
                                                                                                   13.00
                                                                            43.00 | 9.83
                       .833 15.00 | 3.833 3.00 | 6.833
                                                                                                   13.00
                      1.000 15.00 | 4.000 3.00 | 7.000
1.167 20.00 | 4.167 5.00 | 7.167
                                                                            43.00 | 10.00
                                                                                                   13.00
                                                                            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
1.667 20.00 | 4.667 5.00 | 7.667
                                                                             20.00 | 10.50
20.00 | 10.67
                                                                                                   13.00
                                20.00 | 4.667
                                                                                                   13.00
                               20.00 | 4.833 | 5.00 | 7.833
                                                                            20.00 | 10.83
                      1.833
                                                                                                  13.00

      2.000
      20.00 | 5.000
      5.00 | 8.000

      2.167
      10.00 | 5.167
      20.00 | 8.167

                                                                            20.00 | 11.00
23.00 | 11.17
                                                                                                 13.00
                                                                                                   8.00
                               10.00 | 5.333 | 20.00 | 8.333
                                                                            23.00 | 11.33
                                                                                                 8.00
                      2.333
                                                                            23.00 | 11.50 8.00
23.00 | 11.67 8.00
                      2.500 10.00 | 5.500 20.00 | 8.500
                                10.00 | 5.667
                                                       20.00 | 8.667
                                                                             23.00 | 11.67
                      2.667
                                                    20.00 | 8.833
                              10.00 | 5.833
                                                                           23.00 | 11.83 8.00
                      2.833
                                                     20.00 | 9.000
                                                                           23.00 | 12.00 8.00
                      3.000
                              10.00 | 6.000
      Unit Hyd Qpeak (cms)=
                                        .047
                           (cms) = .036
(hrs) = 7.000
                                          .036 (i)
       PEAK FLOW
       TIME TO PEAK
      RUNOFF VOLUME (mm) = 116.652
TOTAL RAINFALL (mm) = 193.000
      RUNOFF COEFFICIENT =
       (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
                           (cms) = .013 (i)
(hrs) = 7.000
      PEAK FLOW
      TIME TO PEAK
      RUNOFF VOLUME (mm) = 116.388
TOTAL RAINFALL (mm) = 193.000
      RUNOFF COEFFICIENT = .603
       (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

STANDHYD (0201) | Area (ha) = 1.92

|ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 18.00

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

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

		TRA	ANSFORME	D HYETOGI	RAPH	_	
TIME	RAIN		RAIN		RAIN		RAIN
hrs	mm/hr			hrs	mm/hr		mm/hr
.083	15.00	i ner enere		6.083	43.00	9.08	13.00
.167		3.167		6.167	43.00	9.17	13.00
.250		3.250		6.250	43.00	9.25	13.00
.333		3.333		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		3.00	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		13.00
.917	15.00	3.917		6.917	43.00		13.00
1.000	15.00	4.000	3.00	7.000	43.00	111111000 11 0000000	13.00
1.083		4.083	5.00	7.083	20.00		13.00
1.167		4.167		7.167	20.00		13.00
1.250		4.250		7.250	20.00		13.00
1.333	20.00		- C C C C	7.333	20.00	State of the state	13.00
1.417		4.417	5.00	7.417	20.00	The second second	13.00
1.500		4.500	5.00	A 100 100 HOLDER GOLD	20.00	N - MANUEL - NO. 10.	13.00
1.583		4.583		7.583	20.00		13.00
1.667		4.667		7.667	20.00		13.00
1.750		4.750		7.750	20.00		13.00
1.833		4.833	5.00	7.833	20.00	10.83	13.00 13.00
1.917		4.917		7.917 8.000	20.00	the second of the second	13.00
2.000		5.000			20.00	No see year man year	8.00
2.083 2.167		5.083 5.167		8.083	23.00		8.00
2.250		5.250	tion process because	8.250	23.00		8.00
2.333		5.333		8.333	23.00	D AND AND DESCRIPTION	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500		5.500	20.00	8.500		11.50	8.00
2.583	10 101 101101	5.583	20.00	8.583	23.00	11.58	8.00
2.667		5.667		8.667		11.67	8.00
2.750		5.750		8.750	23.00		8.00
2.833		5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917		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 (5.00		15.00			
	min)=	5.43		14.22 (i	i)		
Unit Hyd. Tpeak (5.00		15.00			
Unit Hyd. peak (cms)=	.20		.08			
						TALS*	
	cms)=	.04		.17		.213 (ii	1)
STATE OF THE STATE	hrs)=	6.92	4	7.00		7.00	
	(mm) =	192.00		58.22		4.30	
	(mm) =	193.00	1	93.00	19.	3.00	
RUNOFF COEFFICIEN	T =	.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	OHMER OF	CHODACE		OUTFLOW	STORAGE
DT= 5.0 min	OUTFLOW	STORAGE	- 1		(ha.m.)
	(cms)	(ha.m.) .0000	1	(cms)	.0654
	.0000	.0049	1	.0393	.0739
	.0011	.0102	- 1	.1153	.0828
	.0021	.0158	i	.2258	.0921
	.0033	.0218	i	.3706	.1017
	.0037	.0281	i	.5506	.1117
	.0041	.0349	1.10	.7671	.1220

```
.0045 .0420 | 1.0214 .1327
.0048 .0494 | 1.3149 .1438
.0051 .0572 | .0000 .0000
                                 AREA QPEAK TPEAK (ha) (cms) (hrs) 1.136 .125 7.00 1.136 .084 7.25
                                                     TPEAK
                                                                 R.V.
(mm)
160.96
                            1.136
                                                        7.00
     INFLOW : ID= 2 (0202)
                                                                   159.97
     OUTFLOW: ID= 1 (0302)
                                1.136
                    PEAK FLOW REDUCTION [Qout/Qin](%) = 67.65
                    TIME SHIFT OF PEAK FLOW
                                                   (min) = 15.00
                    MAXIMUM STORAGE USED
                                                  (ha.m.) = .0792
| ADD HYD (0903) |
                            AREA QPEAK (ha) (cms) .45 .036 .16 .013
                                             TPEAK R.V. (hrs) (mm)
  1 + 2 = 3
                                            (nrs, 7.00 116.65
         ID1=1 (0205):
                                              7.00 116.39
        + ID2= 2 (0204):
           .049
          ID = 3 (0903):
                              .61
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| RESERVOIR (0301) |
  IN= 2---> OUT= 1 |
                         OUTFLOW STORAGE | OUTFLOW (cms) (ha.m.) | (cms) .0000 | .0707
| DT= 5.0 min |
                                                           STORAGE
                                                             (ha.m.)
                                     .0000
                                                             .0775
                                             | .0707
| .1232
| .2290
| .3811
| .5760
| .8126
                                                              .0859
                                       .0052
                            .0010
                                       .0108
                            .0020
                                     .0233
                                                               .1031
                            .0030
                                                               .1120
                                     .0302
                            .0040
                                    .0453 | 1.0915
.0531 | 1.4134
.0611 | 1.7793
.0692 | .0000
                                       .0376
                            .0164
                            .0392
                                                               .1301
                                                               .1394
.1488
                            .0602
                            .0639
                            .0674
                                                                .0000
                            AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
1.925 .213 7.00 164.30
1.925 .172 7.17 163.61
                                                        7.00
     INFLOW : ID= 2 (0201)
     OUTFLOW: ID= 1 (0301)
                                1.925
                                             .172
                                                                   163.61
                   PEAK FLOW REDUCTION [Qout/Qin](%)= 80.93
                   TIME SHIFT OF PEAK FLOW (min) = 10.00
                                                  (ha.m.) = .0899
                   MAXIMUM STORAGE USED
| ADD HYD (0902) |
                            AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 1.14 .084 7.25 159.97 .61 .049 7.00 116.58
 1 + 2 = 3
         ID1= 1 (0302):
        + ID2= 2 (0903):
           ID = 3 (0902):
                            1.74
                                   .128
                                               7.17 144.84
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
_____
| ADD HYD (0901) |
                                   ∠rEAK TPEAK
(cms) (hrs)
.128 7.17
                                             TPEAK R.V. (hrs) (mm)
| 1 + 2 = 3 |
                             AREA
                             (ha)
                                               7.17 144.84
7.17 163.61
          ID1= 1 (0902):
                             1.74
                          1.92
        + ID2= 2 (0301):
                                      .172
          ______
          ID = 3 (0901): 3.67 .300
                                               7.17 154.69
     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
FINISH
```

SCS - Post I SSSSS U U A V SS U U A A SS V V U AAAAA L IJ Ι SS U U A A L SSSSS UUUUU A A LLLLL V V Ι VV000 TTTTT TTTTT Н H Y Y M0 0 H Y Y MM MM O O \mathbf{T} \mathbf{T} Η Н Y T \mathbf{T} Η

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***** DETAILED OUTPUT *****

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 $\label{lem:summary} Summary filename: I:\2015PR~1\115185~1\Design\HYDROL~1\115185~1\Post Development SCS.sum and the summary filename of the summary$

DATE: 9/20/2017

000

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 hrsMass curve time step = 15.00 min

TIME	RAIN	1	TIME	RAIN	TIME	RAIN	١	TIME	RAIN
hrs	mm/hr	1:	hrs	mm/hr	hrs	mm/hr		hrs	mm/hr
.25	.58	1	6.25	.97	12.25	7.01	1	18.25	.78
.50	.39	1	6.50	.78	12.50	3.70	1	18.50	.97
.75	.58	1	6.75	.97	12.75	3.51		18.75	.78
1.00	.58	1	7.00	.97	13.00	2.73	1	19.00	.97
1.25	.58	1	7.25	1.17	13.25	2.53	1	19.25	.78
1.50	.39	1	7.50	.97	13.50	2.14	1	19.50	.97
1.75	.58	1	7.75	1.17	13.75	1.95	1	19.75	.78
2.00	.58	1	8.00	1.17	14.00	1.56	1	20.00	.58
2.25	.78	1	8.25	1.36	14.25	1.36		20.25	.58
2.50	.58	1	8.50	1.36	14.50	1.56	1	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	1	21.00	.58
3.25	.78	1	9.25	1.56	15.25	1.36		21.25	.58
3.50	.58	1	9.50	1.75	15.50	1.56		21.50	.58
3.75	.58	1	9.75	1.75	15.75	1.36	1	21.75	.58
4.00	.78		10.00	2.14	16.00	.97		22.00	.58
4.25	.78	1	10.25	2.34	16.25	.78		22.25	.58
4.50	.78	1	10.50	2.92	16.50	.97		22.50	.58
4.75	.78	1	10.75	3.12	16.75	.78	1	22.75	.58
5.00	.78	1	11.00	4.68	17.00	.97		23.00	.58
5.25	.78	1	11.25	4.68	17.25	.78		23.25	.58
5.50	.78	1	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	1	12.00	7.01	18.00	. 97	Ī		

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

(ha) =.50 Area

Total Imp(%) = 22.00 Dir. Conn. (%) = 5.00

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

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

		TR	ANSFORME	D HYETOG	RAPH	_	
TIME		TIME		TIME	RAIN		RAIN
hrs	mm/hr	hrs	mm/hr	l hrs	mm/hr	223300007 2000	mm/hr
.083	.58	6.083	.97	112.083	7.01		.78
.167 .250	.58 .58	6.167 6.250	.97 .97	12.167 12.250	7.01 7.01		.78 .78
.333	.39	6.333	.78	112.230	3.70		.97
.417	.39	6.417	.78	112.417	3.70	100 000 000	.97
.500	.39	6.500	.78	12.500	3.70		.97
.583	.58	6.583	.97	12.583	3.51	18.58	.78
.667	.58	6.667	. 97	112.667	3.51	10000000 10000000000000000000000000000	.78
.750	.58	6.750	.97	112.750	3.51		.78
.833 .917		6.833 6.917	.97 .97	12.833 12.917	2.73 2.73		.97 .97
1.000		1 7.000	.97	113.000	2.73		.97
1.083		7.083	1.17	113.083	2.53	Transport tone sees	.78
1.167		7.167	1.17	13.167	2.53	19.17	.78
1.250		7.250	1.17	13.250	2.53		.78
1.333		1 7.333	. 97	13.333	2.14	incompens contributions	.97
1.417		7.417	.97	113.417	2.14		. 97
1.500 1.583		7.500 7.583	.97 1.17	13.500 13.583	2.14 1.95	COMPANY DESCRIPTION	.97 .78
1.667		7.667	1.17	113.667	1.95		.78
1.750		7.750	1.17	113.750	1.95		.78
1.833	.58	7.833	1.17	13.833	1.56		.58
1.917		7.917	1.17	13.917	1.56	TO A CONTROL OF THE PARTY	.58
2.000		8.000	1.17	114.000	1.56	STANDARD COLUMN TENS	.58
2.083		8.083	1.36	114.083	1.36	Service con uso	.58
2.167 2.250		8.167 8.250	1.36 1.36	14.167 14.250	1.36 1.36		.58 .58
2.333		8.333	1.36	114.230	1.56	CONTRACTOR WOODS - DURING	.58
2.417		8.417	1.36	114.417	1.56		.58
2.500	.58	8.500	1.36	114.500	1.56		.58
2.583		8.583	1.36	114.583	1.36		.58
2.667		8.667	1.36	114.667	1.36	MANAGEMENT CONTRACTOR	.58
2.750 2.833		8.750 8.833	$1.36 \\ 1.56$	14.750 14.833	1.36 1.56	Larries Seat Land	.58 .58
2.917	.58	8.917	1.56	114.033	1.56		.58
3.000		9.000	1.56	15.000	1.56	Account and the same	.58
3.083	.78	9.083	1.56	15.083	1.36	21.08	.58
3.167		9.167	1.56	15.167	1.36	the same to the same same	.58
3.250		9.250	1.56	115.250	1.36	21.25	.58
3.333 3.417		9.333 9.417	1.75 1.75	15.333 15.417	1.56 1.56	Control of the Control of the Control	.58 .58
3.500		9.417		115.417	1.56	account was rown	.58
3.583		9.583	1.75	115.583	1.36		.58
3.667	.58	9.667	1.75	15.667	1.36	21.67	.58
3.750		9.750	1.75	115.750	1.36	ATTENDED OF SELECT	.58
3.833		9.833		115.833	.97		.58
3.917 4.000		9.917 10.000		15.917 16.000	.97 .97	21.92	.58 .58
4.000		110.083	2.34	116.000	.78		.58
4.167		10.167	2.34	16.167	.78		.58
4.250		110.250		116.250	.78		.58
4.333		110.333	2.92	116.333	. 97	22.33	.58
4.417		110.417	2.92	116.417	.97		.58
4.500 4.583		10.500 10.583	2.92 3.12	16.500 16.583	.97 .78	22.50	.58 .58
4.667		10.667	3.12	116.667	.78		.58
4.750		10.750		116.750	.78		.58
4.833		10.833	4.68	116.833	.97	22.83	.58
4.917		110.917		116.917	.97		.58
5.000		11.000	4.68	17.000	. 97		.58
5.083		11.083		117.083	.78		.58
5.167 5.250		11.167 11.250	4.68 4.68	17.167 17.250	.78 .78		.58 .58
5.333		11.230	14.41	117.230	.78	23.23	.58
5.417		111.417	14.42	117.417	.97		.58
5.500		11.500	14.42	17.500	.97	23.50	.58
5.583		111.583		17.583	.78		.58
5.667		111.667	59.61	117.667	.78		.58
5.750 5.833		11.750 11.833	59.61 7.02	17.750 17.833	.78 .97		.58
5.917		11.033		17.033	.97		
6.000		12.000		18.000	.97		

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

***** 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.

```
Area (ha) = 1.92
Total Imp(%) = 43.00 Dir. Conn.(%) = 18.00
| STANDHYD (0201) |
|ID= 1 DT= 5.0 min |
_____
                                 IMPERVIOUS PERVIOUS (i)
                                               1.10
                        (ha) =
                                  .83
     Surface Area
     Dep. Storage (mm) =
                                   1.00
                                                     3.70
     Average Slope (%)=
                                                2.00
40.00
                                                      2.00
                                  200.00
     Length
                          (m) =
     Mannings n
                                  59.61 53.47
5.00 15.00
4.76 (ii) 13.83 (ii)
5.00 15.00
     Max.Eff.Inten.(mm/hr)=
                over (min)
     Storage Coeff. (min)=
     Unit Hyd. Tpeak (min) =
     Unit Hyd. peak (cms)=
                                                                   *TOTALS*
                                                      .09
     PEAK FLOW (cms) = .06 .09

TIME TO PEAK (hrs) = 11.75 11.83

RUNOFF VOLUME (mm) = 47.55 24.95

TOTAL RAINFALL (mm) = 48.55 48.55

RUNOFF COEFFICIENT = 98
     PEAK FLOW
                                       .06
                                                                      .136 (iii)
                                                                      11.75
                                                                    29.02
48.55
     RUNOFF COEFFICIENT =
                                      .98
```

***** 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.

		-	TF	RANSFORM	ED HYETOG	RAPH			
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	ĺ	hrs	mm/hr	hrs	mm/hr	1	hrs	mm/hr
.167	.58	1	6.167	.97	112.167	7.01	1	18.17	.78
.333	.49	1	6.333	.88	112.333	5.36	1	18.33	.88
.500	.39	Ĩ	6.500	.78	112.500	3.70	1	18.50	.97
.667	.58		6.667	.97	112.667	3.51	1	18.67	.78
.833	.58	1	6.833	.97	112.833	3.12	1	18.83	.88
1.000	.58	1	7.000	.97	13.000	2.73		19.00	.97
1.167	.58	1	7.167	1.17	13.167	2.53	1	19.17	.78
1.333	.49	1	7.333	1.07	13.333	2.34	I	19.33	.88
1.500	.39	1	7.500	.97	13.500	2.14	1	19.50	.97
1.667	.58	1	7.667	1.17	13.667	1.95	1	19.67	.78
1.833	.58	1	7.833	1.17	13.833	1.75		19.83	.68
2.000	.58	1	8.000	1.17	114.000	1.56		20.00	.58
2.167	.78	1	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	1	8.500	1.36	114.500	1.56		20.50	.58
2.667	.58		8.667	1.36	14.667	1.36	1	20.67	.58
2.833	.58	1	8.833	1.46	114.833	1.46	1	20.83	.58

```
.58 | 9.000
                                                   1.56 \mid 21.00
                                  1.56 | 15.000
           3.000
                                                                     .58
           3.167
                     .78 | 9.167
                                   1.56 | 15.167
                                                   1.36 | 21.17
                     .68 | 9.333
.58 | 9.500
                                  1.66 | 15.333
1.75 | 15.500
           3.333
                                                    1.46 | 21.33
                                                   1.56 | 21.50
                                                                     .58
           3.500
                     .58 | 9.667
                                  1.75 | 15.667
                                                   1.36 | 21.67
                                                                     .58
           3.667
                    .68 | 9.833
                                  1.95 | 15.833
2.14 | 16.000
           3.833
                                                   1.17 | 21.83
                                                                     .58
                                                   .97 | 22.00
           4.000
                     .78 |10.000
                                                                     .58
                     .78 |10.167
                                                     .78 | 22.17
                                   2.34 | 16.167
                                                                     .58
           4.167
                                   2.63 | 16.333
                    .78 |10.333
                                                    .88 | 22.33
.97 | 22.50
                                                                     .58
           4.333
           4.500
                     .78 |10.500
                                    2.92 | 16.500
                                                                     .58
                     .78 |10.667
                                                     .78 | 22.67
           4.667
                                   3.12 | 16.667
                                  3.90 |16.833
                     .78 |10.833
                                                     .88 | 22.83
                                                                     .58
           4.833
                     .78 |11.000
                                                     .97 | 23.00
           5.000
                                   4.68 | 17.000
                                                                     .58
                     .78 |11.167
                                                     .78 | 23.17
                                   4.68 | 117.167
           5.167
                                                                     .58
                     .78 |11.333
                                   9.55 | 17.333
                                                    .88 | 23.33
           5.333
                                  .78 |11.500
           5.500
                                                                     .58
                    .78 |11.667
                                                                     .58
           5.667
                                  33.31 | 17.833 .88 | 23.83
                                                                    .29
           5.833
                     .78 |11.833
                     .78 |12.000
           6.000
                                    7.01 | 18.000
                                                     .97 |
Unit Hyd Qpeak (cms) =
                          .020
               (cms) = .003 (i)
               (hrs) = 12.000
TIME TO PEAK
RUNOFF VOLUME (mm) = 11.966
TOTAL RAINFALL (mm) = 48.554
RUNOFF COEFFICIENT =
                        .246
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

PEAK FLOW

```
I CALIB
| CALIB
| NASHYD (0205) | Area (ha)= .45
| TD= 1 DT=10.0 min | Ia (mm)= 5.00
                                              .45 Curve Number (CN) = 69.0
|ID= 1 DT=10.0 min |
                                                      \# of Linear Res.(N)= 3.00
                        U.H. Tp(hrs)=
                                             .36
______
     Unit Hyd Qpeak (cms)=
                                    .047
                                  .009 (i)
     PEAK FLOW
                        (cms) =
     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
||TD= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
                              IMPERVIOUS
                                            PERVIOUS (i)
                              .44
                      (ha) =
                                            .69
    Surface Area
                                 1.00
                                              3.80
    Dep. Storage
                      (mm) =
    Average Slope
                       (%)=
                                  1.00
                      (m)=
                                65.00
                                             40.00
    Length
    Mannings n
                                 .013
                                              .250
```

		TR	ANSFORME	D HYETOG	RAPH	_	
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	112.083	7.01	18.08	.78
.167	.58	6.167	.97	112.167	7.01	18.17	.78
.250	.58	6.250	.97	12.250	7.01	18.25	.78
.333	.39	6.333	.78	112.333	3.70	18.33	.97
.417	.39	6.417	.78	112.417	3.70	18.42	.97
.500	.39	6.500	.78	112.500	3.70	18.50	.97
.583	.58	1 6.583	.97	112.583	3.51	18.58	.78
.667	.58	6.667	.97	112.667	3.51	18.67	.78
.750	.58	6.750	.97	112.750	3.51	18.75	.78
.833	.58	6.833	.97	112.833	2.73	18.83	. 97
.917	.58	6.917	.97	112.917	2.73	18.92	.97
1.000	.58	7.000	.97	13.000	2.73	19.00	.97
1.083	.58	1 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	1 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	113.583	1.95	19.58	.78

```
1.95 | 19.67
                               1.17 |13.667
                                                                 .78
          1.667
                   .58 | 7.667
                                                                 .78
          1.750
                    .58 | 7.750
                                 1.17 | 13.750
                                                1.95 | 19.75
                   .58 | 7.833
          1.833
                                 1.17 | 13.833
                                               1.56 | 19.83
                               1.17 |13.917
                                               1.56 | 19.92
          1.917
                   .58 | 7.917
                                                                 .58
                    .58 | 8.000
                                 1.17 |14.000
                                                1.56 | 20.00
                                                                 .58
          2.000
                    .78 | 8.083 | 1.36 | 14.083
                                               1.36 | 20.08
          2.083
                                               1.36 | 20.17
                               1.36 |14.167
                   .78 | 8.167
                                                                 .58
          2.167
                    .78 | 8.250
                                 1.36 | 14.250
                                                 1.36 | 20.25
                                                                 .58
          2.250
                   .58 | 8.333 | 1.36 | 14.250
                                               1.56 | 20.33
                                                                .58
          2.333
                                               1.56 | 20.42
                                                                 .58
          2.417
                   .58 | 8.417
                               1.36 | 14.417
                               1.36 |14.500
1.36 |14.583
                                                1.56 | 20.50
          2.500
                    .58 | 8.500
                                               1.36 | 20.58
          2.583
                    .58 | 8.583
                                                                 .58
                                                                 .58
                   .58 | 8.667
                               1.36 |14.667
                                               1.36 | 20.67
          2.667
                               1.36 | 14.750
          2.750
                    .58 | 8.750
                                                1.36 | 20.75
                                                                 .58
                                               1.36 | 20.83
                                                                 .58
          2.833
                    .58 | 8.833
                                 1.56 | 14.833
                   .58 | 8.917
                               1.56 | 14.917
                                               1.56 | 20.92
                                                                .58
          2.917
                                               1.56 | 21.00
                   3.000
                                                                 .58
                                                1.36 | 21.08
          3.083
                                                                 .58
                   .78 | 9.167 1.56 | 15.167
                                               1.36 | 21.17
          3.167
                                               1.36 | 21.25
                                                                .58
          3.250
                   3.333
                    .58 | 9.333
                                 1.75 | 15.333
                                                1.56 | 21.33
                                                                 .58
                               1.75 | 15.417
                                               1.56 | 21.42
                   .58 | 9.417
                                                                .58
          3.417
                   .58 | 9.500 1.75 | 15.500
                                               1.56 | 21.50
                                                                .58
          3.500
                               1.75 |15.583
1.75 |15.667
                    .58 | 9.583
                                                 1.36 | 21.58
                                                                 .58
          3.583
                                               1.36 | 21.67
                   .58 | 9.667
                                                                 .58
          3.667
                   .58 | 9.750 1.75 | 15.750
                                               1.36 | 21.75
                                                                .58
          3.750
                               2.14 |15.833
                                               .97 | 21.83
                   .78 | 9.833
          3.833
                                                                 .58
                   .78 | 9.917
                                                  .97 | 21.92
          3.917
                                 2.14 | 15.917
                                                                 .58
                                               .97 | 22.00
                                                                .58
                   .78 | 10.000 2.14 | 16.000
          4.000
                               2.34 |16.083
                   .78 |10.083
                                                  .78 | 22.08
          4.083
                                                                 .58
                                                  .78 | 22.17
                    .78 |10.167
                                 2.34 | 16.167
                                                                 .58
          4.167
                                                                .58
          4.250
                   .78 | 10.250 2.34 | 16.250
                                                  .78 | 22.25
                               2.92 |16.333
                    .78 |10.333
                                                  .97 | 22.33
          4.333
                                                                 .58
                                                  .97 | 22.42
                                                                 .58
                                 2.92 | 16.417
          4.417
                   .78 |10.417
                   .78 | 10.500 2.92 | 16.500
                                                  .97 | 22.50
                                                                .58
          4.500
                               3.12 |16.583
3.12 |16.667
                                                  .78 | 22.58
          4.583
                   .78 |10.583
                                                                 .58
                                                  .78 | 22.67
          4.667
                   .78 |10.667
                                                                 .58
                   .78 | 10.750 3.12 | 16.750
                                                  .78 | 22.75
                                                                .58
          4.750
                   .97 | 22.83
                                                                 .58
          4.833
                                                  .97 | 22.92
          4.917
                   .78 |10.917
                                 4.68 | 16.917
                                                                 .58
                   .78 | 11.000 4.68 | 17.000
                                                  .97 | 23.00
          5.000
                                                  .78 | 23.08
.78 | 23.17
                   .78 | 11.083 4.68 | 17.083
          5.083
                                                                .58
                               4.68 | 17.167
4.68 | 17.250
                   .78 |11.167
                                                                 .58
          5.167
                   .78 |11.250
                                                  .78 | 23.25
          5.250
                                                  .97 | 23.33
                                                                .58
                   .78 | 11.333 | 14.41 | 17.333
          5.333
                   .78 |11.417
                                                  .97 | 23.42
          5.417
                                 14.42 | 17.417
                                                                 .58
                                                  .97 | 23.50
                   .78 |11.500
                               14.42 | 17.500
                                                                 .58
          5.500
                                59.60 | 17.583
                                                  .78 | 23.58
                                                                .58
                   .78 |11.583
          5.583
                   .78 |11.667
                                59.61 | 17.667
                                                  .78 | 23.67
                                                                 .58
          5.667
                                                  .78 | 23.75
                    .78 |11.750
                                59.61 | 17.750
                                                                 .58
          5.750
                               7.02 | 17.833
                   .78 |11.833
                                                  .97 |
          5.833
                                  7.01 | 17.917
                                                  .97 |
          5.917
                    .78 |11.917
                                7.01 |18.000
                                                  .97
                    .78 |12.000
          6.000
                       59.61
5.00
2.43 (ii)
5.00
Max.Eff.Inten.(mm/hr)=
                                      47.46
                                      15.00
          over (min)
Storage Coeff. (min) =
                                     11.94 (ii)
                                     15.00
Unit Hyd. Tpeak (min) =
Unit Hyd. peak (cms)=
                            .30
                                       .09
                                                   *TOTALS*
                                      .06
                           .03
                                                     .080 (iii)
              (cms) =
                        11.75
                                     11.83
                                                    11.75
TIME TO PEAK
               (hrs) =
              (mm) =
                        47.55
RUNOFF VOLUME
                                     23.38
                                                    27.49
TOTAL RAINFALL (mm) =
                                                   48.55
                      48.55
                                      48.55
                                                      .57
RUNOFF COEFFICIENT =
                           .98
                                        . 48
```

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

PEAK FLOW

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: $CN^* = 81.0$ Ia = Dep. Storage (Above)
- 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	STORAGE	1	OUTFLOW	STORAGE
	(cms)	(ha.m.)	1	(cms)	(ha.m.)
	.0000	.0000		.0707	.0775
	.0010	.0052	1	.1232	.0859
	.0020	.0108	1	.2290	.0944

```
.0233 | .3811
.0302 | .5760
.0376 | .8126
.0453 | 1.0915
.0531 | 1.4134
.0611 | 1.7793
.0692 | .0000
                                                                                            .1031
                                          .0030
                                                                                               .1120
                                          .0040
                                          .0164
                                                                                              .1210
                                                                                              .1301
                                          .0392
                                          .0602
                                          .0639
                                                                                              .1488
                                          .0674
                                                          QPEAK TPEAK R.V. (cms) (hrs) (mm) .136 11.75 29.02 .011
                                                 AREA
                                                  (ha)
        INFLOW : ID= 2 (0201)
                                                 1.925
                                               1.925
                                                                                 13.33
        OUTFLOW: ID= 1 (0301)
                                                                  .011
                              PEAK FLOW REDUCTION [Qout/Qin](%)= 8.11
                             TIME SHIFT OF PEAK FLOW (min)= 95.00
MAXIMUM STORAGE USED (ha.m.)= .034
                                                                           (ha.m.) = .0344
 | ADD HYD (0903) |
                                       AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) .16 .003 12.00 11.97 .45 .009 12.00 11.99
1 + 2 = 3
             ID1= 1 (0204):
            + ID2= 2 (0205):
               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 STORAGE | OUTFLOW STORAGE

        UTFLOW
        STORAGE
        OUTFLOW

        (cms)
        (ha.m.)
        (cms)

        .0000
        .0000
        .0054

        .0011
        .0049
        .0393

        .0021
        .0102
        .1153

        .0027
        .0158
        .2258

        .0033
        .0218
        .3706

        .0037
        .0281
        .5506

        .0041
        .0349
        .7671

        .0045
        .0420
        1.0214

        .0048
        .0494
        1.3149

        .0051
        .0572
        .0000

                                                                                       (ha.m.)
                                       (cms)
                                                                                          (na.m.)
.0654
.0739
.0828
.0921
.1017
.1117
.1220
.1327
.1438
                                                                                                 R.V.
(mm)
27.49
                                                 AREA QPEAK TPEAK (ha) (cms) (hrs) 1.136 .080 11.75 1.136 .003 15.83
       INFLOW: ID= 2 (0202) 1.136
OUTPLOW: TD= 1 (0302) 1.136
                                                                                                     26.49
                                      FLOW REDUCTION [Qout/Qin](%)= 3.97
                             TIME SHIFT OF PEAK FLOW
                                                                            (min) = 245.00
                             MAXIMUM STORAGE USED
                                                                           (ha.m.) = .0205
| ADD HYD (0902) |
            2 = 3 | AREA QPEAK TPEAK R.V.

------ (ha) (cms) (hrs) (mm)

ID1= 1 (0903): .61 .012 12.00 11.99

+ ID2= 2 (0302): 1.14 .003 15.83 26.49
                                                                  TPEAK R.V. (hrs) (mm)
1 + 2 = 3
______
               ______
               ID = 3 (0902):
                                          1.74 .014 12.00 21.43
       NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
           2 = 3 | AREA QPEAK TPEAK R.V.

------ (ha) (cms) (hrs) (mm)

ID1= 1 (0301): 1.92 .011 13.33 28.33

+ ID2= 2 (0902): 1.74 .014 12.00 21.43
| 1 + 2 = 3 |
    _____
                      _____
              ID = 3 (0901): 3.67 .018 12.00 25.05
       NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

** SIMULATION NUMBER: 2 **

++++++ Filename: I:\2015 Projects\115 MASS STORM 185 - Monterra Phase 2 Natural Hazard Assessm \Design\Hydrology\115185 vo2\STORMS\SCS24H.MS Comments: SCS Type II 24 HR MASS CURVE | Ptotal= 62.00 mm | _____ = 23.75 hrsDuration of storm Mass curve time step = 15.00 min RAIN | TIME RATN TIME RAIN | TIME RAIN | TIME mm/hr | mm/hr | hrs mm/hr | hrs mm/hr hrs hrs .99 .74 | 6.25 1.24 | 12.25 8.93 | 18.25 .25 .50 | 6.50 .99 | 12.50 4.71 | 18.50 1.24 .50 4.46 | 18.75 .74 | 6.75 1.24 | 12.75 .99 .75 1.24 | 13.00 3.47 | 19.00 1.24 1.00 .74 | 7.00 .74 | 7.25 .50 | 7.50 1.49 | 13.25 3.22 | 19.25 1.25 1.24 | 13.50 2.73 | 19.50 1.24 1.50 .99 .74 | 7.75 2.48 | 19.75 1.75 1.49 | 13.75 .74 | 8.00 1.98 | 20.00 .74 2.00 1.49 | 14.00 .74 1.74 | 20.25 1.74 | 14.25 2.25 .99 | 8.25 1.98 | 20.50 .74 2.50 .74 | 8.50 1.74 | 14.50 1.74 | 14.75 .74 | 8.75 .74 | 9.00 1.74 | 20.75 .74 2.75 .74 1.98 | 15.00 1.98 | 21.00 3.00 .99 | 9.25 1.98 | 15.25 1.74 | 21.25 .74 3.25 .74 | 9.50 .74 | 9.75 .74 2.23 | 15.50 1.98 | 21.50 3.50 1.74 | 21.75 .74 3.75 2.23 | 15.75

4.50 .99 | 10.50 3.72 | 16.50 1.24 | 22.50 .74 .99 | 10.75 .99 | 22.75 .74 3.97 | 16.75 4.75 1.24 | 23.00 .99 | 11.00 5.95 | 17.00 .74 5.00 .99 | 11.25 5.95 | 17.25 .99 | 23.25 .74 5.25 1.24 | 23.50 .74 .99 | 11.50 18.35 | 17.50 5.50 .74 .99 | 11.75 75.89 | 17.75 .99 | 23.75 5.75 .99 | 12.00 8.93 | 18.00 1.24 | 6.00 ______

2.73 | 16.00

2.98 | 16.25

1.24 | 22.00

.99 | 22.25

.74

.74

.99 | 10.00

.99 | 10.25

4.00

4.25

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

		TR	ANSFORME	D HYETOG	RAPH	-		
TIME	RAIN	TIME	RAIN	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	1	hrs	mm/hr
.083	.74	6.083	1.24	112.083	8.93	1	18.08	.99
.167	.74	6.167	1.24	112.167	8.93		18.17	.99
.250	.74	6.250	1.24	112.250	8.93	1	18.25	.99
.333	.50	6.333	.99	112.333	4.71		18.33	1.24
.417	.50	6.417	.99	112.417	4.71	1	18.42	1.24
.500	.50	6.500	.99	12.500	4.71	Ţ	18.50	1.24
.583	.74	6.583	1.24	112.583	4.46		18.58	.99
.667	.74	1 6.667	1.24	112.667	4.46		18.67	.99
.750	.74	6.750	1.24	12.750	4.46	1	18.75	.99
.833	.74	6.833	1.24	112.833	3.47		18.83	1.24
.917	.74	6.917	1.24	112.917	3.47	1	18.92	1.24
1.000	.74	7.000	1.24	13.000	3.47	1	19.00	1.24
1.083	.74	7.083	1.49	13.083	3.22	1	19.08	.99
1.167	.74	7.167	1.49	13.167	3.22	1	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	1	19.33	1.24
1.417	.50	7.417	1.24	13.417	2.73	1	19.42	1.24
1.500	.50	7.500	1.24	13.500	2.73	1	19.50	1.24
1.583	.74	7.583	1.49	113.583	2.48		19.58	.99
1.667	.74	1 7.667	1.49	13.667	2.48	1	19.67	.99
1.750	.74	7.750	1.49	13.750	2.48		19.75	.99
1.833	.74	1 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	114.000	1.98	1	20.00	.74
2.083	.99	8.083	1.74	114.083	1.74	1	20.08	.74
2.167	.99	8.167	1.74	14.167	1.74		20.17	.74
2.250	.99	8.250	1.74	114.250	1.74	1	20.25	.74
2.333	.74	8.333	1.74	114.333	1.98	1	20.33	.74

```
2.417
                    .74 | 8.417
                                  1.74 | 14.417
                                                   1.98 | 20.42
                                                                    .74
                    .74 | 8.500
                                                                    .74
                                  1.74 | 14.500
                                                 1.98 | 20.50
           2.500
                                  1.74 | 14.583
                     .74 | 8.583
                                                                    .74
           2.583
                                                   1.74 | 20.58
           2.667
                     .74 | 8.667
                                   1.74 | 14.667
                                                   1.74 | 20.67
                                                                    .74
                     .74 | 8.750
                                 1.74 | 14.750
                                                   1.74 | 20.75
                                                                    .74
           2.750
                    .74 | 8.833 | 1.98 | 14.833
                                                                    .74
           2.833
                                                   1.98 | 20.83
           2.917
                     .74 | 8.917
                                   1.98 | 14.917
                                                   1.98 | 20.92
                                                                    .74
                                                                    .74
                     .74 | 9.000
                                 1.98 | 15.000
           3.000
                                                   1.98 | 21.00
                                                                    .74
                                                   1.74 | 21.08
           3.083
                     .99 | 9.083 | 1.98 | 15.083
                     .99 | 9.167
                                   1.98 | 15.167
                                                   1.74 | 21.17
                                                                    .74
           3.167
                                 1.98 | 15.250
                                                                    .74
                     .99 | 9.250
                                                   1.74 | 21.25
           3.250
                     .74 | 9.333 2.23 | 15.333
                                                   1.98 | 21.33
           3.333
                                                                    .74
                     .74 | 9.417
                                   2.23 | 15.417
                                                   1.98 | 21.42
                                                                    .74
           3.417
                     .74 | 9.500
                                 2.23 | 15.500
                                                                    .74
           3.500
                                                   1.98 | 21.50
                                 2.23 |15.583
           3.583
                    .74 | 9.583
                                                   1.74 | 21.58
                                                                    .74
                     .74 | 9.667
           3.667
                                   2.23 | 15.667
                                                   1.74 | 21.67
                                                                    .74
                                 2.23 |15.750
                                                   1.74 | 21.75
                                                                    .74
                     .74 | 9.750
           3.750
           3.833
                     .99 | 9.833
                                 2.73 | 15.833
                                                   1.24 | 21.83
                                                                    .74
                     .99 | 9.917
           3.917
                                   2.73 | 15.917
                                                   1.24 | 21.92
                                                                    .74
                                                   1.24 | 22.00
           4.000
                     .99 |10.000
                                    2.73 | 16.000
                                                                    .74
                                                   .99 | 22.08
                    .99 |10.083
                                 2.98 | 16.083
                                                                    .74
           4.083
                                 2.98 | 16.167
                                                   .99 | 22.17
                    .99 |10.167
                                                                    .74
           4.167
           4.250
                    .99 |10.250
                                   2.98 | 16.250
                                                    .99 | 22.25
                                                                    .74
                    .99 |10.333
                                                                    .74
           4.333
                                 3.72 | 16.333
                                                   1.24 | 22.33
                                 3.72 | 16.417
                                                                    .74
                                                   1.24 | 22.42
                    .99 |10.417
           4.417
                                                   1.24 | 22.50
           4.500
                     .99 |10.500
                                   3.72 | 16.500
                                                                    .74
                                                   .99 | 22.58
           4.583
                    .99 |10.583
                                 3.97 | 116.583
                                                                    .74
                                   3.97 | 16.667
                                                   .99 | 22.67
                                                                    .74
           4.667
                    .99 | 10.667
                    .99 |10.750
                                                    .99 | 22.75
                                   3.97 | 16.750
                                                                    .74
           4.750
                                 5.95 | 16.833
                    .99 |10.833
                                                   1.24 | 22.83
                                                                    .74
           4.833
                                 5.95 |16.917
                                                                    .74
                    .99 |10.917
                                                 1.24 | 22.92
           4.917
                    .99 |11.000
                                                                    .74
           5.000
                                 5.95 | 17.083
5.95 | 17.083
                                   5.95 | 17.000
                                                   1.24 | 23.00
                                                   .99 | 23.08
                                                                    .74
                    .99 |11.083
           5.083
                                 5.95 | 17.167
                                                   .99 | 23.17
                                                                    .74
                    .99 |11.167
           5.167
           5.250
                    .99 |11.250
                                   5.95 | 17.250
                                                    .99 | 23.25
                                                                    .74
                    1.24 | 23.33
                                                                    .74
           5.333
                    1.24 | 23.42
                                                                    .74
           5.417
                                                 1.24 | 23.50
                    .99 |11.500
                                  18.35 | 17.500
                                                                    .74
           5.500
                                                   .99 | 23.58
                                  75.88 | 17.583
                                                                    .74
           5.583
                    .99 |11.583
                                                   .99 | 23.67
           5.667
                    .99 |11.667
                                 75.89 | 17.667
                                                                    .74
                                 75.89 | 17.750
8.94 | 17.833
8.93 | 17.917
           5.750
                    .99 |11.750
                                                    .99 | 23.75
                                                                    .74
           5.833
                    .99 |11.833
                                                   1.24 |
                                                  1.24
           5.917
                    .99 |11.917
                                  8.93 | 18.000
           6.000
                     .99 | 12.000
                                                   1.24
                           75.89
                                        49.57
Max.Eff.Inten.(mm/hr)=
                         5.00
1.39 (ii)
5.00
                                       15.00
10.73 (ii)
           over (min)
Storage Coeff. (min) =
Unit Hyd. Tpeak (min) =
                                        15.00
                                         .09
Unit Hyd. peak (cms)=
                            .33
                                                     *TOTALS*
                             .01
                                         .03
                                                      .035 (iii)
PEAK FLOW
                (cms) =
                         11.75
60.81
61.81
                                       11.83
TIME TO PEAK
               (hrs) =
                                                       11.83
RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) =
                                        27.36
                                                       29.02
                                        61.81
                                                       61.81
RUNOFF COEFFICIENT =
```

***** 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
                              1.00
                                          3.70
                    (mm) =
    Dep. Storage
                             1.00
    Average Slope
                    (%)=
                                          2.00
                    (m) =
                          200.00
                                         40.00
    Length
                                         .250
    Mannings n
                             .013
                           75.89
                                         76.18
    Max.Eff.Inten.(mm/hr)=
                                         15.00
             over (min)
                            5.00
    Storage Coeff. (min) =
                              4.32 (ii)
                                         12.19 (ii)
                            5.00
                                         15.00
    Unit Hyd. Tpeak (min) =
                             .23
    Unit Hyd. peak (cms)=
                                          .09
```

```
*TOTALS*

      PEAK FLOW
      (cms)=
      .07
      .14

      TIME TO PEAK
      (hrs)=
      11.75
      11.83

      RUNOFF VOLUME
      (mm)=
      60.81
      35.81

      TOTAL RAINFALL
      (mm)=
      61.81
      61.81

      COMPRESCIENT
      =
      .98
      .58

                                                                                                                                                                                                                                                            .196 (iii)
                                                                                                                                                                                                                                                       11.75
                                                                                                                                                                                                                                                   40.31
```

**** 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.

```
(0204) | Area (ha) = .16 Curve Number (CN) = 69.0 0.0 min | Ia (mm) = 5.00 # of Linear Res.(N) = 3.00
 NASHYD
|ID= 1 DT=10.0 min |
.31 U.H. Tp(hrs) = .31
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

```
---- TRANSFORMED HYETOGRAPH ----
 1.24
1.000
1.333
                                                                          1.12
1.24
                                                                            .99
                                                                            .87
            .74
2.000
                                                                            .74
2.333
2.167
            .74
2.500
2.667
                                                                            .74
2.833
            .74
3.000
                                                                            .74
3.167
3.333
                                                                            .74
            3.500
                                                                            .74
                                                                            .74
3.667
                                                                            .74
3.833
            .99 | 10.000 | 2.73 | 16.000 | 1.24 | 22.00
4.000
                                                                            .74
            .99 | 10.167 | 2.98 | 16.167 | .99 | 22.17 | .99 | 10.333 | 3.35 | 16.333 | 1.12 | 22.33
           .99 |10.167
4.167

      4.333
      .99 | 10.333
      3.35 | 16.333
      1.12 | 22.33

      4.500
      .99 | 10.500
      3.72 | 16.500
      1.24 | 22.50

      4.667
      .99 | 10.667
      3.97 | 16.667
      .99 | 22.67

      4.833
      .99 | 10.833
      4.96 | 16.833
      1.12 | 22.83

      5.000
      .99 | 11.000
      5.95 | 17.000
      1.24 | 23.00

      5.167
      .99 | 11.167
      5.95 | 17.167
      .99 | 23.17

      5.333
      .99 | 11.333
      12.15 | 17.333
      1.12 | 23.33

      5.500
      .99 | 11.500
      18.35 | 17.500
      1.24 | 23.50

      7.5 89 | 17.667
      .99 | 2.3 67

                                                                            .74
4.333
                                                                            .74
                                                                            .74
                                                                            .74
                                                                            .74
                                                                            .74
                                                                            .74
            .74
5.667
                                                                            .37
5.833
6.000
```

```
Unit Hyd Qpeak (cms) = .020
                (cms) = .005 (i)
PEAK FLOW
               (hrs) = 11.833

(mm) = 18.782

(mm) = 61.634
TIME TO PEAK
RUNOFF VOLUME
                  (mm) = 61.814
TOTAL RAINFALL
                          .304
RUNOFF COEFFICIENT =
```

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

```
Curve Number (CN) = 69.0
                                  \# of Linear Res.(N) = 3.00
 D = 1 DT = 10.0 \text{ main} 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.

		TRA	ANSFORME	D HYETOG	RAPH		
TIME	RAIN			TIME	RAIN		RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.083	.74	6.083	1.24	112.083	8.93	18.08	.99
.167	.74	6.167	1.24	112.167	8.93	18.17	.99
.250	.74	6.250	1.24	112.250	8.93	18.25	.99
.333	.50	6.333	.99	112.333	4.71	18.33	1.24
.417	.50	6.417	.99	112.417	4.71	18.42	1.24
.500	.50	6.500	.99	112.500	4.71		1.24
.583	.74	6.583	1.24	112.583	4.46		.99
.667		6.667	1.24	112.667	4.46		.99
.750		6.750	1.24	112.750	4.46		.99
.833		6.833	1.24	112.833	3.47		1.24
.917		6.917	1.24	112.917	3.47		1.24
1.000		7.000		13.000	3.47		1.24
1.083		7.083		113.083	3.22		.99
1.167		7.167		13.167	3.22		.99
1.250		7.250		13.250	3.22		.99
1.333		1 7.333		13.333	2.73		1.24
1.417		7.417		13.417	2.73		1.24
1.500		7.500		13.500	2.73		1.24
1.583		7.583		13.583	2.48		.99
1.667		7.667	1.49	13.667	2.48		.99
1.750		7.750	1.49	113.750	2.48		.99
1.833		7.833	1.49	13.833	1.98		.74
1.917		7.917	1.49	113.917	1.98		.74 .74
2.000		8.000	1.49	114.000	1.98		.74
2.083		8.083	1.74	114.083	1.74		.74
2.167		8.167	$1.74 \\ 1.74$	114.167	1.74 1.74		.74
2.250		8.250	1.74	14.250 14.333	1.74 1.98		.74
2.333		8.333	1.74 1.74	114.333	1.98		.74
2.417	15 (0.100)	8.417 8.500	1.74	114.417	1.98		.74
2.500 2.583		8.500 8.583	1.74	114.583	1.74		.74
2.565		8.667	1.74	114.667	1.74		.74
2.750		8.750	1.74	114.750	1.74		.74
2.730		8.833	1.98	114.833	1.98		.74
2.033		8.917	1.98	114.917	1.98		.74
3.000		9.000	1.98	115.000	1.98		.74
3.083		9.083	1.98	115.083	1.74		.74
3.167		9.167	1.98	115.167	1.74		.74
3.250		9.250	1.98	115.250	1.74		.74
3.333		9.333	2.23	115.333	1.98		.74
3.417		9.417	2.23	115.417	1.98		.74
3.500		9.500	2.23	15.500	1.98		.74
3.583		9.583	2.23	115.583	1.74		.74
3.667		9.667		115.667	1.74		.74
3.750		9.750	2.23	115.750	1.74		.74
3.833		9.833		115.833	1.24		.74
3.917		9.917	2.73	115.917	1.24		.74
4.000		110.000		116.000	1.24	22.00	.74
4.083		110.083	2.98	116.083	.99		.74
4.167		110.167	2.98	116.167	.99	22.17	.74
4.250		10.250	2.98	116.250	.99	22.25	.74
4.333		110.333	3.72	116.333	1.24	22.33	.74
4.417		110.417	3.72	116.417	1.24	22.42	.74
4.500		10.500	3.72	116.500	1.24	22.50	.74
4.583		10.583	3.97	116.583	.99	22.58	.74
4.667		110.667	3.97	116.667	.99	22.67	.74
4.750		110.750	3.97	116.750	.99	22.75	.74

```
5.95 | 16.833
                4.833
                                                         1.24 | 22.83
                          .99 |10.833
                                                                           .74
                                         5.95 | 16.917
                          .99 |10.917
                                                         1.24 | 22.92
                4.917
                5.000
                          .99 |11.000
                                       5.95 | 17.000
                                                         1.24 | 23.00
                                                                           .74
                                         5.95 | 17.083
                                                          .99 | 23.08
                                                                           .74
                5.083
                          .99 |11.083
                                                          .99 | 23.17
                                                                           .74
                5.167
                          .99 | 11.167
                                         5.95 | 17.167
                5.250
                          .99 |11.250
                                        5.95 | 17.250
                                                          .99 | 23.25
                                                                           .74
                                                                           .74
                          .99 |11.333
                                                         1.24 | 23.33
                5.333
                                        18.35 | 117.333
                                                         1.24 | 23.42
                5.417
                          .99 |11.417
                                        18.35 | 17.417
                                                                           .74
                          .99 |11.500
                                       18.35 | 17.500
                                                         1.24 | 23.50
                                                                           .74
                5.500
                                                          .99 | 23.58
                                                                           .74
                5.583
                          .99 |11.583
                                        75.88 | 17.583
                                                          .99 | 23.67
                5.667
                          .99 |11.667
                                        75.89 | 17.667
                                                                           .74
                          .99 |11.750
                                        75.89 | 17.750
                                                          .99 | 23.75
                                                                           .74
                5.750
                                       8.94 | 17.833
                                                         1.24
                5.833
                          .99 |11.833
                5.917
                          .99 |11.917
                                        8.93 | 17.917
                                                         1.24 |
                                       8.93 | 18.000
                6.000
                          .99 |12.000
                                                         1.24
     Max.Eff.Inten.(mm/hr) =
                                 75.89
                                              15.00
                                  5.00
               over (min)
     Storage Coeff. (min) =
                                  2.20 (ii)
                                              10.42 (ii)
                                  5.00
                                              15.00
     Unit Hyd. Tpeak (min) =
     Unit Hyd. peak (cms)=
                                  .30
                                                .09
                                                            *TOTALS*
                                   .04
                                                .09
     PEAK FLOW
                                                              .116 (iii)
                     (cms) =
                                                              11.75
     TIME TO PEAK
                     (hrs) =
                                 11.75
                                              11.83
     RUNOFF VOLUME
                     (mm) =
                                 60.81
                                              33.88
                                                              38.46
                                 61.81
                                              61.81
                                                              61.81
     TOTAL RAINFALL
                      (mm) =
     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	•	STORAGE (ha.m.) .0000 .0052 .0108 .0233 .0302 .0376 .0453 .0531 .0611		EFLOW Sems) (0707 1232 2290 3811 5760 8126 0915 4134 7793 0000	
	(0201) 1.	(ha) 925 925 REDUCTION PEAK FLOW	[Qout/Qir	12.50	(mm) 40.31 39.62
ID = 3 (09)	AREA (ha) (ha) (204): .16 (205): .45	(cms) .005 .014	12.00	(mm) 18.78 18.83 ====== 18.82	

STORAGE

(ha.m.)

.0000

.0049

OUTFLOW

(cms)

.0000

.0011

OUTFLOW

(cms)

.0054

.0393

STORAGE

(ha.m.)

.0654

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

| DT= 5.0 min |

```
.0021
                                      .0102
                                                   .1153
                                                                .0828
                                                   .2258
                                     .0158
                           .0027
                                     .0218
                                                 .3706
                                                               .1017
                           .0033
                                                 .5506
                                                                .1117
                                     .0281
                           .0037
                                                              .1220
                                     .0349
                           .0041
                                     .0420 | 1.0214
.0494 | 1.3149
.0572 | .0000
                                                   .7671
                                   .0420
                           .0045
                                                               .1327
                                                                .1438
                           .0048
                                                                .0000
                           .0051
                                        QPEAK
                                                      TPEAK
                                AREA
                                         (cms)
                                (ha)
                                                       (hrs)
                                                                    (mm)
                                                      11.75
                                           .116
   INFLOW : ID= 2 (0202)
                             1.136
                                                                    38.46
   OUTFLOW: ID= 1 (0302)
                               1.136
                                            .004
                                                        16.00
                        FLOW REDUCTION [Qout/Qin](%)= 3.28
                  PEAK
                  TIME SHIFT OF PEAK FLOW
                                                   (min) = 255.00
                  MAXIMUM STORAGE
                                     USED
                                                  (ha.m.) = .0298
                                   QPEAK
                                                       R.V. (mm)
                            AREA
                                              TPEAK
                                             (hrs) (nun,
12.00 18.82
37.46
                            (ha)
                                  .019
                             .61
       ID1= 1 (0903):
      + ID2= 2 (0302):
                           1.14
                                    .004
        _____
        ID = 3 (0902):
                           1.74
                                    .022
                                             12.00
                                                    30.96
   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
                                  QPEAK TPEAK R.V. (cms) (hrs) (mm)
                            AREA
                           (ha)
                                   .032
                                             12.50
                                                      39.62
       ID1= 1 (0301):
                           1.92
      + ID2= 2 (0902):
                            1.74
                                     .022
                                             12.00
                                                       30.96
        .046 12.33
                                                    35.50
        ID = 3 (0901):
                           3.67
   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
** SIMULATION NUMBER: 3 **
                      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 \text{ hrs}
                       Mass curve time step = 15.00 \text{ min}
                      RAIN | TIME
                                       RAIN | TIME
                                                        RAIN | TIME
                hrs mm/hr | hrs mm/hr | hrs
.25 .85 | 6.25 1.42 | 12.25
.50 .57 | 6.50 1.13 | 12.50
                                                       mm/hr | hrs mm/hr
10.21 | 18.25 | 1.13
5.39 | 18.50 | 1.42
                       .85 | 6.75 | 1.42 | 12.75
.85 | 7.00 | 1.42 | 13.00
.85 | 7.25 | 1.70 | 13.25
                                                        5.10 | 18.75
3.97 | 19.00
3.69 | 19.25
                                                                         1.13
1.42
                                                                          1.13
                        .57
                                                        3.12 | 19.50 1.42
                               7.50 1.42 | 13.50
                                                        2.84 | 19.75
2.27 | 20.00
                        .85 | 7.75
.85 | 8.00
                                      1.70 | 13.75
1.70 | 14.00
                                                                          .85
.85
                                                        1.99 | 20.25
                      1.13 | 8.25 1.99 | 14.25
                                                        2.27 | 20.25
                      .85
                                                          1.99 | 20.75
                                                                            .85
                         .85 | 9.00 2.27 | 15.00
                                                        2.27 | 21.00
                       1.13 | 9.25 | 2.27 | 15.25

.85 | 9.50 | 2.55 | 15.50

.85 | 9.75 | 2.55 | 15.75
                                                        1.99 | 21.25
2.27 | 21.50
                                                                            .85
                                                        1.99 | 21.75
                      1.13 | 10.00 3.12 | 16.00
1.13 | 10.25 3.40 | 16.25
1.13 | 10.50 4.25 | 16.50
                                                        1.42 | 22.00
                                                                           .85
                                                          1.13 | 22.25
                                                                            .85
                                                        1.42 | 22.50
                                                                            .85
                                                        1.13 | 22.75
1.42 | 23.00
1.13 | 23.25
                                                                           .85
                      1.13 | 10.75 4.54 | 16.75
                                       6.81 | 17.00
6.81 | 17.25
                      1.13 | 11.00
1.13 | 11.25
                                                                            .85
                                                                            .85
                                                                           .85
                      1.13 | 11.50
                                      20.99 | 17.50
                                                        1.42 | 23.50
                                        86.78 | 17.75
                       1.13 | 11.75
                                                          1.13 | 23.75
                                                                            .85
```

1.42

10.21 | 18.00

| ADD HYD (0902) |

| ADD HYD (0901) |

| 1 + 2 = 3 |

I MASS STORM

| Ptotal= 70.90 mm |

TIME

.75

1.00

1.25

1.50

1.75

2.00

2.25

2.50

2.75 3.00

3.25 3.50 3.75

4.00 4.25

4.50

4.75

5.00

5.25 5.50

5.75

6.00

1.13 | 12.00

1 + 2 = 3

CALIB	Area Total	(ha) = .50 Imp(%) = 22.00		5.00
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) =	IMPERVIOUS .11 1.00 1.00 30.00 .013	PERVIOUS (i) .39 4.30 2.00 40.00 .250	

		TRA	NSFORME	D HYETOGE	RAPH		
TIME	RAIN	TIME		TIME	RAIN		RAIN
hrs		hrs		hrs	mm/hr		mm/hr
.083		6.083		112.083	10.21		1.13
.167		6.167		112.167	10.21		1.13 1.13
.250 .333	.85 .57	6.250 6.333		12.250 12.333	5.39		1.42
.417	.57	6.417	1.13	112.417	5.39		1.42
.500	.57	6.500		112.500	5.39		1.42
.583	.85	1 6.583	1.42	112.583	5.10	18.58	1.13
.667	.85	6.667	1.42	112.667	5.10		1.13
.750	.85	6.750	1.42	112.750	5.10		1.13
.833	.85	6.833	1.42	112.833	3.97		$1.42 \\ 1.42$
.917 1.000	.85 .85	6.917 7.000	$1.42 \\ 1.42$	12.917 13.000	3.97 3.97		1.42
1.083	.85	7.083		113.083	3.69		1.13
1.167	.85	7.167		113.167	3.69		1.13
1.250	.85	7.250		113.250	3.69	19.25	1.13
1.333	.57	7.333		13.333	3.12		1.42
1.417	.57	7.417		13.417	3.12		1.42
1.500	.57	7.500	1.42 1.70	13.500 13.583	3.12 2.84		1.42 1.13
1.583 1.667	.85 .85	7.583 7.667	1.70	113.583	2.84 2.84		1.13
1.750	.85	7.750	1.70	113.750	2.84		1.13
1.833	.85	7.833	1.70	13.833	2.27		.85
1.917	.85	7.917	1.70	113.917	2.27	19.92	.85
2.000	.85	8.000	1.70	114.000	2.27		.85
2.083	1.13	8.083	1.99	114.083	1.99		.85
2.167		8.167	1.99	114.167	1.99		.85 .85
2.250 2.333	1.13	8.250 8.333	1.99 1.99	14.250 14.333	1.99 2.27		.85
2.417	.85	8.417	1.99	114.417	2.27		.85
2.500	.85	8.500	1.99	114.500	2.27		.85
2.583	.85	8.583	1.99	114.583	1.99	20.58	.85
2.667	.85	8.667	1.99	14.667	1.99		.85
2.750	.85	8.750	1.99	114.750	1.99		.85
2.833	.85	8.833	2.27	114.833	2.27		.85 .85
2.917 3.000	.85 .85	8.917 9.000	2.27 2.27	14.917 15.000	2.27		.85
3.083	1.13	9.083	2.27	115.083	1.99		.85
3.167	1.13	9.167	2.27	15.167	1.99		.85
3.250	1.13	9.250	2.27	115.250	1.99	21.25	.85
3.333	.85	9.333	2.55	15.333	2.27		.85
3.417	.85	9.417	2.55	115.417	2.27		.85
3.500	.85	9.500	2.55	15.500 15.583	2.27		.85 .85
3.583 3.667	.85 .85	9.583	2.55	115.667	1.99		.85
3.750	.85	9.750		115.750	1.99		.85
3.833	1.13	9.833		15.833	1.42		.85
3.917	1.13			15.917	1.42		.85
4.000		110.000		16.000	1.42		.85
4.083		110.083	3.40	116.083	1.13		.85
4.167 4.250		10.167 10.250	3.40 3.40	16.167 16.250	1.13 1.13		.85 .85
4.230		110.230		116.230	1.42		.85
4.417		110.417	4.25	16.417	1.42	The same of the same of	.85
4.500		110.500	4.25	116.500	1.42	22.50	.85
4.583		10.583	4.54	16.583	1.13		.85
4.667		10.667	4.54	16.667	1.13		.85
4.750		110.750	4.54	16.750 16.833	1.13 1.42		.85 .85
4.833 4.917		10.833 10.917	6.81 6.81	116.833	$1.42 \\ 1.42$	rement terren	.85
5.000		111.000	6.81	117.000	1.42		.85
5.083		111.083	6.81	17.083	1.13	E recree terre	.85
5.167		111.167	6.81	17.167	1.13		.85
5.250		11.250	6.81	117.250	1.13		.85
5.333		11.333	20.99	117.333		23.33	.85
5.417 5.500		11.417 11.500	20.99	17.417 17.500		23.42	.85
J. 500	1.13	111.300	20.23	111.000	1.72	23.30	.00

```
1.13 | 11.583 | 86.78 | 17.583 | 1.13 | 23.58 | 1.13 | 11.667 | 86.78 | 17.667 | 1.13 | 23.67
              5.583
                                                                                      .85
              5.667
                                                               1.13 | 23.75
                                                                                      .85
                       1.13 | 11.750 86.78 | 17.750
              5.750
                                          10.22 | 17.833
10.21 | 17.917
                                                                 1.42 |
                         1.13 | 11.833
              5.833
                                                               1.42
                         1.13 | 11.917
             5.917
              6.000
                       1.13 | 12.000 10.21 | 18.000
                                                               1.42 |
                                  86.78
                                                    61.31
Max.Eff.Inten.(mm/hr) =
                                5.00
                                                  10.00
            over (min)
                                    1.31 (ii)
Storage Coeff. (min) =
                                                    9.90 (ii)
                                    5.00
                                                   10.00
Unit Hyd. Tpeak (min) =
Unit Hyd. peak (cms)=
                                                   .11
                                                                   *TOTALS*
PEAK FLOW (cms) = .U1
TIME TO PEAK (hrs) = 11.75
RUNOFF VOLUME (mm) = 69.69
TOTAL RAINFALL (mm) = 70.69
BUNGEF COEFFICIENT = .99
                                                                      .052 (iii)
                                                     . 05
                                               11.75
33.91
70.69
                                                                       11.75
                                                                     35.68
70.69
```

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

I CALTB Area (ha) = 1.92STANDHYD (0201) | Total Imp(%) = 43.00 Dir. Conn.(%) = 18.00|ID= 1 DT= 5.0 min | IMPERVIOUS PERVIOUS (i) .83 1.00 1.00 (ha) =1.10 Surface Area Dep. Storage (mm) =3.70 (%) = 2.00 Average Slope (m) = 200.00 40.00 Length Mannings n = .013 .250 Max.Eff.Inten.(mm/hr) = 86.78 over (min) 5.00 Storage Coeff. (min) = 4.10 (ii) Unit Hyd. Tpeak (min) = 5.00 Unit Hyd. opak (cms) = 24 91.86 15.00 11.40 15.00 11.40 (ii) .09 .24 Unit Hyd. peak (cms)= .08 .18 11.75 11.83 69.69 43.41 70.69 70.69 .99 *TOTALS* .239 (iii) PEAK FLOW (cms) =TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = 11.75 48.14 70.69 KUNOFF COEFFICIENT = . 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.

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

			TF	RANSFORME	ED HYETOG	RAPH		
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.167	.85	Ī	6.167	1.42	112.167	10.21	18.17	1.13
.333	.71	1	6.333	1.28	112.333	7.80	18.33	1.28
.500	.57	1	6.500	1.13	112.500	5.39	18.50	1.42
.667	.85	Ī	6.667	1.42	112.667	5.10	18.67	1.13
.833	.85	1	6.833	1.42	112.833	4.54	18.83	1.28
1.000	.85	1	7.000	1.42	13.000	3.97	19.00	1.42
1.167	.85	1	7.167	1.70	113.167	3.69	19.17	1.13
1.333	71		7.333	1.56	13.333	3.40	19.33	1.28

```
3.12 | 19.50
2.84 | 19.67
2.55 | 19.83
          1.500
                                                          1.42
          1.667
                 .85 | 7.833 | 1.70 | 13.833
          1.833
                                            2.27 | 20.00
          2.000
                  .85
          2.167
                 1.13 | 8.167
                                             1.99 | 20.17
                                                            .85
                 .99 | 8.333 | 1.99 | 14.333
          2.333
                                            2.13 | 20.33
                                            2.27 | 20.50
                                                            .85
                  .85 | 8.500 1.99 | 14.500
          2.500
                 1.99 | 20.67
          2.667
                                                             .85
                                            2.13 | 20.83
          2.833
                                            2.27 | 21.00
                                                            .85
          3.000
                  .85 | 9.000 2.27 | 15.000
                 1.13 | 9.167
                               2.27 | 15.167
                                             1.99 | 21.17
                                                            .85
          3.167
                 .99 | 9.333 | 2.41 | 15.333
                                                            .85
                                            2.13 | 21.33
          3.333
          3.500
                  .85 | 9.500 2.55 | 15.500
                                            2.27 | 21.50
                                                            .85
                 1.99 | 21.67
1.70 | 21.83
          3.667
                                                            .85
          3.833
          4.000
                1.13 | 10.000 3.12 | 16.000
                                            1.42 | 22.00
                                                            .85
                                            1.13 | 22.17
                1.13 | 10.167 | 3.40 | 16.167 | 1.13 | 10.333 | 3.83 | 16.333
          4.167
                                                            .85
                                             1.28 | 22.33
          4.333
                                                             .85
          4.500
                1.13 | 10.500 4.25 | 16.500
                                            1.42 | 22.50
                                            1.13 | 22.67
                .85
          4 667
                                                            .85
          4.833
                                             1.28 | 22.83
                1.13 | 11.000 6.81 | 17.000
                                            1.42 | 23.00
          5.000
                                            1.13 | 23.17
                                                            .85
          5.167
                6.81 | 17.167
          5.333
                                             1.28 | 23.33
                                                            .85
                                            1.42 | 23.50
          5.500
                                           1.13 | 23.67
1.28 | 23.83
1.42 |
                1.13 | 11.667 86.78 | 17.667
                                                           .85
          5.667
                 1.13 |11.833
                              48.49 | 17.833
                                                            .43
          5.833
                1.13 | 12.000 | 10.21 | 18.000
          6.000
Unit Hyd Qpeak (cms) =
                       .020
             (cms) = .007 (i)

(hrs) = 11.833

(mm) = 23.872
TIME TO PEAK
RUNOFF VOLUME
TOTAL RAINFALL (mm) = 70.687
RUNOFF COEFFICIENT =
                     . 338
                                   Curve Number (CN) = 69.0
```

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

PEAK FLOW

```
I CALTB
| NASHYD
                    Area (ha) = .45
Ia (mm) = 5.00
           (0205)
                                           \# of Linear Res.(N) = 3.00
|ID= 1 DT=10.0 min |
                     U.H. Tp(hrs) = .36
    Unit Hyd Qpeak (cms) =
                             .047
    PEAK FLOW
                              .017 (i)
                    (cms) =
                    (hrs) = 12.000
    TIME TO PEAK
                   (mm) = 23.927
    RUNOFF VOLUME
    TOTAL RAINFALL
                     (mm) = 70.687
    RUNOFF COEFFICIENT =
                             .338
```

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

```
Area (ha)= 1.14
Total Imp(%)= 39.00 Dir. Conn.(%)= 17.00
| STANDHYD (0202) |
|ID= 1 DT= 5.0 min |
_____
                            IMPERVIOUS PERVIOUS (i)
                    (ha) =
                            .44
1.00
                                        .69
3.80
    Surface Area
                  (ha) =
(mm) =
(%) =
    Dep. Storage
    Average Slope
                              1.00
                    (%)=
                                          2.00
                            65.00
    Length
                    (m) =
                                          40.00
                               .013
    Mannings n
```

TRANSFORMED HYETOGRAPH											
TIME	RAIN	1	TIME	RAIN	TIME	RAIN	1	TIME	F	MIA	
hrs	mm/hr	1	hrs	mm/hr	hrs	mm/hr	1	hrs	mm	ı/hr	
.083	.85	1	6.083	1.42	112.083	10.21	1	18.08	1	.13	
.167	.85	1	6.167	1.42	112.167	10.21	1	18.17	1	.13	
.250	.85	1	6.250	1.42	112.250	10.21		18.25	1	.13	
.333	.57	1	6.333	1.13	112.333	5.39	1	18.33	1	.42	
.417	.57	1	6.417	1.13	112.417	5.39	Ī	18.42	1	.42	
.500	.57	1	6.500	1.13	112.500	5.39	1	18.50	1	.42	
.583	.85		6.583	1.42	112.583	5.10	1	18.58	1	.13	
.667	.85	1	6.667	1.42	112.667	5.10	1	18.67	1	.13	
.750	.85	1	6.750	1.42	112.750	5.10	1	18.75	1	.13	
.833	.85	1	6.833	1.42	112.833	3.97	1	18.83	1	.42	

```
3.97 | 18.92
                                                                        1.42
             .917
                      .85 | 6.917
                                      1.42 | 12.917
            1.000
                      .85 | 7.000
                                       1.42 | 13.000
                                                        3.97 | 19.00
                       .85 | 7.083
                                                        3.69 | 19.08
                                       1.70 | 13.083
                                                                         1.13
            1.083
            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
                                                        3.12 | 19.33
                       .57 | 7.333
                                       1.42 | 113.333
                                                                        1.42
            1.333
            1.417
                       .57 | 7.417
                                      1.42 | 13.417
                                                        3.12 | 19.42
                                                                        1.42
            1.500
                       .57 | 7.500
                                       1.42 | 113.500
                                                        3.12 | 19.50
                                                                         1.42
                       .85 | 7.583
                                       1.70 | 13.583
                                                        2.84 | 19.58
                                                                        1.13
            1.583
            1.667
                       .85 | 7.667
                                       1.70 | 13.667
                                                        2.84 | 19.67
                                                                        1.13
            1.750
                                       1.70 | 13.750
                       .85 | 7.750
                                                        2.84 | 19.75
                                                                         1.13
                                                                          .85
            1.833
                       .85 |
                             7.833
                                       1.70 | 13.833
                                                        2.27 | 19.83
                                       1.70 | 13.917
                                                        2.27 | 19.92
                                                                          .85
            1.917
                      .85 | 7.917
                                      1.70 | 14.000
                                                        2.27 | 20.00
                                                                          .85
            2.000
                      .85 |
                             8.000
            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
            2.250
                                                        1.99 | 20.25
                                                                          .85
                      1.13 | 8.250
                                       1.99 | 14.250
            2.333
                      .85
                           | 8.333
                                       1.99 | 14.333
                                                        2.27
                                                             | 20.33
                                                                          .85
                      .85 | 8.417
                                      1.99 | 14.417
                                                        2.27 | 20.42
                                                                          .85
            2.417
                                                                          .85
                      .85 | 8.500
                                      1.99 |14.500
                                                        2.27 | 20.50
            2.500
                                       1.99 | 14.583
                                                        1.99
                                                             1 20.58
            2.583
                      .85 | 8.583
                                                                          .85
                                                        1.99 | 20.67
                                                                          .85
                                       1.99 | 14.667
            2.667
                      .85 | 8.667
                                                                          .85
            2.750
                      .85 | 8.750
                                       1.99 | 14.750
                                                        1.99 | 20.75
            2.833
                       .85 | 8.833
                                       2.27 | 14.833
                                                        2.27 | 20.83
                                                                          .85
                                       2.27 | 14.917
                                                        2.27 | 20.92
                                                                          .85
            2.917
                      .85 | 8.917
                                                                          .85
            3.000
                      .85 | 9.000
                                       2.27 | 15.000
                                                        2.27 | 21.00
            3.083
                      1.13 | 9.083
                                       2.27 | 15.083
                                                        1.99 | 21.08
                                                                          .85
                                                        1.99 | 21.17
            3.167
                      1.13 | 9.167
                                       2.27 | 15.167
                                                                          .85
            3.250
                      1.13 | 9.250
                                       2.27 | 15.250
                                                        1.99 | 21.25
                                                                          .85
                      .85 | 9.333
                                       2.55 | 15.333
                                                        2.27 | 21.33
                                                                          .85
            3.333
            3.417
                      .85 | 9.417
                                       2.55 | 15.417
                                                        2.27 | 21.42
                                                                          .85
                                                        2.27 | 21.50
            3.500
                      .85 | 9.500
                                       2.55 | 15.500
                      .85 | 9.583
                                                        1.99 | 21.58
                                       2.55 | 15.583
                                                                          .85
            3.583
            3.667
                      .85 | 9.667
                                       2.55 | 15.667
                                                        1.99 | 21.67
                                                                          .85
                                                                          .85
            3.750
                      .85 | 9.750
                                       2.55 | 15.750
                                                        1.99 | 21.75
                                                        1.42 | 21.83
                                                                          .85
            3.833
                     1.13 | 9.833
                                       3.12 | 15.833
            3.917
                      1.13 | 9.917
                                       3.12 | 15.917
                                                        1.42
                                                             | 21.92
                                                                          .85
                                                                          .85
            4.000
                     1.13 | 10.000
                                       3.12 | 16.000
                                                        1.42 | 22.00
                     1.13 |10.083
                                                                          .85
            4.083
                                       3.40 | 16.083
                                                        1.13 | 22.08
                                       3.40 | 16.167
                                                        1.13 | 22.17
                                                                          .85
            4.167
                      1.13 | 10.167
            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
                                       4.25 | 16.417
                                                        1.42
                                                             22.42
                                                                          .85
            4.417
                     1.13 | 10.417
                                       4.25 | 16.500
                                                        1.42 | 22.50
            4.500
                      1.13 | 10.500
                                                                          .85
                                                                          .85
            4.583
                     1.13 | 10.583
                                       4.54 | 16.583
                                                        1.13 | 22.58
            4.667
                     1.13 | 10.667
                                       4.54 | 16.667
                                                        1.13 | 22.67
                                                                          .85
                                       4.54 | 16.750
                                                        1.13 | 22.75
            4.750
                     1.13 | 10.750
                                                                          .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
                                                        1.42 | 23.00
                                                                          .85
            5.000
                     1.13 | 11.000
                                       6.81 | 17.000
            5.083
                     1.13 | 11.083
                                       6.81 | 17.083
                                                        1.13 | 23.08
                                                                          .85
            5.167
                                       6.81 | 17.167
                                                        1.13 | 23.17
                                                                          .85
                     1.13 | 11.167
                                                        1.13 | 23.25
            5.250
                     1.13 | 11.250
                                       6.81 | 17.250
                                                                          .85
            5.333
                     1.13 | 11.333
                                      20.99 | 17.333
                                                        1.42 | 23.33
                                                                          .85
                                      20.99 | 17.417
                                                        1.42 | 23.42
            5.417
                                                                          .85
                     1.13 | 11.417
            5.500
                     1.13 | 11.500
                                      20.99 | 17.500
                                                        1.42 | 23.50
                                                                          .85
                                      86.78 | 17.583
            5.583
                     1.13 | 111.583
                                                        1.13 | 23.58
                                                                          .85
                                      86.78 | 17.667
                                                        1.13 | 23.67
            5.667
                     1.13 | 11.667
            5.750
                     1.13 | 11.750
                                      86.78 | 17.750
                                                        1.13 | 23.75
                                                                          .85
                     1.13 | 11.833
                                      10.22 | 117.833
                                                        1.42 |
            5.833
                                                        1.42 |
            5.917
                     1.13 | 11.917
                                      10.21 | 17.917
            6.000
                     1.13 | 12.000
                                      10.21 | 18.000
                                                        1.42 |
Max.Eff.Inten.(mm/hr)=
                              86.78
                                            82.91
                             5.00
                                            10.00
           over (min)
Storage Coeff. (min) =
                               2.09 (ii)
                                            9.70 (ii)
                             5.00
                                            10.00
Unit Hyd. Tpeak (min) =
                                .31
                                             .11
Unit Hyd. peak (cms)=
                                                          *TOTALS*
PEAK FLOW
                 (cms) =
                               .05
                                             .11
                                                            .161 (iii)
TIME TO PEAK
                                            11.75
                                                            11.75
                 (hrs) =
                              11.75
                              69.69
                                            41.27
                                                            46.10
RUNOFF VOLUME
                  (mm) =
                  (mm) =
                              70.69
                                            70.69
                                                            70.69
TOTAL RAINFALL
                                .99
                                              .58
RUNOFF COEFFICIENT
```

⁽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 STORAGE | OUTFLOW
                                                                                                                         STORAGE
                                                                                                                         (ha.m.)
                                                                       (ha.m.)
                                                                                             (cms)
| .0707
                                                       (cms)
                                                                          .0000
                                                         .0000
                                                                                                         .1232
                                                                               .0052
                                                                                                                                   .0859
                                                         .0010
                                                                                                                               .0944
                                                                                                     .2290
                                                         .0020
                                                                            .0108
                                                                           .0100 | .2230
.0233 | .3811
.0302 | .5760
.0376 | .8126
.0453 | 1.0915
.0531 | 1.4134
.0611 | 1.7793
                                                                          .0233
.0302
.0376
                                                                                                                                .1031
                                                         .0030
                                                         .0040
                                                                                                                                .1210
                                                         .0164
                                                                                                                                .1301
                                                         .0392
                                                         .0602
                                                                                                                                 .1394
                                                         .0639
                                                         .0674
                                                                           .0692 | .0000
                                                                   AREA QPEAK (ha) (cms) 1.925 .239
                                                                                                                  TPEAK
                                                                                                                  (hrs) (mm)
11.75 48.14
           INFLOW : ID= 2 (0201)
                                                                  1.925
                                                                                           .048
          OUTFLOW: ID= 1 (0301)
                                                                  1.925
                                                                                                                  12.42
                                                     FLOW REDUCTION [Qout/Qin](%) = 20.12
                                        PEAK
                                        TIME SHIFT OF PEAK FLOW (min) = 40.00
                                                                                                      (ha.m.) = .0486
                                        MAXIMUM STORAGE USED
| ADD HYD (0903) |
1 + 2 = 3
                                                          AREA QPEAK TPEAK R.V.
                                                              (ha) (cms) (hrs) (mm)
.16 .007 11.83 23.87
.45 .017 12.00 23.93
                                                          (ha)
     _____
                                                                                                                     (mm)
                                                         .16
                 ID1 = 1 (0204):
                + ID2= 2 (0205):
                    ID = 3 (0903): .61 .024 12.00 23.91
          NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| RESERVOIR (0302) |
   IN= 2---> OUT= 1 |
                                                                                                                          STORAGE
                                                    OUTFLOW STORAGE | OUTFLOW
| DT= 5.0 min |
                                                                                             (cms)
| .0054
| .0393
                                                                         (ha.m.)
                                                       (cms)
                                                                                                                              .0654
                                                                           .0000
                                                         .0000
                                                                                                                               .0739
                                                         .0011
                                                                              .0049
                                                                               .0102
                                                                                                     .2258
                                                                                                          .1153
                                                         .0021
                                                                               .0158
                                                                                             .2258
| .3706
| .5506
| .7671
                                                         .0027
                                                                           .0218 | .3706
.0281 | .5506
.0349 | .7671
.0420 | 1.0214
                                                                               .0218
                                                                                                                                .1017
                                                         .0033
                                                                                                                                .1017
.1117
.1220
.1327
.1438
                                                         .0037
                                                         .0041
                                                         .0045
                                                         .0048 .0494
.0051 .0572
                                                                               .0494 | 1.3149
.0572 | .0000
                                                                                                                                 R.V.
(mm)
46.10
45.11
                                                              AREA QPEAK TPEAK
(ha) (cms) (hrs)
1.136 .161 11.75
1.136 .004 16.00
          INFLOW: ID= 2 (0202)
          OUTFLOW: ID= 1 (0302)
                                                    FLOW REDUCTION [Qout/Qin](%)= 2.61
                                        TIME SHIFT OF PEAK FLOW
                                                                                                          (min) = 255.00
                                        MAXIMUM STORAGE
                                                                              USED
                                                                                                       (ha.m.) = .0364
| ADD HYD (0902) |
                                                                                            TPEAK
(hrs)
1 + 2 = 3
                                                            AREA QPEAK
                                                                                                                R.V. (mm)
                                                           (ha)
                                                                             (cms)
                                                             (ha) (cms) (....), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h. 2), (h.
                    ID1 = 1 (0903):
                TD1= 1 (0903): .61
+ ID2= 2 (0302): 1.14
                     _____
                    ID = 3 (0902):
                                                         1.74
                                                                         .028
          NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
                                                           AREA
                                                                                            TPEAK
(hrs)
                                                                                                               R.V.
(mm)
1 + 2 = 3
                                                                             QPEAK
```

(ha)

ID1 = 1 (0301):

(cms)

1.92 .048 12.42 47.45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| 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	1	TIME	RAIN	1	TIME	RAIN	1	TIME	RAIN
hrs	mm/hr	i	hrs	mm/hr	i	hrs	mm/hr	ĺ	hrs	mm/hr
.25	.98	ĺ	6.25	1.64	1	12.25	11.81	1	18.25	1.31
.50	.66	i	6.50	1.31	1	12.50	6.23	1	18.50	1.64
.75	.98	Ì	6.75	1.64	Ī	12.75	5.90	1	18.75	1.31
1.00	.98	1	7.00	1.64	-1	13.00	4.59	1	19.00	1.64
1.25	.98	1	7.25	1.97		13.25	4.26	1	19.25	1.31
1.50	.66	1	7.50	1.64	1	13.50	3.61	1	19.50	1.64
1.75	.98	Ì	7.75	1.97		13.75	3.28	1	19.75	1.31
2.00	.98	1	8.00	1.97	- 1	14.00	2.62	Ī	20.00	.98
2.25	1.31	1	8.25	2.30		14.25	2.30	1	20.25	.98
2.50	.98	1	8.50	2.30	-	14.50	2.62	1	20.50	.98
2.75	.98	1	8.75	2.30	- 1	14.75	2.30	1	20.75	.98
3.00	.98		9.00	2.62		15.00	2.62	1	21.00	.98
3.25	1.31	1	9.25	2.62		15.25	2.30	1	21.25	.98
3.50	.98	1	9.50	2.95	1	15.50	2.62	1	21.50	.98
3.75	.98	1	9.75	2.95	1	15.75	2.30	1	21.75	. 98
4.00	1.31	1	10.00	3.61	1	16.00	1.64	1	22.00	. 98
4.25	1.31	1	10.25	3.94	1	16.25	1.31	-	22.25	. 98
4.50	1.31	1	10.50	4.92	-	16.50	1.64	1	22.50	. 98
4.75	1.31	1	10.75	5.25	1	16.75	1.31		22.75	. 98
5.00	1.31	1	11.00	7.87	1	17.00	1.64	1	23.00	.98
5.25	1.31		11.25	7.87	1	17.25	1.31		23.25	. 98
5.50	1.31	1	11.50	24.27	1	17.50	1.64		23.50	. 98
5.75	1.31	1	11.75	100.37	-1	17.75	1.31		23.75	.98
6.00	1.31	1	12.00	11.81	-	18.00	1.64			

| CALIB STANDHYD (0203) Area (ha) = .50Total Imp(%) = 22.00 Dir. Conn.(%) = 5.00| 1D= 1 DT= 5.0 min | PERVIOUS (i) IMPERVIOUS Surface Area (ha) =.11 .39 Dep. Storage (mm) =1.00 4.30 1.00 2.00 Average Slope (%)= (m) =Length 30.00 40.00 .013 .250 Mannings n

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

	TR	ANSFORME	D HYETOG	RAPH	_		
RAIN	TIME	RAIN	TIME	RAIN	1	TIME	RAIN
mm/hr	hrs	mm/hr	hrs	mm/hr	1	hrs	mm/hr
.98	6.083	1.64	12.083	11.81	1	18.08	1.31
.98	6.167	1.64	12.167	11.81	1	18.17	1.31
.98	6.250	1.64	112.250	11.81	1	18.25	1.31
.66	6.333	1.31	112.333	6.23	1	18.33	1.64
.66	6.417	1.31	112.417	6.23	1	18.42	1.64
.66	6.500	1.31	12.500	6.23	1	18.50	1.64
.98	6.583	1.64	12.583	5.90	1	18.58	1.31
.98	6.667	1.64	112.667	5.90	1	18.67	1.31
.98	6.750	1.64	112.750	5.90	1	18.75	1.31
.98	6.833	1.64	12.833	4.59	1	18.83	1.64
.98	6.917	1.64	112.917	4.59	1	18.92	1.64
.98	7.000	1.64	13.000	4.59	1	19.00	1.64
.98	7.083	1.97	13.083	4.26	1	19.08	1.31
.98	7.167	1.97	13.167	4.26	1	19.17	1.31
.98	7.250	1.97	13.250	4.26	1	19.25	1.31
.66	7.333	1.64	13.333	3.61	1	19.33	1.64
.66	7.417	1.64	13.417	3.61		19.42	1.64
.66	7.500	1.64	13.500	3.61		19.50	1.64
. 98	7.583	1.97	13.583	3.28		19.58	1.31
	mm/hr .98 .98 .98 .66 .66 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .98 .66 .66 .66 .66 .66	RAIN TIME mm/hr hrs .98 6.083 .98 6.167 .98 6.250 .66 6.333 .66 6.417 .66 6.583 .98 6.667 .98 6.750 .98 6.833 .98 6.917 .98 7.000 .98 7.000 .98 7.083 .98 7.167 .98 7.250 .66 7.333 .66 7.417 .66 7.500	RAIN TIME mm/hr mm/hr hrs mm/hr hrs mm/hr .98 6.083 1.64 .98 6.167 1.64 .98 6.250 1.64 .66 6.333 1.31 .66 6.500 1.31 .98 6.583 1.64 .98 6.667 1.64 .98 6.750 1.64 .98 6.917 1.64 .98 6.917 1.64 .98 7.000 1.64 .98 7.083 1.97 .98 7.167 1.97 .98 7.250 1.97 .98 7.250 1.64 .66 7.417 1.64 .66 7.417 1.64 .66 7.500 1.64	RAIN TIME mm/hr hrs mm/hr hrs .98 6.083 1.64 12.083 .98 6.167 1.64 12.167 .98 6.250 1.64 12.250 .66 6.333 1.31 12.233 .66 6.417 1.31 12.417 .66 6.500 1.31 12.500 .98 6.583 1.64 12.583 .98 6.667 1.64 12.667 .98 6.750 1.64 12.750 .98 6.833 1.64 12.833 .98 6.917 1.64 12.917 .98 7.000 1.64 13.000 .98 7.083 1.97 13.083 .98 7.167 1.97 13.167 .98 7.250 1.97 13.250 .66 7.333 1.64 13.333 .66 7.417 1.64 13.417 .66 7.500 1.64 13.500	mm/hr hrs mm/hr hrs mm/hr .98 6.083 1.64 12.083 11.81 .98 6.167 1.64 12.167 11.81 .98 6.250 1.64 12.250 11.81 .66 6.333 1.31 12.333 6.23 .66 6.500 1.31 12.500 6.23 .98 6.583 1.64 12.583 5.90 .98 6.667 1.64 12.750 5.90 .98 6.750 1.64 12.750 5.90 .98 6.833 1.64 12.833 4.59 .98 6.917 1.64 12.917 4.59 .98 7.000 1.64 13.000 4.59 .98 7.167 1.97 13.083 4.26 .98 7.250 1.97 13.250 4.26 .66 7.333 1.64 13.333 3.61 .66 7.417 1.64	RAIN TIME RAIN TIME RAIN mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs	RAIN TIME RAIN TIME RAIN TIME mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr hrs 18.08 6.083 1.64 12.083 11.81 18.08 19.08 6.250 1.64 12.167 11.81 18.17 19.08 6.250 1.64 12.250 11.81 18.25 66 6.333 1.31 12.333 6.23 18.33 6.66 6.417 1.31 12.417 6.23 18.42 66 6.500 1.31 12.583 5.90 18.50 98 6.583 1.64 12.583 5.90 18.58 98 6.667 1.64 12.667 5.90 18.58 98 6.667 1.64 12.750 5.90 18.75 98 6.750 1.64 12.833 4.59 18.83 98 6.917 1.64 12.833 4.59 18.92 98 7.000 1.64 13.000 4.59 19.00 98 7.083 1.97 13.083 4.26 19.08 98 7.167 1.97 13.167 4.26 19.17 98 7.250 1.97 13.250 4.26 19.17 19.8 7.250 1.64 13.333 3.61 19.33 66 7.417 1.64 13.417 3.61 19.42 66 7.500 1.64 13.500 3.61 19.50

```
.98 | 7.750
           1.750
                                 1.97 | 13.750
                                                 3.28 | 19.75
                                 1.97 | 13.833
                                                   2.62 | 19.83
                    .98 | 7.833
           1.833
                    .98 | 7.917
                                   1.97 | 13.917
                                                   2.62 | 19.92
           1.917
                                 1.97 | 14.000
           2,000
                     .98 | 8.000
                                                   2.62 | 20.00
                                                   2.30 | 20.08
                                                                   .98
                   1.31 | 8.083 2.30 | 14.083
           2.083
                                                                   .98
                                   2.30 | 14.167
                                                   2.30 | 20.17
           2.167
                    1.31 | 8.167
                                 2.30 | 14.250
                   1.31 | 8.250
                                                   2.30 | 20.25
           2.250
                                                                   .98
                    .98 | 8.333 2.30 | 14.333
                                                   2.62 | 20.33
           2.333
                                                   2.62 | 20.42
           2.417
                    .98 | 8.417
                                   2.30 | 14.417
                                                                   .98
                    .98 | 8.500
                                 2.30 | 14.500
                                                   2.62 | 20.50
           2.500
                                                                   .98
                    .98 | 8.583
                                2.30 | 14.583
           2.583
                                                  2.30 | 20.58
                    .98 | 8.667
           2.667
                                   2.30 | 14.667
                                                   2.30 | 20.67
                                                                   .98
                                   2.30 | 14.750
                                                                   .98
                                                   2.30 | 20.75
           2.750
                    .98 | 8.750
                                                                   .98
                    .98 | 8.833
                                 2.62 | 14.833
                                                  2.62 | 20.83
           2.833
                    .98 | 8.917
           2.917
                                   2.62 | 14.917
                                                   2.62 | 20.92
                                                   2.62 | 21.00
                                                                   .98
                                   2.62 | 15.000
           3.000
                     .98 | 9.000
                                2.62 | 15.083
                                                   2.30 | 21.08
                                                                   .98
           3.083
                    1.31 | 9.083
                                                                   .98
                                   2.62 | 15.167
                                                   2.30 | 21.17
                    1.31 | 9.167
           3.167
                                                                   .98
           3.250
                    1.31 | 9.250
                                   2.62 | 15.250
                                                   2.30 | 21.25
                    .98 | 9.333
                                                                   .98
           3.333
                                 2.95 | 15.333
                                                  2.62 | 21.33
                                 2.95 | 15.417
                                                                   .98
                                                   2.62 | 21.42
           3.417
                    .98 | 9.417
                    .98 | 9.500
                                   2.95 | 15.500
                                                   2.62 | 21.50
                                                                   .98
           3.500
                    .98 | 9.583
           3.583
                                 2.95 | 15.583
                                                   2.30 | 21.58
                                 2.95 | 15.667
                                                                   .98
                                                   2.30 | 21.67
                    .98 | 9.667
           3.667
                     .98 | 9.750
                                   2.95 | 15.750
                                                   2.30 | 21.75
                                                                   .98
           3.750
                                 3.61 | 15.833
                                                                   .98
                    1.31 | 9.833
                                                  1.64 | 21.83
           3.833
                                                                   .98
                                 3.61 | 15.917
                                                  1.64 | 21.92
           3.917
                   1.31 | 9.917
                                 3.61 | 16.000
3.94 | 16.083
                                                   1.64 | 22.00
           4.000
                    1.31 | 10.000
                                                                   .98
                                                  1.31 | 22.08
           4.083
                    1.31 | 10.083
                                                                   .98
                   1.31 | 10.167 3.94 | 16.167
                                                 1.31 | 22.17
           4.167
                                 3.94 | 16.250
4.92 | 16.333
           4.250
                   1.31 |10.250
                                                   1.31 | 22.25
                                                                   .98
                                                   1.64 | 22.33
                                                                   .98
           4.333
                    1.31 | 10.333
                                                                   .98
                                 4.92 | 16.417
                                                  1.64 | 22.42
           4.417
                   1.31 | 10.417
                   1.31 | 10.500 4.92 | 16.500
                                                   1.64 | 22.50
           4 500
                                                   1.31 | 22.58
                                                                   .98
           4.583
                    1.31 |10.583
                                   5.25 | 16.583
                    1.31 | 10.667 5.25 | 16.667
                                                  1.31 | 22.67
                                                                   .98
           4.667
           4.750
                   1.31 | 10.750 5.25 | 16.750 1.31 | 10.833 7.87 | 116.833
                                                   1.31 | 22.75
                                                                   .98
                                                   1.64 | 22.83
           4.833
                    1.31 | 10.833
                                   7.87 | 16.833
                                                                   .98
                   1.31 | 10.917 7.87 | 16.917
           4.917
                                                  1.64 | 22.92
                                                                   .98
                   1.64 | 23.00
                                                                   .98
           5.000
                                                   1.31 | 23.08
           5.083
                    1.31 | 11.083
                                                                   .98
                   1.31 | 11.167 7.87 | 17.167
                                                 1.31 | 23.17
           5.167
                                   7.87 | 17.250
                                                                   .98
                                                   1.31 | 23.25
           5.250
                   1.31 |11.250
                                24.27 | 17.333
           5.333
                    1.31 | 11.333
                                                   1.64 | 23.33
                                                                    .98
                   1.64 | 23.42
           5.417
                                                 1.64 | 23.50
                                                                   .98
                   1.31 | 11.500 24.27 | 17.500
           5.500
           5.583
                    1.31 | 11.583 100.36 | 17.583
                                                   1.31 | 23.58
                                                                   .98
                   1.31 | 11.667 100.37 | 17.667
                                                  1.31 | 23.67
           5.667
                                                 1.31 | 23.75
                   1.31 | 11.750 100.37 | 17.750
                                                                    .98
           5.750
           5.833
                    1.31 | 11.833
                                  11.82 | 17.833
                                                   1.64 |
                                  11.81 | 17.917
                                                   1.64 |
                    1.31 | 11.917
           5.917
           6.000
                   1.31 | 12.000
                                 11.81 | 18.000
                                                   1.64 |
                        100.37
                                        76.58
Max.Eff.Inten.(mm/hr)=
                         5.00
                                       10.00
          over (min)
                            1.24 (ii)
                                        9.09 (ii)
Storage Coeff. (min) =
                           5.00
Unit Hyd. Tpeak (min) =
                                        10.00
Unit Hyd. peak (cms)=
                            .33
                                         .12
                                                     *TOTALS*
                           .01
                                         .06
                                                       .067 (iii)
PEAK FLOW
                (cms) =
                         11.75
TIME TO PEAK
                                       11.75
                                                       11.75
               (hrs) =
              (mm) =
                                        42.47
                                                       44.37
RUNOFF VOLUME
                           80.75
                           81.75
TOTAL RAINFALL
                 (mm) =
                                        81.75
                                                      81.75
RUNOFF COEFFICIENT =
                            .99
                                         .52
                                                        .54
```

1.667

.98 | 7.667

1.97 | 13.667

3.28 | 19.67

- (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.

```
Average Slope (%)= 1.00
Length (m)= 200.00
                                       2.00
                                     40.00
                          .013
Mannings n
                                        .250
Max.Eff.Inten.(mm/hr) = 100.37
                                     111.75
                         5.00
                                        15.00
          over (min)
                      3.87
5.00
.25
                                      10.62 (ii)
Storage Coeff. (min) =
Unit Hyd. Tpeak (min) =
                                       15.00
                                        .09
Unit Hyd. peak (cms)=
                                                    *TOTALS*
                                        .22
                            .10
PEAK FLOW
                (cms) =
                                                      .294 (iii)
              (cms) = .10

(hrs) = 11.75

(mm) = 80.75

(mm) = 81.75
              (hrs)=
                                    11.83
                                                       11.75
TIME TO PEAK
RUNOFF VOLUME
                                        53.16
                                                      58.13
TOTAL RAINFALL
                                       81.75
                                                      81.75
                                                       .71
                          .99
RUNOFF COEFFICIENT =
                                        .65
```

- (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.

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

		TR	ANSFORME	D HYETOG	RAPH	-	
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	112.167	11.81	18.17	1.31
.333	.82	6.333	1.48	112.333	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	0.00	18.67	1.31
.833	. 98	6.833	1.64	112.833	5.25	18.83	1.48
1.000		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		7.833	1.97	13.833		19.83	1.15
2.000		8.000	1.97	114.000		20.00	. 98
2.167		8.167	2.30	114.167		20.17	.98
2.333		8.333	2.30	14.333		20.33	.98
2.500	.98	8.500	2.30	14.500	2.62	20.50	.98
2.667	.98	8.667	2.30	114.667	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	115.167	2.30	21.17	.98
3.333	1.15	9.333	2.79	115.333		21.33	.98
3.500	.98	9.500	2.95	15.500		21.50	.98
3.667	.98	9.667	2.95	15.667		21.67	.98
3.833	1.15	9.833	3.28	15.833	1.97	21.83	.98
4.000		110.000	3.61	16.000	1.64	22.00	.98
4.167	1.31	110.167	3.94	16.167	1.31	22.17	.98
4.333	1.31	110.333	4.43	16.333	1.48	22.33	.98
4.500	1.31	110.500	4.92	16.500	1.64	22.50	.98
4.667		10.667	5.25	116.667	1.31	22.67	.98
4.833		110.833	6.56	16.833	1.48	22.83	.98
5.000		11.000	7.87	17.000	1.64	23.00	.98
5.167	1.31	11.167	7.87	117.167	1.31	23.17	.98
5.333		111.333	16.07	117.333	1.48	23.33	.98
5.500		11.500	24.27	17.500	1.64	23.50	.98
5.667		11.667	100.37	117.667	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.

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

		тр	N N C E O D M E	D HYETOGI	DADH	_	
TIME	RAIN	TIME		TIME	RAIN		RAIN
hrs		hrs	mm/hr	hrs		hrs	mm/hr
.083		6.083	1.64	112.083	11.81	N com com communication	1.31
.167		6.167	1.64	112.167	11.81		1.31
.250		6.250	1.64	112.250	11.81	di con est a servicio	1.31
.333		6.333	1.31	112.333	6.23		1.64
.417		6.417	1.31	112.417	6.23	A CONTRACTOR OF ACCUMENT	1.64
.500		6.500	1.31	112.500	6.23	D and the term to the	1.64
.583		6.583	1.64	112.583		18.58	1.31
.667	.98	6.667	1.64	112.667	5.90	18.67	1.31
.750	.98	6.750	1.64	112.750	5.90	18.75	1.31
.833	.98	6.833	1.64	112.833	4.59	18.83	1.64
.917	.98	6.917	1.64	112.917	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	113.250	2 20 20 2	19.25	1.31
1.333		7.333	1.64	13.333	3.61		1.64
1.417		7.417	1.64	113.417	3.61	CONTROL OF CONTROL	1.64
1.500		7.500	1.64	13.500	3.61		1.64
1.583		7.583	1.97	113.583		19.58	1.31
1.667		7.667	1.97	113.667		19.67	1.31
1.750		7.750	1.97	13.750		19.75	1.31
1.833		7.833	1.97	13.833		19.83	.98
1.917		7.917	1.97	113.917		19.92	.98
2.000		8.000	1.97	14.000 14.083	2.62	20.00	.98 .98
2.083		8.083	2.30	114.063		20.00	.98
2.167 2.250		8.167 8.250	2.30	114.167		20.17	.98
2.230		8.333	2.30	114.230		20.23	.98
2.333		8.417	2.30	114.417		20.33	.98
2.500	.98	8.500	2.30	114.500		20.50	.98
2.583		8.583	2.30	114.583		20.58	.98
2.667	.98	8.667	2.30	114.667	2.30		.98
2.750		8.750	2.30	114.750	2.30	Noncome and the	.98
2.833	.98	8.833	2.62	114.833		20.83	.98
2.917		8.917	2.62	114.917		20.92	.98
3.000	.98	9.000	2.62	115.000		21.00	.98
3.083		9.083	2.62	115.083	2.30	21.08	.98
3.167	1.31	9.167	2.62	115.167	2.30	21.17	.98
3.250	1.31	9.250	2.62	115.250	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		21.42	.98
3.500		9.500	2.95	15.500		21.50	.98
3.583		9.583	2.95	15.583		21.58	.98
3.667		9.667	2.95	15.667		21.67	.98
3.750		9.750	2.95	115.750		21.75	.98
3.833	1.31	9.833	3.61	15.833		21.83	.98
3.917		9.917	3.61	115.917		21.92	.98
4.000	1.31	10.000	3.61	116.000	1.64	22.00	.98

.

```
.98
                                                   1.31 | 22.08
           4.083
                    1.31 |10.083
                                  3.94 | 16.083
           4.167
                    1.31 | 10.167
                                    3.94 | 16.167
                                                    1.31 | 22.17
                                   3.94 | 16.250
                                                    1.31 | 22.25
                                                                      .98
                    1.31 | 10.250
           4.250
           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
                                                     1.64 | 22.50
                                    4.92 | 16.500
           4.500
                    1.31 | 10.500
                                                                      .98
           4.583
                    1.31 |10.583
                                   5.25 | 16.583
                                                    1.31 | 22.58
                                                                      .98
           4.667
                                    5.25 | 16.667
                                                    1.31 | 22.67
                                                                      .98
                    1.31 | 10.667
                                                     1.31 | 22.75
           4.750
                    1.31 | 10.750
                                    5.25 | 16.750
                                                                      .98
           4.833
                    1.31 | 10.833
                                    7.87 | 16.833
                                                    1.64 | 22.83
                                                                      .98
           4.917
                                    7.87 | 16.917
                                                    1.64 | 22.92
                    1.31 | 10.917
           5.000
                    1.31 |11.000
                                    7.87 | 17.000
                                                     1.64 | 23.00
                                                                      .98
                                   7.87 | 17.083
           5.083
                    1.31 |11.083
                                                    1.31 | 23.08
                                  7.87 |17.167
7.87 |17.250
                                                                      .98
           5.167
                    1.31 | 11.167
                                                    1.31 | 23.17
                                                                      .98
           5.250
                    1.31 |11.250
                                                     1.31 | 23.25
                                 24.27 | 17.333
                    1.31 | 11.333
                                                    1.64 | 23.33
           5.333
                                  24.27 | 17.417
                                                                      .98
                                                   1.64 | 23.42
           5.417
                    1.31 | 11.417
           5.500
                    1.31 |11.500
                                   24.27 | 17.500
                                                     1.64 | 23.50
                                                                      .98
                    1.31 | 11.583 100.36 | 17.583
                                                                      .98
                                                    1.31 | 23.58
           5.583
                                                                      .98
           5.667
                    1.31 | 11.667 100.37 | 17.667
                                                    1.31 | 23.67
                                 100.37 | 17.750
           5.750
                    1.31 |11.750
                                                    1.31 | 23.75
                                                                      .98
                                  11.82 | 17.833
                    1.31 | 11.833
                                                    1.64 |
           5.833
           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
                                        10.00
                          5.00
           over (min)
                             1.97 (ii)
Storage Coeff. (min) =
                                         8.99 (ii)
                          5.00
Unit Hyd. Tpeak (min) =
                                         10.00
                             .31
Unit Hyd. peak (cms) =
                                                       *TOTALS*
                                          .14
                             .05
PEAK FLOW
                                                        .199 (iii)
                (cms) =
                         11.75
80.75
81.75
                                                         11.75
                                         11.75
TIME TO PEAK
                (hrs) =
                                        50.79
               (mm) = (mm) =
                                                         55.88
RUNOFF VOLUME
                                         81.75
                                                        81.75
TOTAL RAINFALL
                                           .62
RUNOFF COEFFICIENT =
                            .99
```

- (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 (03.01) |
 IN= 2---> OUT= 1 |
                                                     STORAGE
| DT= 5.0 min |
                       OUTFLOW STORAGE | OUTFLOW
                                         (cms)
0707
1.1232
                                                       (ha.m.)
                       (cms)
                                 (ha.m.)
                        .0000
                                 .0000
                                                        .0775
                                  .0052
                                                         .0859
                         .0010
                         .0020
                                   .0108
                                              .2290
                                                          .0944
                                               .3811
                                   .0233
                                                          .1031
                         .0030
                                                         .1120
                         .0040
                                   .0302
                                            .5760
                                               .8126
                         .0164
                                   .0376
                                         1.0915
                                                          .1301
                                   .0453
                         .0392
                                                          .1394
                         .0602
                                   .0531
                                         1.4134
                                         1.7793
                         .0639
                                   .0611
                                                          .1488
                                               .0000
                                                          .0000
                         .0674
                                   .0692
                                      QPEAK
                              AREA
                                                  TPEAK
                                                             R.V.
                                     (cms)
                              (ha)
                                                  (hrs)
                                                              (mm)
    INFLOW : ID= 2 (0201)
                             1.925
                                        .294
                                                  11.75
                                                              58.13
                             1.925
                                        .062
                                                              57.44
    OUTFLOW: ID= 1 (0301)
                                                   12.33
                       FLOW
                             REDUCTION [Qout/Qin](%) = 21.06
                 PEAK
                 TIME SHIFT OF PEAK FLOW (min) = 35.00
                 MAXIMUM STORAGE USED
                                            (ha.m.) = .0570
| ADD HYD (0903) |
| 1 + 2 = 3 |
                          AREA
```

QPEAK TPEAK (hrs) R.V. (mm) (ha) (cms) ID1= 1 (0204):.16 30.70 .023 + ID2= 2 (0205): .45 12.00 30.77 _____ ID = 3 (0903): .61 .031 12.00 30.76

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| RESERVOIR (0302) |
I TN= 2---> OUT= 1 |
                        OUTFLOW STORAGE | OUTFLOW
| DT= 5.0 min |
                                                           STORAGE
                                            (cms)
| .0054
| .0393
                                  (ha.m.)
                                                           (ha.m.)
                          (cms)
                                                           .0654
                                   .0000
                          .0000
                                                            .0654
.0739
.0828
.0921
.1017
.1117
.1220
.1327
.1438
                                    .0049
                           .0011
                                                .1153
                                     .0102
                           .0021
                                   .0158
                           .0027
                                    .0218
                                            .3706
                           .0033
                                            .5506
.7671
                                     .0281
                           .0037
                                     .0349
                           .0041
                                                  .7671
                                    .0420
                                            1.0214
                           .0045
                                     .0494 | 1.3149
.0572 | .0000
                           .0048
                                                 .0000
                           .0051
                                      QPEAK
(cms)
.199
.005
                                AREA
                                                      TPEAK
                                                   (hrs)
                                 (ha)
                                                                  (mm)
                                                                 55.88
     INFLOW : ID= 2 (0202)
                              1.136
                                                      16.08
                                                                 54.89
     OUTFLOW: ID= 1 (0302)
                               1.136
                         FLOW REDUCTION [Qout/Qin](%)= 2.32
                   TIME SHIFT OF PEAK FLOW
                                             (min) = 260.00
                   MAXIMUM STORAGE USED
                                                (ha.m.) = .0450
| ADD HYD (0902) |
                                                    R.V.
                                  QPEAK
1 + 2 = 3
                            AREA
                                             TPEAK
                            (ha)
                                             (hrs)
                                                       (mm)
   ______
                                    (cms)
       TD1= 1 (0903): .61 .031 12.00 30.76
+ TD2= 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) |
                                  QPEAK
                                  QPEAK TPEAK R.V. (cms) (hrs) (mm) .062 12.33 57.44 .035 12.00 46.48
1 + 2 = 3
                            AREA
                            (ha)
                         1.92
1.74
        ID1= 1 (0301):
       + ID2= 2 (0902):
                                    _____
          _____
         ID = 3 (0901): 3.67 .094 12.08 52.23
    NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ** SIMULATION NUMBER: 5 **
                       Filename: I:\2015 Projects\115
 MASS STORM |
                                  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 \text{ hrs}
                       Mass curve time step = 15.00 min
                 FIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
                TIME
                                      1.81 | 12.25
1.44 | 12.50
                                                       13.00 | 18.25
6.86 | 18.50
                       1.08 | 6.25
.72 | 6.50
                 .25
                                                                        1.44
                                                                        1.81
                 .50
                                                                       1.44
                                                       6.50 | 18.75
                 .75
                       1.08 | 6.75 | 1.81 | 12.75
                                                       5.06 | 19.00
4.70 | 19.25
                       1.00
                                                                        1.81
                                                                        1.44
                1.25
                         .72 | 7.50 1.81 | 13.50
                                                                       1.81
                1.50
                                                      3.61 | 19.75
                                                       3.97 | 19.50
                        1.08 | 7.75 2.17 | 13.75
1.08 | 8.00 2.17 | 14.00
                                                                        1.44
                1.75
                                                                        1.08
                                                        2.89 | 20.00
                2.00
                2.25
                       1.44 | 8.25 2.53 | 14.25
                                                       2.53 | 20.25
                       1.08 | 8.50 2.53 | 14.50
1.08 | 8.75 2.53 | 14.75
1.08 | 9.00 2.89 | 15.00
                                                       2.89 | 20.50
2.53 | 20.75
                                                                        1.08
                2.50
                2.75
                                                                        1.08
                3.00
                                                       2.89 | 21.00
                       2.53 | 21.25
2.89 | 21.50
2.53 | 21.75
                                                                        1.08
                3.25
                 3.50
```

3.75

4.00

1.44 | 10.00

1.08

1.08

3.97 | 16.00 1.81 | 22.00

```
4.25
                                       1.44 | 22.25
                                                     1.08
                                     1.81 | 22.50
4.50
                                       1.44 | 22.75
1.81 | 23.00
                                                     1.08
                    5.78 | 16.75
4.75
       1.44 | 10.75
       1.44 | 11.00
1.44 | 11.25
                      8.67 | 17.00
8.67 | 17.25
5.00
                                       1.44 | 23.25
                                                     1.08
5.25
       1.44 | 11.50
                     26.73 | 17.50
                                       1.81 | 23.50
                                                      1.08
5.50
       1.44 | 11.75 | 110.53 | 17.75
                                       1.44 | 23.75
                                                      1.08
5.75
                     13.00 | 18.00
       1.44 | 12.00
                                       1.81 |
6.00
```

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

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

		TR	ANSFORME	D HYETOG	RAPH	_	
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.083	1.08	1 6.083	1.81	112.083	13.00	18.08	1.44
.167	1.08	6.167		112.167	13.00	18.17	1.44
.250	1.08	6.250	1.81	112.250		18.25	1.44
.333	.72	6.333	1.44	112.333		18.33	1.81
.417	.72	6.417	1.44	112.417		18.42	1.81
.500	.72	6.500		112.500		18.50	1.81
.583	1.08	1 6.583		112.583		18.58	1.44
.667	1.08	1 6.667	1.81	112.667		18.67	1.44
.750	1.08	6.750		112.750		18.75	1.44
.833	1.08	6.833		112.833		18.83	1.81
.917	1.08	6.917		112.917		18.92	1.81
1.000	1.08	7.000		113.000		19.00	1.81
1.083	1.08	7.083	$2.17 \\ 2.17$	113.083		19.08 19.17	1.44
1.167	1.08	7.167	2.17	13.167 13.250		19.17 19.25	1.44
1.250	1.08 .72	7.250 7.333		113.230		19.33	1.81
1.333	.72	7.417	1.81	113.417	3.97	19.42	1.81
1.500	.72	7.500	1.81	113.500	100000000000000000000000000000000000000	19.50	1.81
1.583	1.08	7.583	2.17	113.583	3.61	19.58	1.44
1.667	1.08	7.667	2.17	113.667	the transfer of the transfer o	19.67	1.44
1.750	1.08	7.750	2.17	113.750		19.75	1.44
1.833	1.08	7.833	2.17	113.833		19.83	1.08
1.917	1.08	7.917	2.17	113.917		19.92	1.08
2.000		8.000	2.17	114.000	2.89	20.00	1.08
2.083	1.44	8.083	2.53	114.083	2.53	20.08	1.08
2.167		8.167	2.53	114.167	2.53	20.17	1.08
2.250	1.44	8.250	2.53	114.250	2.53	20.25	1.08
2.333	1.08	8.333	2.53	114.333		20.33	1.08
2.417	1.08	8.417	2.53	114.417	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	114.583	2.53	and the same of th	1.08
2.667		8.667	2.53	114.667		20.67	1.08
2.750	1.08	8.750	2.53	114.750		20.75	1.08
2.833		8.833	2.89	114.833		20.83	1.08
2.917		8.917	2.89	14.917		20.92	1.08
3.000		9.000	2.89	15.000		21.00	1.08
3.083		9.083	2.89	15.083		21.08	1.08
3.167		9.167	2.89	115.167		21.17	1.08
3.250	1.44	9.250	2.89	115.250		21.25	1.08
3.333		9.333	3.25 3.25	115.333		21.33	1.08
3.417		9.417	3.25	15.417 15.500		21.42	1.08
3.500		9.500	3.25	115.583		21.58	1.08
3.667		9.667	3.25	115.667		21.67	1.08
3.750		9.750	3.25	115.750		21.75	1.08
3.833		9.833	3.23	15.833		21.83	1.08
3.917		9.917	3.97	15.917		21.92	1.08
4.000	1.44	110.000	3.97	116.000	1.81	22.00	1.08
4.083	1.44	110.083	4.33	116.083	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	116.250	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	116.417	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	116.583	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
                          1.44 | 10.917 8.67 | 16.917
                                                                 1.81 | 22.92
               4.917
                                                                 1.81 | 23.00
1.44 | 23.08
1.44 | 23.17
                          1.44 | 11.000 8.67 | 17.000
1.44 | 11.083 8.67 | 17.083
              5.000
                                                                                        1.08
                                                                                       1.08
              5.083
                          1.44 | 11.167 8.67 | 17.167
              5.167
                                                                 1.44 | 23.25
              5.250

    1.44
    | 11.250
    8.67
    | 17.250

    1.44
    | 11.333
    26.73
    | 17.333

    1.44
    | 11.417
    26.73
    | 17.417

                                                                                        1.08
               5.333
                                                                    1.81 | 23.33
                                                                                         1.08
                                                                 1.81 | 23.42
              5.417
                         1.44 | 11.500 | 26.73 | 17.500

1.44 | 11.583 | 110.52 | 17.583

1.44 | 11.667 | 110.53 | 17.667
                                                                 1.81 | 23.50
                                                                                       1.08
1.08
              5.500
                                                                    1.44 | 23.58
              5.583
                                                                 1.44 | 23.67
                                                                                       1.08
              5.667
                                                                  1.44 | 23.75 1.08
                        1.44 | 11.750 110.53 | 17.750
              5.750
                                           13.01 | 17.833
13.00 | 17.917
              5.833
                          1.44 | 11.833
                                                                    1.81 |
              5.917
                          1.44 | 11.917
                                                                   1.81 |
                                           13.00 | 18.000
               6.000
                       1.44 | 12.000
                                                                    1.81 |
Unit Hyd. Tpeak (min) = 5.00
Unit Hyd. peak (cms) = 5.00

PEAK FLOW
                                                     88.35
                                                    10.00
                                                      8.61 (ii)
                                                     10.00
                                                      .12
                                                                      *TOTALS*
                                                     .07
                                                                          .079 (iii)
                                 .01
11.75
                                                  11.75
                              11.75
89.03
90.03
TIME TO PEAK (hrs) =
                                                                         11.75
                                                    49.11
                                                                        51.09
RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) =
                                                     90.03
                                                                        90.03
                                     .99
RUNOFF COEFFICIENT =
                                                      .55
                                                                          .57
```

- (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.

```
I CALTB
                                    Area (ha) = 1.92
  STANDHYD (0201) |
| \text{ID} = 1 \text{ DT} = 5.0 \text{ min } | \text{ Total Imp}(\$) = 43.00 \text{ Dir. Conn.}(\$) = 18.00
                                                                      PERVIOUS (i)
                                                IMPERVIOUS
                                                .83
                                                                      1.10
       Surface Area (ha) = Dep. Storage (mm) =
                               .83
(%) = 1.00
(%) = 1.00
(m) = 200.00
= .01?
                                                                         3.70
2.00
       Average Slope
                                                                        40.00
       Length
       Mannings n
       Max.Eff.Inten.(mm/hr) = 110.53 126.77 over (min) 5.00 15.00 Storage Coeff. (min) = 3.72 (ii) 10.14 Unit Hyd. Tpeak (min) = 5.00 15.00 Init Hyd. peak (ms) = 25 10.00 15.00
                                                                       15.00
10
                                                                          10.14 (ii)
                                                                         15.00
       Unit Hyd. peak (cms)=
                                                                         .26
                                                                                               *TOTALS*
       TIME TO PEAK (hrs) = .10
TIME TO PEAK (hrs) = 11.75
RUNOFF VOLUME (mm) = 89.03
TOTAL RAINFALL (mm) = 90.03
RUNOFF COEFFICIENT = .99
                                                                                                 .337 (iii)
                                                                     11.83
60.60
90.03
                                                                                                   11.75
                                                                                                  65.71
                                                                                                 90.03
```

***** 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.

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

```
mm/hr
             hrs
                  mm/hr | hrs mm/hr | hrs
                                                  mm/hr |
                                                           hrs
                   1.08 | 6.167
                                  1.81 | 12.167
                                                  13.00 | 18.17
                                                                   1.44
            .167
                    .90 | 6.333
                                   1.63 | 12.333
1.44 | 12.500
                                                  9.93 | 18.33
6.86 | 18.50
            .333
                                                                    1.63
            .500
                     .72 | 6.500
                                                                    1.81
                                 1.81 | 12.667
                                                  6.50 | 18.67
            .667
                    1.08 | 6.667
                                                   5.78 | 18.83
                                 1.81 | 12.833
                    1.08 | 6.833
            .833
                                                                    1.63
                                                    5.06 | 19.00
           1.000
                    1.08 | 7.000
                                   1.81 | 13.000
                                                                    1.81
                                 2.17 | 13.167
                                                   4.70 | 19.17
           1.167
                    1.08 | 7.167
                                                                   1.44
                    .90 | 7.333
                                  1.99 | 13.333
                                                   4.33 | 19.33
                                                                    1.63
           1.333
                                                    3.97 | 19.50
                     .72 | 7.500
                                   1.81 | 13.500
                                                                    1.81
           1.500
           1.667
                    1.08 | 7.667
                                  2.17 | 13.667
                                                    3.61 | 19.67
                                                                    1.44
                                                                    1.26
                                 2.17 |13.833
                                                    3.25 | 19.83
           1.833
                    1.08 | 7.833
                    1.08 | 8.000
                                   2.17 |14.000
                                                    2.89 | 20.00
                                                                    1.08
           2.000
                                 2.17 113.2
                    1.44 | 8.167
                                                   2.53 | 20.17
                                                                    1.08
           2,167
                                                                    1.08
                                                   2.71 | 20.33
           2.333
                   1.26 | 8.333
                                 2.53 | 14.333
                                                    2.89 | 20.50
           2.500
                    1.08 | 8.500
                                   2.53 | 14.500
                                 2.53 | 14.667
                                                    2.53 | 20.67
                                                                    1.08
                    1.08 | 8.667
           2.667
           2.833
                                                  2.71 | 20.83
                  1.08 | 8.833 2.71 | 14.833
                                                                    1.08
           3.000
                   1.08 | 9.000
                                   2.89 | 15.000
                                                    2.89 | 21.00
                                                                    1.08
                                 2.89 | 15.167
                                                    2.53 | 21.17
                    1.44 | 9.167
                                                                    1.08
           3.167
                   1.26 | 9.333
                                 3.07 | 15.333
                                                   2.71 | 21.33
                                                                    1.08
           3.333
                                 3.25 | 15.500
                                                    2.89 | 21.50
                                                                    1.08
           3.500
                   1.08 | 9.500
                    1.08 | 9.667
                                   3.25 | 15.667
                                                    2.53 | 21.67
           3.667
                                                                    1.08
                                                   2.17 | 21.83
           3.833
                   1.26 | 9.833 3.61 | 15.833
                                                  1.81 | 22.00
                   1.44 | 10.000 3.97 | 16.000
1.44 | 10.167 4.33 | 16.167
                                                                    1.08
           4.000
           4.167
                    1.44 | 10.167
                                   4.33 | 16.167
                                                    1.44 | 22.17
                                                                    1.08
                   1.44 | 10.333 4.88 | 16.333
           4.333
                                                  1.63 | 22.33
                                                                    1.08
                   1.44 | 10.500 5.42 | 16.500
                                                  1.81 | 22.50
                                                                    1.08
           4.500
                    1.44 | 10.667
                                   5.78 | 16.667
                                                    1.44 | 22.67
                                                                    1.08
           4.667
                   1.44 | 10.887 | 5.78 | 16.887 | 1.44 | 10.833 | 7.22 | 16.833
                                                  1.63 | 22.83
                                                                   1.08
           4.833
                                                                   1.08
                                                  1.81 | 23.00
                  1.44 | 11.000 8.67 | 17.000
           5.000
           5.167
                    1.44 | 11.167
                                    8.67 | 17.167
                                                    1.44 | 23.17
                                                                    1.08
                    1.44 | 11.333 | 17.70 | 17.333
                                                  1.63 | 23.33
                                                                   1.08
           5.333
                                                                  1.08
                  1.44 | 11.500 26.73 | 17.500
                                                  1.81 | 23.50
           5.500
           5.667
                   1.44 | 11.667 | 110.53 | 17.667
                                                    1.44 | 23.67
                                                  1.63 | 23.83
                    1.44 | 11.833
                                 61.76 | 17.833
           5.833
           6.000
                  1.44 | 12.000
                                 13.00 | 18.000
                                                  1.81 |
Unit Hyd Qpeak (cms)=
                          .020
                       .010 (i)
               (cms) =
               (hrs) = 11.833
TIME TO PEAK
RUNOFF VOLUME
                (mm) = 36.116
TOTAL RAINFALL
                (mm) = 90.029
RUNOFF COEFFICIENT =
                         .401
```

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

PEAK FLOW

```
NASHYD (0205) |
                     Area (ha) = .45
Ia (mm) = 5.00
                                      .45 Curve Number (CN) = 69.0
                                             \# of Linear Res.(N) = 3.00
| ID= 1 DT=10.0 min |
                      U.H. Tp(hrs)=
                                      .36
    Unit Hyd Qpeak (cms)=
                               .047
                               .027 (i)
                     (cms)=
    PEAK FLOW
    TIME TO PEAK
                    (hrs) = 12.000
                    (mm) = 36.198

(mm) = 90.029
    RUNOFF VOLUME
    TOTAL RAINFALL
    RUNOFF COEFFICIENT =
```

```
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
                    Area (ha) = 1.14
Total Imp(%) = 39.00
| STANDHYD (0202) |
|ID= 1 DT= 5.0 min |
                                           Dir. Conn. (%) = 17.00
______
                                        PERVIOUS (i)
                             IMPERVIOUS
                             .44
1.00
                                          .69
3.80
                     (ha) =
    Surface Area
    Dep. Storage
                     (mm) =
                     (%)=
    Average Slope
                               1.00
                                            2.00
                      (m) =
                              65.00
                                            40.00
    Length
    Mannings n
                                .013
                                             .250
```

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

```
---- TRANSFORMED HYETOGRAPH ----
      RAIN | TIME RAIN | TIME RAIN | TIME mm/hr | hrs mm/hr | hrs mm/hr | hrs
TIME
                                             RATN
     mm/hr | hrs
                                            mm/hr
hrs
     1.44
.083
```

.250	3 6.250 1.81 2 6.333 1.44 2 6.417 1.44 2 6.500 1.44 2 6.500 1.44 3 6.583 1.81 3 6.667 1.81 3 6.750 1.81 3 7.000 1.81 3 7.083 2.17 3 7.750 2.17 3 7.750 2.17 3 7.667 2.17 3 7.750 2.17 3 7.750 2.17 3 7.750 2.17 3 8.000 2.17 3 8.03 2.53 3 8.167 2.53 3 8.33 2.53 3 8.33 2.53 3 8.583 2.53 3 8.67 2.53 3 8.583 2.53	12.250	1.44 1.81 1.81 1.81 1.44 1.81 1.81 1.81 1.81 1.81 1.44 1.81 1.44 1.81 1.	18.25 18.33 18.42 18.50 18.58 18.67 18.75 18.83 18.92 19.00 19.08 19.17 19.25 19.33 19.42 19.50 19.58 19.67 19.75 19.83 19.92 20.00 20.08 20.17 20.25 20.33 20.42 20.50 20.58 20.67 20.75 20.83 20.92 21.00 21.08 21.17 21.25 21.33 21.42 21.50 21.58 21.67 21.75 21.83 21.92 22.00 22.08 22.17 22.25 22.33 22.42 22.50 22.58 22.67 22.75 22.83 22.92 23.00 23.08 23.17 22.25 22.33 22.42 22.50 23.58 23.75	1.44 1.44 1.81 1.81 1.44 1.44 1.81 1.81
Max.Eff.Inten.(mm/hr) = over (min) Storage Coeff. (min) = Unit Hyd. Tpeak (min) = Unit Hyd. peak (cms) =	110.53 5.00 1.90 (ii) 5.00 .32	115.50 10.00 8.56 (ii) 10.00 .12		TALS*	
PEAK FLOW (cms) = TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = RUNOFF COEFFICIENT =	.06 11.75 89.03 90.03	.17 11.75 58.08 90.03 .65	11 63	.228 (iii) L.75 3.34).03 .70	

**** 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 | OUTFLOW STORAGE | OUTFLOW STORAGE | DT= 5.0 min | (ha.m.) | (cms) .0000 | .0707 .0052 | .1232 (ha.m.) (cms) .0000 .0010

.0775 .0859 .0944 .1031 .1120 .1210 .0052 | .1232 .0108 | .2290 .0233 | .3811 .0302 | .5760 .0376 | .8126 .0020 .0030
 .0040
 .0302
 | .5760

 .0164
 .0376
 | .8126

 .0392
 .0453
 | 1.0915

 .0602
 .0531
 | 1.4134

 .0639
 .0611
 | 1.7793

 .0674
 .0692
 | .0000
 .1394 .1488 .0000

QPEAK TPEAK (cms) (hrs) .337 11 75 AREA TPEAK R.V. (mm) (ha) INFLOW: ID= 2 (0201) 1.925 OUITFI.OW: ID= 1 (0301) 1.925 65.71 OUTFLOW: ID= 1 (0301) .065

> PEAK FLOW REDUCTION [Qout/Qin](%)= 19.41 TIME SHIFT OF PEAK FLOW (min) = 35.00 MAXIMUM STORAGE USED (ha.m.) = .0648

| ADD HYD (0903) | AREA QPEAK TPEAK R.V. 1 + 2 = 3TD1= 1 (0204): .16 .010 11.83 36.12 + ID2= 2 (0205): .45 .027 12.00 36.20 (mm) _____ ID = 3 (0903): .61 .037 12.00 36.18

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0302) |

IN- 2---> OUT= 1 | OUTFLOW STORAGE | OUTFLOW STORAGE | DT= 5.0 min | (ha.m.) | (cms) (ha.m.) .0000 | .0054 .065 .0049 | .0393 .073 (cms) .0000

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

AREA QPEAK TPEAK
(ha) (cms) (hrs)
1.136 .228 11.75
1.136 .005 16.08 R.V. (mm) 63.34 INFLOW : ID= 2 (0202) OUTFLOW: ID= 1 (0302)

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.14 TIME SHIFT OF PEAK FLOW (min)=260.00 MAXIMUM STORAGE USED (ha.m.) = .0516

| ADD HYD (0902) | 2 = 3 | AREA QPEAK TPEAK R.V. ------ (ha) (cms) (hrs) (mm) ID1= 1 (0903): .61 .037 12.00 36.18 + ID2= 2 (0302): 1.14 .005 16.08 62.35 1 + 2 = 3_____ 1.74 .041 12.00 53.22

ID = 3 (0902):

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. | ADD HYD (0901) | 1 + 2 = 3**AREA QPEAK** TPEAK (cms) (hrs) (mm) _____ (ha) .065 12.33 65.03 12.00 53.22 ID1= 1 (0301): 1.92 + ID2= 2 (0902): 1.74 _____ ID = 3 (0901): 3.67 .104 12.00 59.42NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. ** SIMULATION NUMBER: 6 ** | MASS STORM | 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 Ptotal= 98.50 mm | Duration of storm = 23.75 hrsMass curve time step = 15.00 min RAIN | TIME RAIN | TIME RAIN | TIME TIME hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr 14.18 | 18.25 1.18 | 6.25 | 1.97 | 12.25 .79 | 6.50 | 1.58 | 12.50 . 25 1.18 | 6.25 7.49 | 18.50 1.97 .50 1.58 7.09 | 18.75 .75 5.52 | 19.03 5.12 | 19.25 1.00 1.58 1.25 1.97 1.50 7.75 2.36 | 13.75 8.00 2.36 | 14.00 3.94 | 19.75 1.58 1.75 1.18 3.94 | 20.00 1.18 | 8.00 1.18 2.00 2.25 1.58 | 8.25 2.76 | 14.25 2.76 | 20.25 1.18 1.18 | 8.50 | 2.76 | 14.50 1.18 | 8.75 | 2.76 | 14.75 3.15 | 20.50 1.18 2.50 2.76 | 20.75 2.75 1.18 1.18 | 9.00 | 3.15 | 15.00 1.18 3.00 3.15 | 21.00 2.76 | 21.25 1.58 | 9.25 | 3.15 | 15.25 1.18 | 9.50 | 3.55 | 15.50 1.18 | 9.75 | 3.55 | 15.75 3.25 1.18 3.15 | 21.50 3.50 1.18 3.75 2.76 | 21.75 1.97 | 22.00 1.18 4.00 1.58 | 22.25 4.25 1.18 1.97 | 22.50 1.18 4.50 1.58 | 22.75 1.58 | 10.75 | 6.30 | 16.75 1.58 | 11.00 | 9.46 | 17.00 1.58 | 11.25 | 9.46 | 17.25 1.18 4.75 5.00 1.97 | 23.00 1.18 1.58 | 23.25 1.18 5.25 1.97 | 23.50 1.18 5.50 1.58 | 11.50 29.16 | 17.50 1.58 | 11.75 | 120.56 | 17.75 1.58 | 12.00 | 14.18 | 18.00 5.75 1.58 | 23.75 1.18 1.97 | 1.58 | 12.00 6.00

CALIB STANDHYD (0203) ID= 1 DT= 5.0 min	Area Total	(ha)= Imp(%)=	.50 22.00	Dir. Conn.(%)=	5.00
Surface Area Dep. Storage Average Slope	(ha) = (mm) = (%) =	IMPERVI .1 1.0 1.0	1 0 0	PERVIOUS (i) .39 4.30 2.00	
Length	(m) =	30.0	0	40.00	

Mannings n

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

.013

		TR	ANSFORME	ED HYETOG	GRAPH		
TIME	RAIN	TIME	RAIN	ITIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.083	1.18	6.083	1.97	112.083	14.18	18.08	1.58
.167	1.18	6.167	1.97	112.167	14.18	18.17	1.58
.250	1.18	6.250	1.97	112.250	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	112.583	7.09	18.58	1.58
.667	1.18	6.667	1.97	112.667	7.09	18.67	1.58
.750	1.18	6.750	1.97	112.750	7.09	18.75	1.58
.833	1.18	6.833	1.97	112.833	5.52	18.83	1.97

.250

```
1.97 | 12.917
                                                      5.52 | 18.92
                                                                      1.97
             .917
                     1.18 | 6.917
                                     1.97 | 13.000
                     1.18 | 7.000
                                                      5.52 | 19.00
                                                                      1.97
            1.000
                                                      5.12 | 19.08
            1.083
                     1.18 | 7.083
                                     2.36 | 13.083
                                                                      1.58
                                                      5.12 | 19.17
            1.167
                     1.18 | 7.167
                                     2.36 | 13.167
                     1.18 | 7.250
                                                      5.12 | 19.25
            1.250
                                     2.36 |13.250
                                                                      1.58
                     .79 | 7.333
            1.333
                                   1.97 |13.333
                                                      4.33 | 19.33
                                                                      1.97
                      .79 | 7.417
            1.417
                                     1.97 | 13.417
                                                      4.33 | 19.42
                                                                      1.97
                      .79 | 7.500
                                     1.97 | 13.500
                                                      4.33 | 19.50
                                                                      1.97
            1.500
            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
                     1.18 | 7.750
                                     2.36 | 13.750
                                                      3.94 | 19.75
            1.750
                                                                      1.58
                                     2.36 | 13.833
                                                      3.15 | 19.83
            1.833
                     1.18 | 7.833
                                                                      1.18
                                     2.36 |13.917
                     1.18 | 7.917
                                                      3.15 | 19.92
                                                                      1.18
            1.917
            2.000
                     1.18 | 8.000
                                     2.36 | 14.000
                                                      3.15 | 20.00
                                                                      1.18
                                                      2.76 | 20.08
            2.083
                     1.58 | 8.083
                                     2.76 | 14.083
                                                                     1.18
                                     2.76 | 14.167
                                                      2.76 | 20.17
                     1.58 | 8.167
                                                                      1.18
            2.167
            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
                                                      3.15 | 20.42
            2.417
                     1.18 | 8.417
                                     2.76 | 14.417
                                                                      1.18
                                     2.76 | 14.500
                                                      3.15 | 20.50
                                                                      1.18
            2.500
                     1.18 | 8.500
                     1.18 | 8.583
                                     2.76 | 14.583
                                                      2.76 | 20.58
                                                                     1.18
            2.583
                                                      2.76 | 20.67
                                                                     1.18
            2.667
                     1.18 | 8.667
                                     2.76 | 14.667
                                                      2.76 | 20.75
            2.750
                     1.18 | 8.750
                                     2.76 | 14.750
                                                      3.15 | 20.83
                                                                      1.18
                     1.18 | 8.833
                                     3.15 | 14.833
            2.833
            2.917
                     1.18 | 8.917
                                     3.15 | 14.917
                                                      3.15 | 20.92
                                                                     1.18
                     1.18 | 9.000
            3.000
                                     3.15 | 15.000
                                                      3.15 | 21.00
                                                                       1.18
                                                                      1.18
                                     3.15 | 15.083
                                                      2.76 | 21.08
            3.083
                     1.58 | 9.083
                                     3.15 | 15.167
                                                      2.76 | 21.17
                                                                      1.18
            3.167
                     1.58 | 9.167
                     1.58 | 9.250
            3.250
                                     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
                                                      3.15 | 21.42
            3.417
                     1.18 | 9.417
                                     3.55 | 15.417
                                                                      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
                                     3.55 | 15.667
                                                      2.76 | 21.67
            3.667
                     1.18 | 9.667
                                                                      1.18
           3.750
                                                      2.76 | 21.75
                     1.18 | 9.750
                                     3.55 | 15.750
                                                                       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
                                                      1.97 | 22.00
                     1.58 | 10.000
                                   4.33 |16.000
                                                                       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
                                     4.73 | 16.250
                                                      1.58 | 22.25
            4.250
                     1.58 | 10.250
                                                                      1.18
                                     5.91 | 16.333
                                                      1.97 | 22.33
            4.333
                     1.58 | 10.333
                                     5.91 | 16.417
                                                      1.97 | 22.42
                                                                      1.18
            4.417
                     1.58 | 10.417
                                                                     1.18
                                                     1.97 | 22.50
            4.500
                     1.58 | 10.500
                                   5.91 |16.500
                                                      1.58 | 22.58
            4.583
                     1.58 | 10.583
                                     6.30 | 16.583
                                                                       1.18
                                     6.30 | 16.667
                                                      1.58 | 22.67
           4.667
                                                                      1.18
                     1.58 | 10.667
                                                                      1.18
            4.750
                    1.58 | 10.750
                                     6.30 | 16.750
                                                     1.58 | 22.75
            4.833
                     1.58 | 10.833
                                     9.46 | 16.833
                                                      1.97 | 22.83
                                     9.46 | 16.917
                                                      1.97 | 22.92
                                                                      1.18
            4.917
                     1.58 | 10.917
           5.000
                                                                     1.18
                    1.58 | 11.000
                                   9.46 | 17.000
                                                    1.97 | 23.00
            5.083
                    1.58 | 11.083
                                     9.46 | 17.083
                                                      1.58 | 23.08
                                                                       1.18
                                                      1.58 | 23.17
                                     9.46 | 17.167
                                                                       1.18
            5.167
                     1.58 | 11.167
                    1.58 | 11.250
                                     9.46 | 17.250
                                                     1.58 | 23.25
                                                                      1.18
            5.250
           5.333
                                    29.15 | 17.333
                                                      1.97 | 23.33
                    1.58 | 11.333
                                                                       1.18
                                                      1.97 | 23.42
            5.417
                     1.58 | 11.417
                                    29.16 | 17.417
                                                                       1.18
            5.500
                    1.58 | 11.500
                                    29.16 | 17.500
                                                    1.97 | 23.50
                                                                      1.18
                                                      1.58 | 23.58
           5.583
                    1.58 | 11.583 | 120.56 | 17.583
                                                                       1.18
                     1.58 | 11.667
                                   120.56 | 17.667
                                                      1.58 | 23.67
                                                                       1.18
            5.667
            5.750
                    1.58 | 11.750
                                  120.56 | 17.750
                                                      1.58 | 23.75
                                   14.20 | 17.833
                    1.58 | 11.833
                                                      1.97 I
            5.833
                    1.58 | 11.917
            5.917
                                    14.18 | 17.917
                                                      1.97
           6.000
                                   14.18 | 18.000
                                                      1.97 |
                    1.58 | 12.000
Max.Eff.Inten.(mm/hr)=
                           120.56
                                          100.20
                           5.00
                                          10.00
           over (min)
Storage Coeff. (min) =
                             1.15 (ii)
                                           8.20 (ii)
                            5.00
                                           10.00
Unit Hyd. Tpeak (min) =
                                           .13
Unit Hyd. peak (cms)=
                             .34
                                                        *TOTALS*
                               .01
                                            .08
                                                          .091 (iii)
PEAK FLOW
                 (cms) =
                             11.75
                                          11.75
                                                          11.75
TIME TO PEAK
                 (hrs) =
RUNOFF VOLUME
                            97.20
                                          55.83
                                                          57.89
                 (mm) =
                                           98.20
                                                          98.20
                             98.20
TOTAL RAINFALL
                 (mm) =
RUNOFF COEFFICIENT =
                              .99
                                            .57
```

⁽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.

```
Area (ha)= 1.92
Total Imp(%)= 43.00
| STANDHYD (0201) |
|ID= 1 DT= 5.0 min |
                                             Dir. Conn.(%) = 18.00
                             IMPERVIOUS
                                           PERVIOUS (i)
                              .83
                                              1.10
                      (ha) =
    Surface Area
    Dep. Storage (mm)=
                               1.00
                                              3.70
                    (%)=
                                              2.00
    Average Slope
                            200.00
                                             40.00
                      (m) =
    Length
                                .013
    Mannings n
                                              .250
                            120.56
5.00
3.59 (ii)
                                             141.70
    Max.Eff.Inten.(mm/hr)=
                                             10.00
              over (min)
                               3.59 (ii)
5.00
                                              9.73 (ii)
    Storage Coeff. (min) =
    Unit Hyd. Tpeak (min) =
                                             10.00
                                             .11
                                 .26
    Unit Hyd. peak (cms)=
                                                          *TOTALS*
                                               .32
                                       .32
11.75
68.05
98.20
                                                             .430 (iii)
    PEAK FLOW
                                   .11
                     (cms) =
                            11.75
97.20
98.20
.99
    TIME TO PEAK (hrs) =
                                                             11.75
    RUNOFF VOLUME (mm) =
TOTAL RAINFALL (mm) =
                                                            73.30
                                                            98.20
                                                              .75
    RUNOFF COEFFICIENT =
                                .99
                                              .69
```

- (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.

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

		TP	ANGEORME	ED HYETOG	ВДРН		
TIME	RAIN	TIME		TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.167	1.18	6.167	1.97	112.167	14.18	18.17	1.58
.333	.98	6.333	1.77	112.333	10.83	18.33	1.77
.500	.79	6.500	1.58	112.500		1 18.50	1.97
.667	1.18	6.667	1.97	112.667	7.09	18.67	1.58
.833	1.18	6.833	1.97	112.833		18.83	1.77
1.000	1.18	7.000	1.97	113.000		1 19.00	1.97
1.167	1.18	7.167	2.36	113.167	5.12	1 19.17	1.58
1.333	.98	7.333	2.17	113.333	4.73	19.33	1.77
1.500	.79	7.500	1.97	113.500	4.33	1 19.50	1.97
1.667	1.18	1 7.667	2.36	113.667	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	114.000	3.15	1 20.00	1.18
2.167	1.58	8.167	2.76	114.167	2.76	20.17	1.18
2.333	1.38	8.333	2.76	114.333		20.33	1.18
2.500	1.18	8.500	2.76	114.500	3.15	20.50	1.18
2.667	1.18	8.667	2.76	114.667		20.67	1.18
2.833	1.18	8.833	2.95	114.833		20.83	1.18
3.000		9.000	3.15	115.000		21.00	1.18
3.167		9.167	3.15	115.167		21.17	1.18
3.333		9.333	3.35	115.333		21.33	1.18
3.500		9.500	3.55	15.500		21.50	1.18
3.667	1.18	9.667	3.55	115.667	2.76	21.67	1.18
3.833	1.38	9.833	3.94	115.833	2.36	21.83	1.18
4.000	1.58	110.000	4.33	116.000	1.97	22.00	1.18
4.167		110.167	4.73	116.167	1.58	22.17	1.18
4.333		10.333	5.32	116.333	1.77	1 22.33	1.18
4.500		10.500	5.91	16.500	1.97	22.50	1.18
4.667	1.58	10.667	6.30	16.667	1.58	1 22.67	1.18
4.833	1.58	10.833	7.88	116.833	1.77	1 22.83	1.18
5.000	1.58	11.000	9.46	117.000	1.97	23.00	1.18
5.167	1.58	11.167	9.46	117.167	1.58	23.17	1.18
5.333	1.58	11.333	19.31	117.333	1.77	23.33	1.18
5.500		11.500	29.16	117.500	1.97 1.58	23.50	$\frac{1.18}{1.18}$
5.667		11.667	120.56	17.667 17.833	1.77	23.83	.59
5.833		11.833	67.37		1.77	23.83	. 59
6.000	1.58	12.000	14.18	18.000	1.97	J	

```
PEAK FLOW (cms)= .012 (i)
TIME TO PEAK (hrs)= 11.833
RUNOFF VOLUME (mm)= 41.683
TOTAL RAINFALL (mm)= 98.204
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
I CALTB
 NASHYD
                                                       Curve Number (CN) = 69.0
                          Area (ha)= .45 Curve Number (CN)= 69.0

Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
             (0205) |
|ID= 1 DT=10.0 min |
                          U.H. Tp(hrs) = .36
     Unit Hyd Qpeak (cms)=
                                     .047
                                     .031 (i)
      PEAK FLOW
                         (cms) =
                         (hrs) = 12.000
      TIME TO PEAK
                        (mm) = 41.780

(mm) = 98.204
      RUNOFF VOLUME
      TOTAL RAINFALL
      RUNOFF COEFFICIENT =
      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
| STANDHYD (0202) |
                          Area (ha) = 1.14
|ID= 1 DT= 5.0 min |
                         Total Imp(%) = 39.00 Dir. Conn.(%) = 17.00
_____
                                   IMPERVIOUS PERVIOUS (i)
                                    .44
1.00
                                                  .69
3.80
      Surface Area
                          (ha) =
                          (mm) =
      Dep. Storage
      Average Slope
                                       1.00
                          (%)=
                                                       2.00
                                     1.00
65.00
                           (m) =
                                                       40.00
      Length
                                        .013
                                                         .250
      Mannings n
          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
                    TIME
                    .79 | 6.333 | 1.58 |12.333 | 7.49 | 18.33

.79 | 6.417 | 1.58 |12.417 | 7.49 | 18.42

.79 | 6.500 | 1.58 |12.500 | 7.49 | 18.50
                                                                                       1.97
                    .333
                    .417
                                                                                       1.97
                    .500
                                                                   .583
                            1.18 | 6.583 | 1.97 | 12.583
                           .667
                                                                   7.09 | 18.75
                    .750
                           .833
                    .917
                                                                   5.52 | 19.00
                   1.000
                   5.12 | 19.08 1.58

    1.167
    1.18
    | 7.167
    2.36
    | 13.167

    1.250
    1.18
    | 7.250
    2.36
    | 13.250

                                                                   5.12 | 19.17
5.12 | 19.25
                                                                                       1.58
1.58
                             .79 | 7.333 1.97 |13.333
                   1.333
                                                                   4.33 | 19.33
                           .79 | 7.417 | 1.97 | 13.417

.79 | 7.500 | 1.97 | 13.500

1.18 | 7.583 | 2.36 | 13.583
                                                                   4.33 | 19.42
4.33 | 19.50
                                                                                       1.97
1.97
                   1.417
                   1.500
                   1.583
                                                                  3.94 | 19.58
                                                                                       1.58
                                                                   3.94 | 19.67

    1.667
    1.18 | 7.667
    2.36 | 13.667

    1.750
    1.18 | 7.750
    2.36 | 13.750

    1.833
    1.18 | 7.833
    2.36 | 13.833

                                                                                       1.58
1.58
                                                                     3.94 | 19.75
                                                                   3.15 | 19.83
                                                                                       1.18
                                                                  3.15 | 19.92
3.15 | 20.00
2.76 | 20.08
                                                                                       1.18

    1.18 | 7.917
    2.36 | 13.917

    1.18 | 8.000
    2.36 | 14.000

    1.58 | 8.083
    2.76 | 14.083

                   1.917
                   2.000
                                                                                         1.18
                                                                                       1.18
                   2.083
                                                                                       1.18
                           1.58 | 8.167 2.76 | 14.167
                   2.167
                                                                   2.76 | 20.17
                           1.58 | 8.250 2.76 | 14.250
1.18 | 8.333 2.76 | 14.333
                                                                   2.76 | 20.25
3.15 | 20.33
                                                                                       1.18
1.18
                   2.250
                   2.333
                            1.18 | 8.417 2.76 | 14.417
                   2.417
                                                                    3.15 | 20.42
                                                                   3.15 | 20.50
                           1.18 | 8.500 2.76 | 14.500
1.18 | 8.583 2.76 | 14.583
1.18 | 8.667 2.76 | 14.667
                                                                                       1.18
1.18
                   2.500
                                                                     2.76 | 20.58
                   2.583
                                                                    2.76 | 20.67
                                                                                       1.18
                   2.667
                           1.18 | 8.750 2.76 | 14.750
1.18 | 8.833 3.15 | 14.833
1.18 | 8.917 3.15 | 14.917
                                                                                       1.18
1.18
                                                                   2.76 | 20.75
                   2.750
                   2.833
                                                                     3.15 | 20.83
                                                                                       1.18
                                                                   3.15 | 20.92
                   2.917
                  3.000 1.18 | 9.000 3.15 | 15.000
3.083 1.58 | 9.083 3.15 | 15.083
3.167 1.58 | 9.167 3.15 | 15.167
```

1.58 | 9.250 3.15 | 15.250

3.250

1.18

1.18

2.76 | 21.25

Unit Hyd Qpeak (cms)=

```
3.333
                         1.18 | 9.333
                                          3.55 | 15.333
                                                              3.15 | 21.33
                         3.417
                                                                                   1.18
                                                              1.18 | 9.500 3.55 | 15.500
              3.500

    1.18 | 9.583
    3.55 | 15.583

    1.18 | 9.667
    3.55 | 15.667

              3.583
              3.667
                        1.18 | 9.750 3.55 | 15.750
1.58 | 9.833 4.33 | 15.833
1.58 | 9.917 4.33 | 15.917
                                                              2.76 | 21.75
                                                                                   1.18
              3.750
                                                                 1.97 | 21.83
              3.833
                                                              1.97 | 21.92
                                                                                   1.18
              3.917
                                                              1.97 | 22.00
                                                                                   1.18
                         1.58 | 10.000 4.33 | 16.000
              4.000
                        1.58 | 22.08
1.58 | 22.17
              4.083
                                                                                   1.18
              4.167
              4.250
                                                              1.58 | 22.25 1.18
                         1.58 | 10.333 | 5.91 | 16.333 | 1.58 | 10.417 | 5.91 | 16.417
                                                              1.97 | 22.33
1.97 | 22.42
              4.333
                                                                                     1.18
                                                                                   1.18
              4.417
                        1.58 | 10.500 5.91 | 16.500
                                                              1.97 | 22.50
              4.500
                      1.58 | 22.58
1.58 | 22.67
                                                                                   1.18
              4.583
              4.667
                                                              1.58 | 22.75 1.18
              4.750
                      1.58 | 10.833 | 9.46 | 16.833 | 1.58 | 10.917 | 9.46 | 16.917
                                                              1.97 | 22.83 1.18
1.97 | 22.92 1.18
              4.833
              4.917
                        1.58 | 11.000 9.46 | 17.000
                                                              1.97 | 23.00 1.18
              5.000
                      1.58 | 11.083 | 9.46 | 17.083 | 1.58 | 11.167 | 9.46 | 17.167 | 1.58 | 11.250 | 9.46 | 17.250
                                                              5.083
                                                                 1.58 | 23.17
              5.167
                                                              1.58 | 23.25 1.18
              5.250
                      5.333
                        1.58 | 11.417 | 29.16 | 17.417 | 1.58 | 11.500 | 29.16 | 17.500
              5.417
                                                              1.97 | 23.50 1.18
              5.500

    1.58 | 11.583
    120.56 | 17.583
    1.58 | 23.58
    1.18

    1.58 | 11.667
    120.56 | 17.667
    1.58 | 23.67
    1.18

    1.58 | 11.750
    120.56 | 17.750
    1.58 | 23.75
    1.18

              5.583
              5.667
              5.750
                                                              1.97 |
              5.833
                      1.58 | 11.917
1.58 | 12.000
                                          14.18 | 17.917
14.18 | 18.000
                                                              1.97 |
1.97 |
              5.917
              6.000
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
                             .06 .19
11.75 11.75
97.20 65.40
98.20 98.20
                                                                   *TOTALS*
                (cms)=
                                                                  .258 (iii)
11.75
PEAK FLOW
TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) =
                                                                    70.80
                                                                    98.20
RUNOFF COEFFICIENT =
                                   .99
                                                   . 67
```

- (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.

I OUTTI OW	CTODACE	Ĩ	OTTET OM	STORAGE
• Contract accept to the contract		1		
	A CO COLUMN TO SERVICE	1	No. of the contract of the con	.0775
		- 1		
		ļ		.0859
		- 1		.0944
		- 1		.1031
		1		.1120
.0164	.0376	1		.1210
.0392	.0453	1	1.0915	.1301
.0602	.0531	1	1.4134	.1394
.0639	.0611	1	1.7793	.1488
.0674	.0692	Ī	.0000	.0000
	AREA (OPEAK	TPE	AK R.V.
(0201) 1				
C) Management include (C)	.925	.069		
	.0000 .0010 .0020 .0030 .0040 .0164 .0392 .0602 .0639 .0674	(cms) (ha.m.) .0000 .0000 .0010 .0052 .0020 .0108 .0030 .0233 .0040 .0302 .0164 .0376 .0392 .0453 .0602 .0531 .0639 .0611 .0674 .0692	(cms) (ha.m.) .0000 .0000 .0010 .0052 .0020 .0108 .0030 .0233 .0040 .0302 .0164 .0376 .0392 .0453 .0602 .0531 .0639 .0611 .0674 .0692 AREA QPEAK (ha) (cms)	(cms) (ha.m.) (cms) .0000 .0000 .0707 .0010 .0052 .1232 .0020 .0108 .2290 .0030 .0233 .3811 .0040 .0302 .5760 .0164 .0376 .8126 .0392 .0453 1.0915 .0602 .0531 1.4134 .0639 .0611 1.7793 .0674 .0692 .0000

```
| ADD HYD (0903) |
  1 + 2 = 3
                         AREA
                               QPEAK
                                        TPEAK
                                               R.V.
                         (ha)
                               (cms)
                                       (hrs)
                                                (mm)
                              .012
                                             41.68
41.78
                       .16
.45
        ID1 = 1 (0204):
                                       11.83
                                     12.00
       + ID2= 2 (0205):
         _____
        ID = 3 (0903): .61
                               .043 12.00
    NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| RESERVOIR (0302) |
 IN= 2---> OUT= 1 |
                     OUTFLOW
                             STORAGE | OUTFLOW
                                                   STORAGE
| DT= 5.0 min |
                              (ha.m.) | (cms)
.0000 | .0054
                                                    (ha.m.)
                       (cms)
                               .0000
                                                    .0654
                                       .0054
                        .0000
                                 .0049
                                                       .0739
                       .0011
                                                      .0828
                        .0021
                                .0102 | .1153
                                .0158 | .2258
.0218 | .3706
.0281 | .5506
.0349
                        .0027
                        .0033
                                                      .1117
.1220
.1327
                        .0037
                                .0349 | .7671
.0420 | 1.0214
                        .0041
                        .0045
                                .0494 | 1.3149
.0572 | .0000
                        .0048
                                                      .1438
                        .0051
                                 QPEAK
(cms)
.258
.005
                                                         R.V.
                                               TPEAK
                            AREA
                                             (hrs)
11.75
                                                         (mm)
70.80
                            (ha)
    INFLOW : ID= 2 (0202)
                            1.136
    OUTFLOW: ID= 1 (0302)
                           1.136
                                               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) |
                       AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) .61 .043 12.00 41.75
 1 + 2 = 3
                                        (hrs) 41.75
       ID1=1 (0903):
                                .043
                         1.14 .005 16.17
                                             69.81
      + ID2= 2 (0302):
        ID = 3 (0902):
                        1.74 .047 12.00
                                             60.12
    NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
| ADD HYD (0901) |
                       AREA QPEAK TPEAK (ha) (cms) (hrs) 1.92 .069 12.33
                                              R.V.
1 + 2 = 3
                                        TPEAK
                                        (hrs)
                                                (mm)
                                              72.61
       ID1 = 1 (0301):
                        1.74
                               .047 12.00
                                              60.12
      + ID2= 2 (0902):
        ______
        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	Volu	me
	60mm	Outlet Pipe	200 Outlet Pipe	Overflow			
Water Level	Discharge	Discharge	Discharge	Discharge	Discharge	Live	Total
(m)	(m^3/s)	(m^3/s)	(m ³ /s)	(m^3/s)	(m ³ /s)	(m ³)	(m ³)
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

				Volume					
Elev.	Depth	Area	Avg. Area	Dead	Accum. Dead	Live	Accum. Live	Accum. Total	Accum. Total
(m)	(m)	(m^2)	(m ²)	(m^3)	(m ³)	(m^3)	(m ³)	(m ³)	(ha-m)
187.30	0.00	718.3	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	
187.60	0.30	1253.43	1208.84		127.81	60.44	167.95	295.76	
187.65	0.35	1342.62	1298.03		127.81	64.90	232.85	360.66	
187.70	0.40	1431.81	1387.22		127.81	69.36	302.21	430.02	0.04
187.75	0.45	1521.00	1476.41		127.81	73.82	376.03	503.84	
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	
187.95	0.65	1638.11	1623.47		127.81	81.17	691.94	819.75	
188.00	0.70	1667.38	1652.75		127.81	82.64	774.58	902.39	
188.05	0.75	1696.66	1682.02		127.81	84.10	858.68	986.49	
188.10	0.80	1725.94	1711.30		127.81	85.56	944.24	1072.06	
188.15	0.85	1755.22	1740.58		127.81	87.03	1031.27	1159.09	20,000
188.20	0.90	1784.49	1769.85		127.81	88.49	1119.77	1247.58	0.000-0.00
188.25	0.95	1813.77	1799.13		127.81	89.96	1209.72	1337.53	
188.30	1.00	1843.05	1828.41		127.81	91.42	1301.14	1428.96	
188.35	1.05	1872.32	1857.68		127.81	92.88	1394.03	1521.84	
188.40	1.10	1901.60	1886.96		127.81	94.35	1488.38	1616.19	0.16

MONTERRA PHASE II - 115185 NORTH WETLAND DISCHARGE TABLE

Weir constant K

INLET CONTROL For Outlet Pipe

Outlet Pipe DICB Outlet Pipe

Orifice 1 Diameter 60 450 Area 0.002827 0.159043 0.031416

0.63 0.63 Orifice Coef. 0.63 187.45 187.45 187.45 Invert

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 1.83 Variable

Slope of weir opening sides (H:V)

where $Q = K \times L \times H^1.5$ Weir Equation Q = flow rate (cms)

K = constantL = length (m)

H = head on the weir (m)

CONTROL STRUCTURE CONFIGURATION

Water Level	Orific	e Discharge		Pipe Capacity 450 Outlet Pipe		DICB DICB Outlet DICB 200 Outlet Pipe			scharge w Weir	Total	
Water Bever	Head	Discharge	Head	Capacity	Head	Discharge	Head	Discharge	Head	Discharge	Discharge
(m)	(m)	(cms)	(m)	(cms)	(m)	(cms)	(m)	(ems)	(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	0.003
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	0.060
187.90	0.42	0.0051	0.23	0.2105	0.20	0.0982	0.45	0.0588	0.0000	0.0000	0.063
187.95	0.47	0.0054	0.28	0.2327	0.25	0.1373	0.50	0.0620	0.0000	0.0000	0.067
188.00	0.52	0.0057	0.33	0.2530	0.30	0.1804	0.55	0.0650	0.0000	0.0000	0.070
188.05	0.57	0.0060	0.38	0.2718	0.35	0.2274	0.60	0.0679	0.0500	0.0493	0.123
188.10	0.62	0.0062	0.43	0.2893	0.40	0.2778	0.65	0.0707	0.1000	0.1521	0.229
188.15	0.67	0.0065	0.48	0.3059	0.45	0.3315	0.70	0.0733	0.1500	0.3013	0.381
188.20	0.72	0.0067	0.53	0.3216	0.50	0.3882	0.75	0.0759	0.2000	0.4934	0.576
188.25	0.77	0.0069	0.58	0.3365	0.55	0.4479	0.80	0.0784	0.2500	0.7273	0.812
188.30	0.82	0.0071	0.63	0.3509	0.60	0.5103	0.85	0.0808	0.3000	1.0035	1.091
188.35	0.87	0.0074	0.68	0.3646	0.65	0.5754	0.90	0.0832	0.3500	1.3228	1.413
188.40	0.92	0.0076	0.73	0.3779	0.70	0.6431	0.95	0.0854	0.4000	1.6862	1.779

MONTERRA PHASE II - 115185 EAST WETLAND STAGE-STORAGE-DISCHARGE TABLE

Wet Cell

Avg. Side Slope Varied

Dimensions Outlet Pipe
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^3/s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³)	(m ³)	
187.25	0.0000	0.0000	0.0000	0.0000	0.00	0.	
187.30	0.0000	0.0000	0.0000	0.0000	38.15	38.	
187.35	0.0000	0.0000	0.0000	0.0000	79.94	79.	
187.40	0.0000	0.0000	0.0000	0.0000	125.35	125.	
187.45	0.0011	0.0000	0.0000	0.0011	125.35	174.	
187.50	0.0021	0.0000	0.0000	0.0021	125.35	227.	
187.55	0.0027	0.0000	0.0000	0.0027	125.35	283.	
187.60	0.0033	0.0000	0.0000	0.0033	125.35	343.	
187.65	0.0037	0.0702	0.0000	0.0037	125.35	406.	
187.70	0.0041	0.1215	0.0000	0.0041	125.35	474.	
187.75	0.0045	0.1569	0.0000	0.0045	125.35	544.	
187.80	0.0048	0.1857	0.0000	0.0048	125.35	619.	
187.85	0.0051	0.2105	0.0000	0.0051	125.35	697.	
187.90	0.0054	0.2327	0.0000	0.0054	125.35	779.	
187.95	0.0057	0.2530	0.0339	0.0396	125.35	864.	
188.00	0.0060	0.2718	0.1093	0.1153	125.35	953	
188.05	0.0062	0.2893	0.2196	0.2258	125.35	1046	
188.10	0.0065	0.3059	0.3642	0.3706	125.35	1142	
188.15	0.0067	0.3216	0.5440	0.5506	125.35	1242	
188.20	0.0069	0.3365	0.7602	0.7671	125.35	1345	
188.25	0.0071	0.3509	1.0142	1.0214	125.35	1452	
188.30	0.0074	0.3646	1.3075	1.3149	125.35	1563	

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

				Volume					
Elev.	Depth	Area	Avg. Area	Dead	Accum. Dead	Live	Accum. Live	Accum. Total	Accum. Total
(m)	(m)	(m^2)	(m ²)	(m^3)	(m ³)	(m^3)	(m ³)	(m ³)	(ha-m)
187.25	0.00	726.8	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	
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	
187.70	0.45	1380.03	1343.74		125.35	67.19	348.69	474.04	
187.75	0.50	1452.61	1416.32		125.35	70.82	419.50	544.85	
187.80	0.55	1525.19	1488.90		125.35	74.45	493.95	619.30	101100000000000000000000000000000000000
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	
188.05	0.80	1888.10	1851.80		125.35	92.59	920.61	1045.96	
188.10	0.85	1960.68	1924.39		125.35	96.22	1016.83	1142.18	
188.15	0.90	2033.26	1996.97		125.35	99.85	1116.68	1242.03	
188.20	0.95	2105.84	2069.55		125.35	103.48	1220.15	1345.50	
188.25	1.00	2178.42	2142.13		125.35	107.11	1327.26	1452.61	0.15
188.30	1.05	2251.00	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

Diameter

Orifice Coef.

Area

Outlet Pipe

0.63

187.40

60 450 0.002827 0.159043 Length of Weir (m) Weir Sill (m) Weir constant K

Slope of weir opening sides (H:V)

Weir Equation

where $Q = K \times L \times H^1.5$

Q = flow rate (cms) K = constantL = length (m)

WEIR CONTROL

Overflow

H = head on the weir (m)

187.9

Variable

Invert 187.40 Orifice Equation $Q = C \times A \times (2gH)^0.5$

where Q = flow rate (cms) C = constant

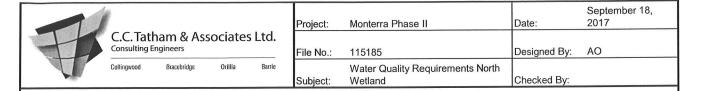
> A = area of opening(sq. m) H = net head on the orifice g = Acceleration due to gravity

0.63

CONTROL STRUCTURE CONFIGURATION

	Orifice	e Discharge	Pipe Capacity Weir Discharge				
Water Level		60	450 O	utlet Pipe		ow Weir	Total
	Head	Discharge	Head	Capacity	Head	Discharge	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	0.005
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	0.0390
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	0.3700
188.15	0.72	0.0067	0.53	0.3216	0.2500	0.5440	0.5500
188.20	0.77	0.0069	0.57	0.3365	0.3000	0.7602	0.767
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



Stormwater Management Facility Water Quality Storage Requirements

Contirbuting 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	
	TO	OTAL AREA	1	.9 ha	%Impervious	43

Required Level of Treatment

80 % E

Enhanced Level

SWM Facility Type

2

(1-Infiltration, 2-Wetlands, 3-Hybrid Wet Pond/Wetland, 4-Wet Pond, 5-Dry Pond)

	Enhanced	Normal	Basic	
Water Quality Storage Requirement	90.0	-	-	cu.m/ha
Permanent Pool Volume Required	50.0	-	-	cu.m/ha
	96	-	-	cu.m
Extended Detention Volume (40cu.m)	40.0	-	-	cu.m/ha
	77	-	-	cu.m
25mm Storm Runoff Volume	11.0 mm			
	213 cu.n	า		

Erosion Control Storage Requirement (Simplified Approach)

FRIMP (%) 18
Soils Group A/B
Source Control 0

Active Storage Volume Requirement 110 cu.m/ha

Erosion Control Volume Required 212 cu.m

Required Extended Detention Volume 289 cu.m

Permanent Pool Volume Provided 128 cu.m Provided > Required

Extended Detention Volume Provided 302 cu.m Provided > Required



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

Contirbuting 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	

TOTAL AREA 1.1 ha %Impervious 39

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	
Water Quality Storage Requirement	85.0	-	-	cu.m/ha
Permanent Pool Volume Required	45.0	-	-	cu.m/ha
	51	-	-	cu.m
Extended Detention Volume (40cu.m)	40.0 45	-	-	cu.m/ha cu.m
25mm Storm Runoff Volume	24.76 1.20(47.770)	mm 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

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} \qquad (h_1^{0.5} - h_2^{0.5})$$

Value where t = drawdown time in seconds A_p = surface area of pond (m²) average area of extended 1289 m² detention stages filled by 25mm event C = discharge coefficient (typically 0.63) 0.63 0.002827 m² 60 mm diameter $A_o = cross-sectional area of orifice (m²)$ g = gravitational acceleration constant (9.81 m/s²) 9.81 m/s^2 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 seconds

t = 37.42 hours

MONTERRA PHASE II FILE No. 115185

DRAWDOWN TIME FOR POND - EXTENDED DETENTION

(Using the falling head orifice equation)

EAST WETLAND SWM FACILITY

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} \qquad (h_1^{0.5} - h_2^{0.5})$$

0 70 (29)		
	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	
$A_o = cross-sectional area of orifice (m2)$	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

