DRAFT
UNR FLOOD WARNING SYSTEM

Reno, Nevada

Prepared For:

UNIVERSITY OF NEVADA
Reno, Nevada

Nimbus Job No. 0423
September 2004

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1.0 INTRODUCTION

Nimbus Engineers was asked to evaluate flood stages on the University of Nevada, Reno campus in order to help program a new flood warning system. The objective of this project is to determine a minimum rainfall intensity upstream of the campus which will likely cause flood damage to the campus. The flood warning alert will then provide the university at least an hour's notice to engage a floodwall system. The UNR campus is located in the Evans Creek watershed, which has previously been modeled by Nimbus Engineers.

The Evans Creek Watershed is located north of the City of Reno, partially within the corporate boundary of the City (Figure 1). The northern portion of the watershed includes a section of Panther Valley, a portion of the Peavine Mountain foothills, and a segment of Old North Virginia Street.

Most of the watershed area upstream of Sierra Street is undeveloped with vegetative cover of sagebrush and grasses. The developed areas of the watershed include residential, commercial, and industrial uses as well as Rancho San Rafael Park.

2.0 HYDROLOGIC ANALYSES

Nimbus Engineers developed a hydrologic model for the Evans Creek Watershed in July 1999. This model was modified to include the UNR campus. The hydrologic analysis for existing conditions was performed using the *U.S. Army Corps of Engineers Flood Hydrograph HEC-1* (version 4.1, 1998) software program.

2.1 Methodology

The HEC-1 model was utilized to estimate the peak flow for the 10, 25, 50, and 100 year storm events of 1, 6, 12, and 24 hour durations for existing conditions. HEC-1 input and output data are attached in Appendix B.

2.1.1 Rainfall Depth and Distribution

In the original report prepared by Nimbus Engineers, a model using the 100-year, 24-hour point rainfall depths was created using HEC-1. Rainfall data was obtained from the National Weather Service's Southwest Semi-arid Precipitation Frequency Study Group (SSPFS, 1997). This precipitation data was incorporated into the Department of Water Resources, Washoe County Precipitation Frequency maps for the one, six, and 24-hour storm durations for the 2-year recurrence frequency. Precipitation estimates for recurrence intervals other than the 2-year event were calculated using the *Washoe County Hydrologic Criteria and Drainage Design Manual* (hereafter referred to as the Washoe County Manual) (1996). Precipitation calculations for each watershed are attached in Appendix A

Since then, NOAA has updated the Precipitation Frequency Estimates. The new data was input into the existing model. For a given latitude and longitude, the NOAA Precipitation Frequency Data Server will output the precipitation frequency for various return periods and storm durations, thus no calculations are necessary for this method. These charts are attached in Appendix 1.

2.1.2 Hydrographic and Sub-basin Areas

The watershed boundary was derived from a U.S. Geological Survey (USGS) quadrangle map (Figure 2). Because land use is varied within the watershed, sub-basins were delineated in order to more accurately depict conditions in the HEC-1 model.

The Evans Creek hydrographic basin has an area of approximately 4.4 square miles. Six sub-basins were defined within the Evans Creek watershed. Sub-basin areas range from 0.2 mi^2 to 1.5 mi^2 with slopes ranging from 2% to greater than 20%. Flow control points for each of these watersheds are shown in Figure 2.

2.1.3 SCS Curve Number

In the original report prepared by Nimbus Engineers, soil types identified by soil hydrologic groups were used to calculate curve numbers within the contributing watersheds. Soils in the U.S. have been classified by the U.S. Soil conservation Service (SCS) method into four hydrologic soil groups: A, B C, and D. Group A soils have a rapid infiltration rate and include very porous soils such as sandy soils. Group D soils have a very slow infiltration rate, which results in a larger percentage of the rainfall expressed as runoff. Water infiltration rates decrease from soil groups A through D. The soil groups were obtained from the Soil Survey of Washoe County, South Part, Nevada digital coverage. Supporting curve number calculations are attached in Appendix 1.

Curve Numbers (CN) were based on an antecedent moisture condition II (AMC-II) which is the accepted soil moisture condition for western states. The AMC-II soil condition represents an average soil moisture condition. AMC-I is representative of dry soils and AMC-III is representative of water-saturated soils. Dry soils have a greater precipitation abstraction and therefore a lower runoff potential. The converse is true for saturated soils.

For each sub-basin, the percent by area of each soil type was calculated and a CN assigned. For undeveloped areas, CN values were obtained from the draft Sparks Drainage Manual, Figure 702-Curve Number for Sage/Grass (Appendix 1). Vegetation cover densities were produced based upon field investigations, aerial photography, site photographs, and by comparing CN values with other references for semi-arid sagebrush/grass communities. Greater vegetation densities yield lower runoff values. Where vegetative densities varied widely within a sub-basin, a weighted average was used.

2.1.4 Lag Time/Time of Concentration

Lag time, or time of concentration, is the time it takes for water to reach the basin outlet from the hydraulic most distant point in the basin. Methodologies outlined in the Washoe County Manual were used to calculate flow lag times. Lag times are calculated based upon the channel lengths, slopes, and roughness as well as the shape of the sub-basin.

Table 1. HEC-1 Model Parameters

Sub-basin	Area (mi2)	Curve Number	Lag Time (hr)
E1	0.772	76	0.77
E2	1.2	77	1.1
E3	1.51	81	1.3
E4	0.576	78	0.57
E5	0.31	80	0.5
E6	0.17	91	0.2

2.1.5 Routing

Overland flow routing was calculated using the SCS Unit Hydrograph technique with the precipitation excess to produce hydrographs for the sub-basins. The resulting hydrographs were routed through subsequent basins using the Muskingum Cunge channel routing function, which is the preferred and more stable routing technique for long, non-urbanized reaches. Table 2 summarizes the reach parameters used in the HEC-1 model.

Table 2. Muskingum Cunge Routing Parameters

Reach	Shape	Length (ft)	Slope (ft/ft)	Width (ft)	Side Slope	Manning's "n"
Rch1	Trap	10,800	0.026	15	2	0.07
Rch2	Trap	4,200	0.023	20	2	0.09
Rch3	Trap	3,400	0.019	20	2	0.045
Rch4	Trap	2,700	0.038	50	5	0.013

Field investigations showed that for high flow conditions, a trapezoidal channel of width and side slope as shown in Table 2 is a good approximation of the average channel conditions within the watershed.

Manning's roughness coefficients (n) were developed based upon site investigations and Table 802 of the draft Washoe County Manual. Field observations and photographs were compared with the type of channel/vegetation description and a value chosen for each stretch. Due to the length of the reaches, it was necessary to choose a roughness value that was indicative of the whole

reach, or average condition. Channel lengths and slopes were determined from the USGS quadrangle maps.

A reservoir routing component was input to the model for the 43" x 68" RCP culvert under Sierra Street. Storage surface areas were obtained from the City of Reno 2' contour map. A rating curve was developed for the storm drain using the methodology per Section 900 of the Washoe County Manual. Flow over Sierra Street was modeled by obtaining a cross-sectional area from the grading plans for the North Virginian Apartments (SEA, Inc., 1979) for input into ISAP version 1.0 (Irregular Section Analysis Program) and the results incorporated into the discharge curve for input into HEC-1.

2.2 Results of Hydrologic Modeling

Results from the HEC-1 models are summarized in Table 3. The modeling point CP5 at the southern end of the campus was used for flow comparison (Figure 2). A total of 16 storm events were analyzed for this project, each with a different duration and intensity. Each storm event was run assuming that the culvert/storm drain under Sierra Street was plugged and no flow was allowed through and assuming the storm drain would carry 245 cfs, the capacity determined in previous reports. Master summaries and hydrographs are in Appendix 2.

Table 3. HEC-1 Model Results

245 cfs Flow Through Storm Drain		
Storm Event	Peak Flow at UNR (cfs)	Time to Peak (hr)
1-hour, 10-year	21*	0.83
1-hour, 25-year	40*	0.83
1-hour, 50-year	60	0.83
1-hour, 100-year	86	0.83
6-hour, 10-year	48	3.25
6-hour, 25-year	72	3.25
6-hour, 50-year	93	3.25
6-hour, 100-year	118	3.25
12-hour, 10-year	63	6.25
12-hour, 25-year	101	8.00
12-hour, 50-year	211	7.92
12-hour, 100-year	299	8.08
24-hour, 10-year	98	13.92
24-hour, 25-year	239	14.08
24-hour, 50-year	449	13.75
24-hour, 100-year	686	13.58
No Flow Allowed Through Storm Drain		
Storm Event	Peak Flow at UNR (cfs)	Time to Peak (hr)
1-hour, 10-year	21*	0.83
1-hour, 25-year	40*	0.83
1-hour, 50-year	83	3.08
1-hour, 100-year	179	2.67
6-hour, 10-year	115	5.58
6-hour, 25-year	198	5.17
6-hour, 50-year	276	5.00
6-hour, 100-year	372	4.83
12-hour, 10-year	221	8.08
12-hour, 25-year	361	7.75
12-hour, 50-year	493	7.67
12-hour, 100-year	665	7.50
24-hour, 10-year	351	13.58
24-hour, 25-year	552	13.67
24-hour, 50-year	746	13.50
24-hour, 100-year	980	13.42

*Flow derived from precipitation directly over campus; no flow routed from subbasins E1-E5.

3.0 HYDRAULIC ANAYSIS

3.1 Methodology

Hydraulic analysis consisted of delineating a channel from a digital topographic map provided by Odyssey Engineering. A total of eighteen cross sections were cut with AutoCAD. The channel was modeled with the *U.S Army Corps of Engineers HEC-RAS 3.1.1* (2003). Cross-section data was modeled with the corresponding flow rates from the HEC-1 model. The flow rate determined from each HEC-1 model was modeled in HEC-RAS in order to determine the flow depth at key points on campus.

3.2 Results of Hydraulic Modeling

Appendix 3 summarizes the results of the hydraulic analysis.

3.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The hydraulic model produced water surface elevations at various locations on the UNR campus. These elevations were then compared to approximate building elevations taken from 2-foot topographic data provided by Odyssey Engineering. The extent of flooding on campus was determined with this comparison. A flood was considered to be any water surface elevation above the assumed building elevations. Results are summarized in Appendix C.

Based upon these analyses, it appears that the most vulnerable building is Fleischmann Agriculture Building, followed by Scrugham Engineering. The other vulnerabilities include Ansari Business Building and the Central Heat Plant.

From the elevation comparison, the university may experience flooding if the rain gages were to receive 2+ inches of precipitation in 12 hours. If the gages measured 1.25+ inches in 6 hours, the system alarm should be triggered. This is approximately a twelve hour duration storm on a 50-year recurrence interval.

A preliminary calculation of basin travel time shows that it will take approximately 1.3 hours for runoff to reach the university from the upper subbasins of the watershed. The model for the 12-hour, 50-year storm shows the peak runoff on campus at 8 hours. If the university were warned at 6 hours this should give approximately a 1 hour warning.

However, these analyses were made on the assumption that the Sierra Street Culvert will be maintained so that the entrance is free from debris and the storm drain will carry 245 cfs of the flow in Evans Creek. If the entrance is not consistently maintained and kept free from debris, the university would need to be warned if the rain gages receive 1+ inch in one hour. This is approximately a one-hour duration storm on a 50-year recurrence

interval. The model for the 1-hour, 50-year storm shows the peak runoff on campus at 3.3 hours. If the university were warned at 1 hour, this should give approximately a 1 hour warning.

4.2 Recommendations

These results give a close approximation of how the warning system should work. However, this data is based on building elevations taken from 2 foot contour data and therefore could be off by as much as 1 foot. If more detailed information is available on the floor elevations of the buildings, it would help to adjust the warning system and determine exactly how much water could possibly enter each building.

An action plan for keeping the Sierra Street culvert/storm drain maintained should be developed. If the entrance to the culvert were to become blocked, this can increase the threat to campus.

5.0 REFRENCES

Washoe County, Draft Hydrologic Criteria and Drainage Design Manual, December 2, 1996

U.S. Geological Survey, Quadrangle Maps

U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Version 4.1, June 1998

U.S. Soil Conservation Service, National Engineering Handbook, Section 4

City of Sparks, Draft Hydrologic Criteria and Drainage Design Manual, June 1998

U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS 3.1.1, 2003

City of Reno, Digital Maps, IMS, 2002

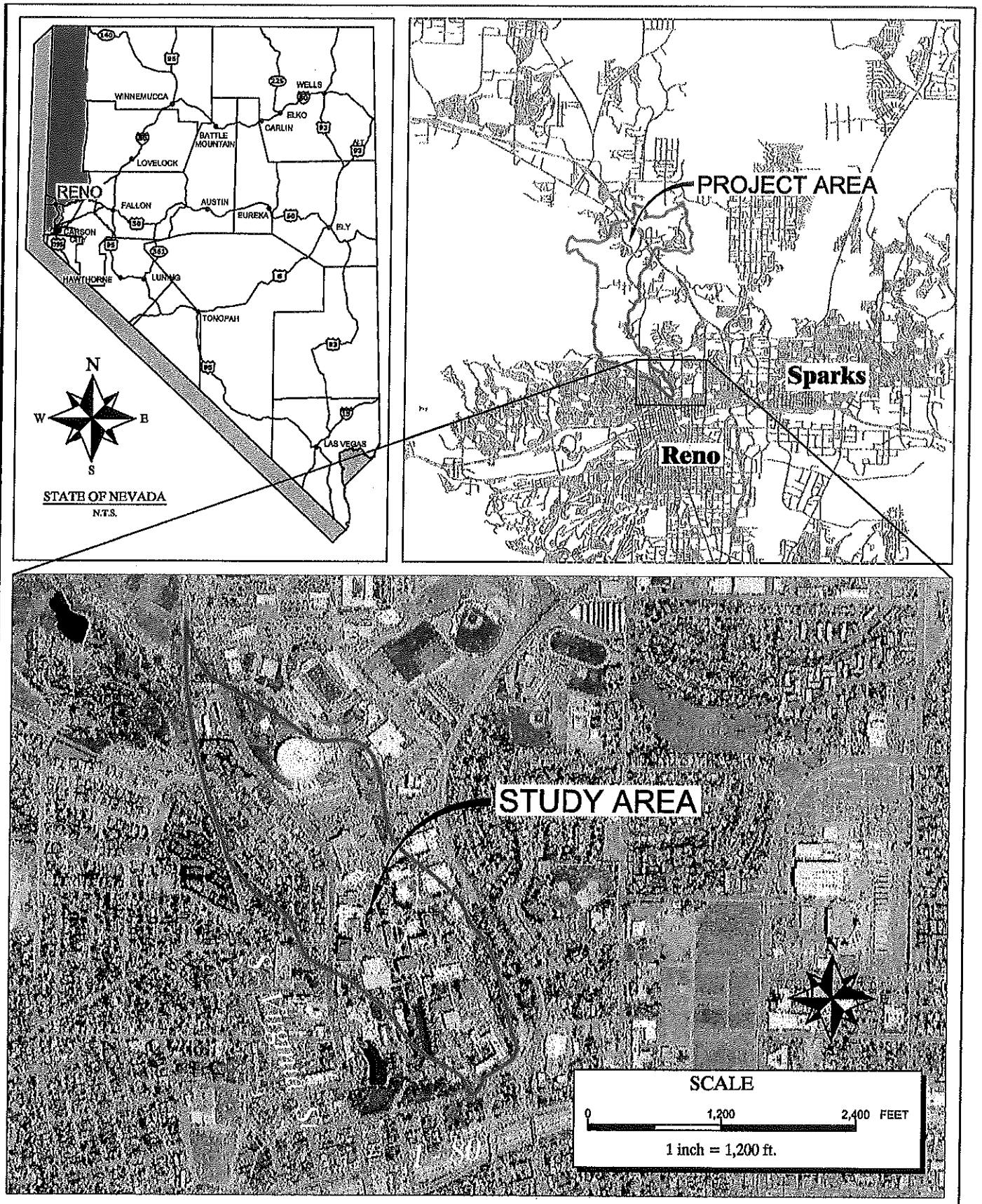

Figure 1

Vicinity Map

UNR Flood Warning System

Nimbus Job #0423

Date: September 2004

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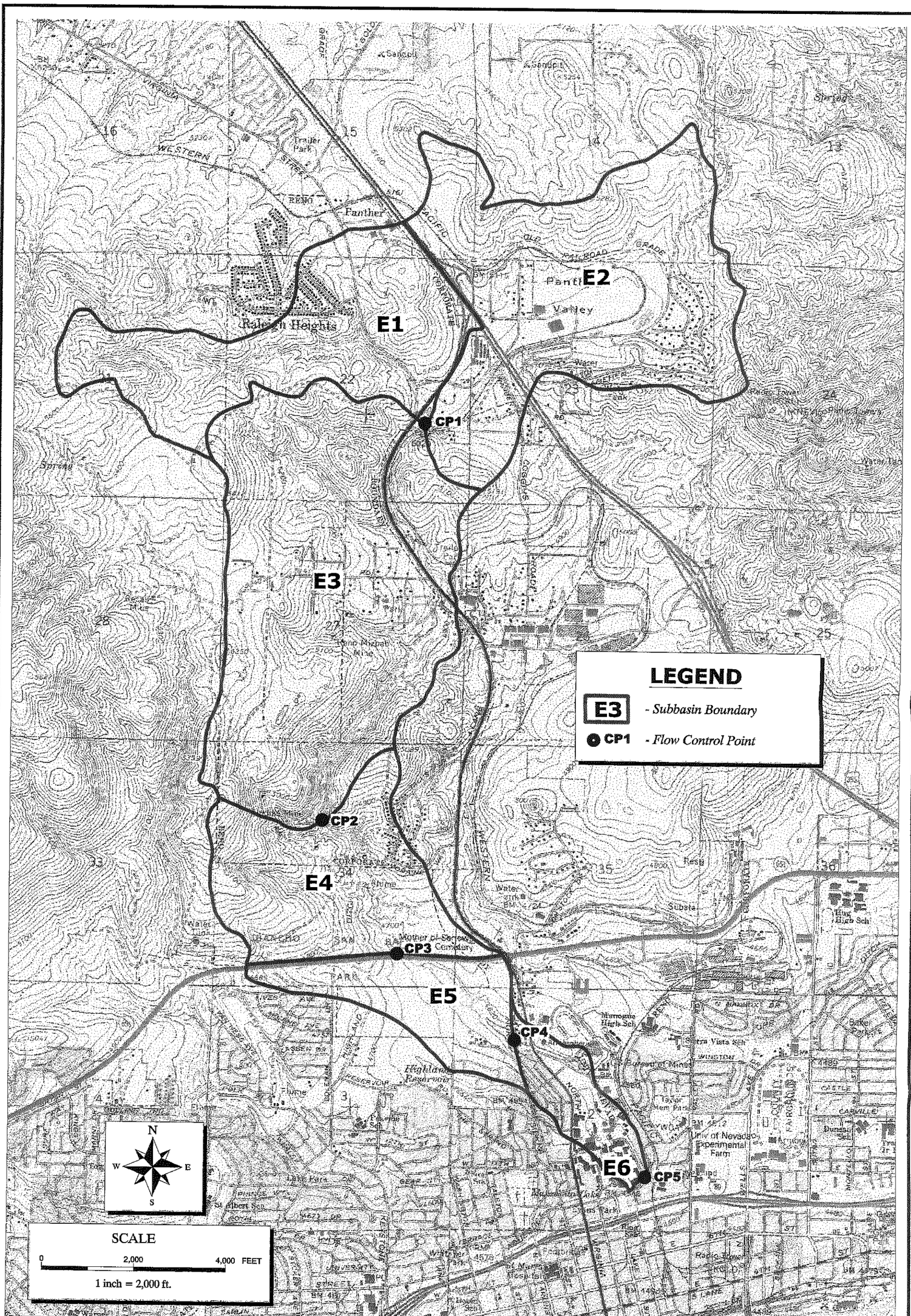

Sheet 1 of 1	**FIGURE 2** **Watershed Map** Flood Warning System ***University of Nevada, Reno***	**Scale:** 1" = 2000'	Revisions:	Nimbus Engineers
Nimbus Job # **0423**		**Contour Interval:** 40'		3785 Baker Ln., Suite 201 • Reno, NV 89509 Mail: P.O. Box 10220 • Reno, NV 89510 (775) 689-8830 • Fax (775) 689-8614 www.nimbusengineers.com
Date: September 2004		**File Name:** 0423_UNR-flood-warning		
		Drawn By: AES		
	Washoe County Nevada	**Designed By:** LAL		

18-HEC-RAS Cross
Section Number

Portable Flood Barrier Locations

15-Lawlor Events Center
9-Ansari Business Building
8-Central Heat Plant
6-Scrugham Engineering Building
4-Palmer Engineering Building
2-Fleischmann Agriculture Building

Sheet
1 of 1
Nimbus Job # 0423

PLATE 1
HYDRAULIC WORK MAP
UNR FLOOD WARNING SYSTEM
RENO *WASHOE COUNTY* *NEVADA*

Scale:	1" = 300'
Date:	AUG 2004
File Name:	flood warning-lal.dwg
Drawn By:	LAL
Designed By:	LAL

Revisions:	*Date:*	*References*
1		
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SCALE 1"=300'

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APPENDIX A
CALCULATIONS

SCS CURVE NUMBERS
LAG TIME/TIME OF CONCENTRATION
RAINFALL

RAINFALL

Subbasin E1 - Evans Creek watershed

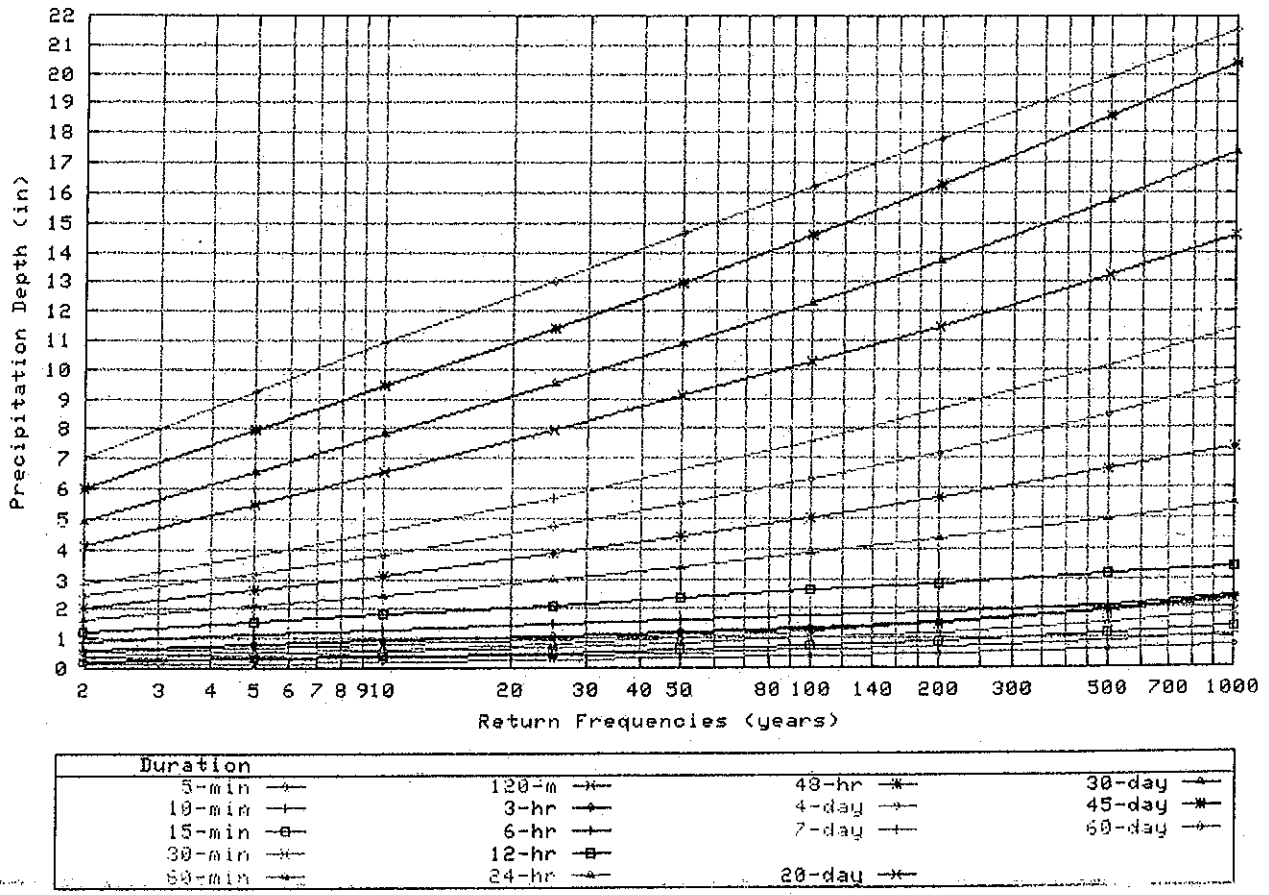
Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.12	0.18	0.23	0.31	0.38	0.52	0.63	0.91	1.22	1.61	2.01	2.40	2.84	3.23	4.13	4.95	6.01	7.03
5	0.17	0.25	0.31	0.42	0.52	0.67	0.79	1.12	1.55	2.07	2.61	3.17	3.78	4.30	5.47	6.55	7.94	9.27
10	0.20	0.31	0.38	0.52	0.64	0.79	0.91	1.28	1.80	2.44	3.10	3.81	4.56	5.16	6.53	7.80	9.42	10.91
25	0.27	0.40	0.50	0.67	0.83	0.98	1.08	1.48	2.11	2.96	3.81	4.73	5.67	6.38	7.96	9.51	11.43	13.03
50	0.32	0.49	0.61	0.82	1.01	1.13	1.21	1.62	2.35	3.38	4.40	5.48	6.58	7.35	9.09	10.86	12.99	14.62
100	0.39	0.59	0.73	0.98	1.21	1.30	1.38	1.77	2.60	3.82	5.01	6.30	7.57	8.40	10.28	12.26	14.60	16.22
200	0.46	0.71	0.88	1.18	1.46	1.50	1.58	1.92	2.84	4.29	5.67	7.18	8.62	9.50	11.50	13.71	16.26	17.80
500	0.59	0.90	1.12	1.50	1.86	1.91	1.98	2.11	3.14	4.94	6.61	8.45	10.14	11.05	13.21	15.73	18.56	19.93
1000	0.71	1.08	1.34	1.80	2.23	2.29	2.35	2.43	3.38	5.46	7.37	9.50	11.39	12.30	14.56	17.31	20.38	21.55

Text version of table

These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.583 N 119.833 W 5190 ft



Subbasin E1 - Evans Creek watershed

Partial duration based Point Precipitation Frequency Estimates Version: 3
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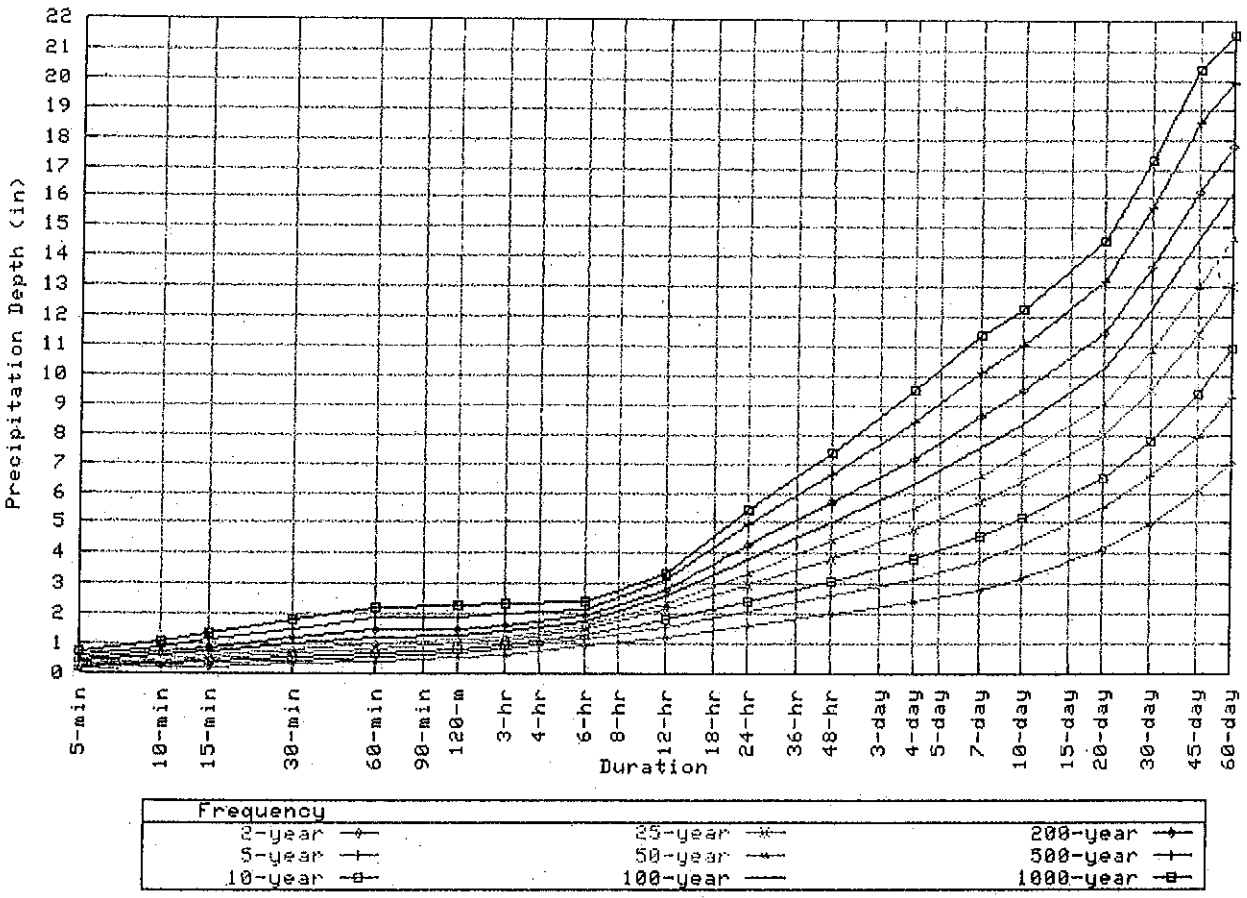


Subbasin E2 - Evans Creek Watershed

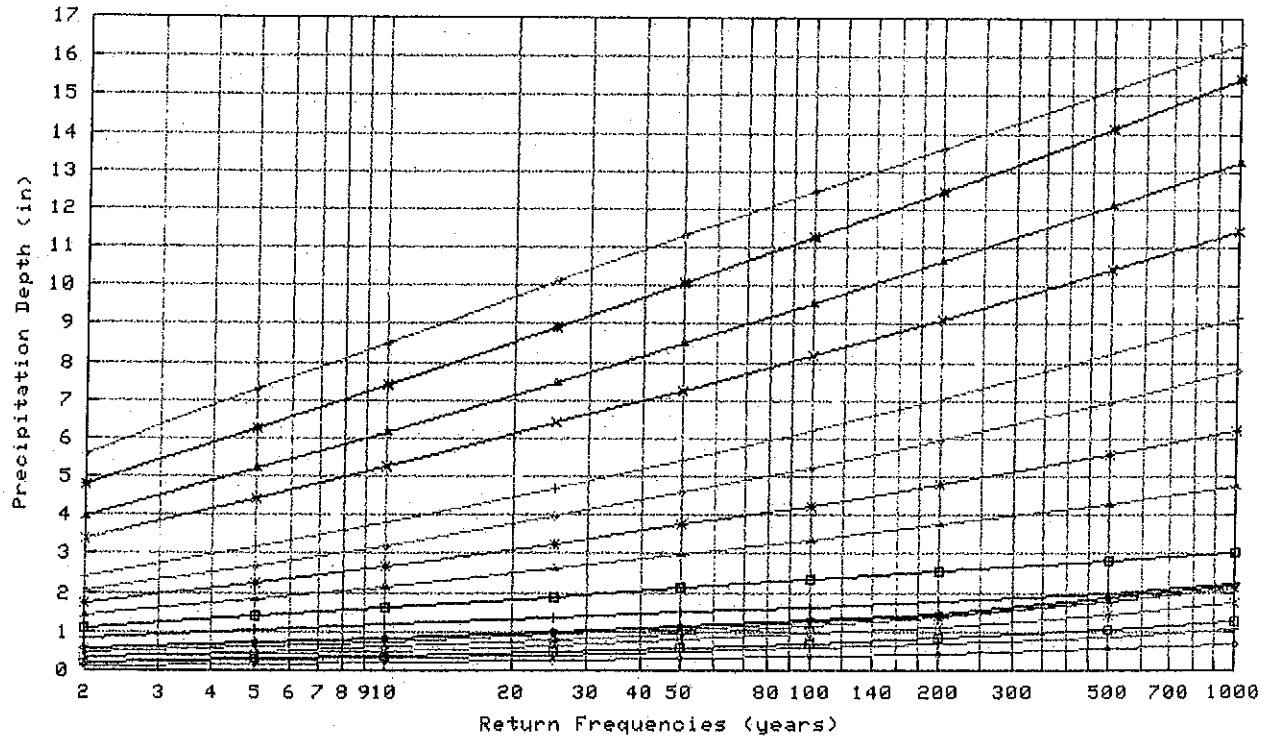
Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.12	0.17	0.22	0.29	0.36	0.49	0.59	0.83	1.10	1.41	1.73	2.05	2.40	2.71	3.38	3.96	4.79	5.56
5	0.16	0.24	0.29	0.40	0.49	0.64	0.74	1.04	1.40	1.81	2.24	2.68	3.17	3.58	4.45	5.20	6.27	7.28
10	0.19	0.29	0.36	0.49	0.60	0.75	0.86	1.18	1.62	2.13	2.66	3.21	3.80	4.27	5.27	6.15	7.39	8.52
25	0.25	0.38	0.47	0.64	0.79	0.92	1.01	1.37	1.90	2.59	3.25	3.96	4.69	5.24	6.39	7.46	8.91	10.12
50	0.30	0.46	0.57	0.77	0.96	1.07	1.14	1.50	2.12	2.95	3.74	4.57	5.42	6.02	7.26	8.48	10.08	11.31
100	0.37	0.56	0.69	0.93	1.15	1.23	1.29	1.64	2.34	3.33	4.25	5.23	6.20	6.84	8.18	9.53	11.27	12.48
200	0.44	0.67	0.83	1.12	1.38	1.42	1.48	1.78	2.56	3.74	4.79	5.93	7.03	7.70	9.11	10.61	12.48	13.63
500	0.56	0.85	1.05	1.42	1.76	1.80	1.86	1.96	2.83	4.30	5.56	6.93	8.22	8.91	10.41	12.10	14.15	15.17
1000	0.67	1.02	1.26	1.70	2.11	2.15	2.20	2.26	3.05	4.74	6.19	7.76	9.20	9.88	11.41	13.25	15.45	16.30

Text version of table

These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.583 N 119.792 W 5045 ft



Subbasin E2 - Evans Creek Watershed

Partial duration based Point Precipitation Frequency Estimates Version: 3
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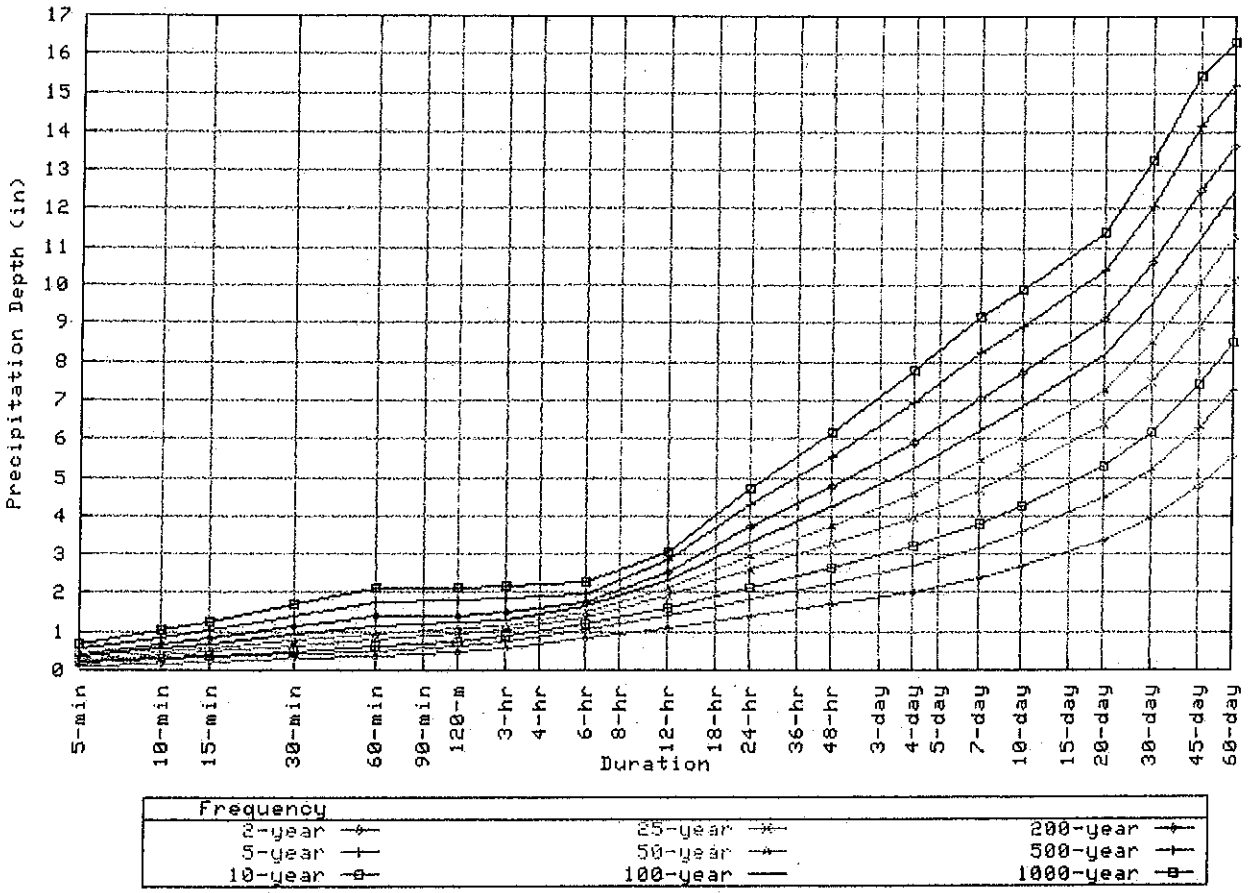

Subbasin E3 - Evans Creek Watershed

Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.12	0.18	0.23	0.30	0.38	0.51	0.61	0.88	1.17	1.52	1.88	2.24	2.64	2.99	3.79	4.50	5.47	6.38
5	0.16	0.25	0.31	0.41	0.51	0.66	0.77	1.08	1.48	1.95	2.44	2.94	3.50	3.97	5.00	5.94	7.19	8.39
10	0.20	0.30	0.38	0.51	0.62	0.77	0.89	1.23	1.72	2.30	2.90	3.53	4.21	4.76	5.95	7.05	8.51	9.85
25	0.26	0.39	0.49	0.66	0.81	0.95	1.04	1.43	2.02	2.79	3.56	4.38	5.22	5.86	7.24	8.58	10.30	11.74
50	0.31	0.47	0.59	0.79	0.98	1.09	1.17	1.56	2.25	3.18	4.09	5.07	6.05	6.75	8.24	9.78	11.69	13.16
100	0.38	0.57	0.71	0.95	1.18	1.26	1.33	1.70	2.48	3.59	4.66	5.81	6.95	7.69	9.31	11.03	13.13	14.57
200	0.45	0.69	0.85	1.15	1.42	1.45	1.52	1.84	2.71	4.03	5.26	6.61	7.89	8.68	10.40	12.32	14.60	15.97
500	0.57	0.87	1.08	1.46	1.80	1.84	1.91	2.02	3.00	4.64	6.12	7.76	9.26	10.07	11.92	14.10	16.62	17.84
1000	0.69	1.05	1.30	1.75	2.16	2.20	2.27	2.33	3.22	5.12	6.82	8.71	10.38	11.20	13.11	15.49	18.21	19.25

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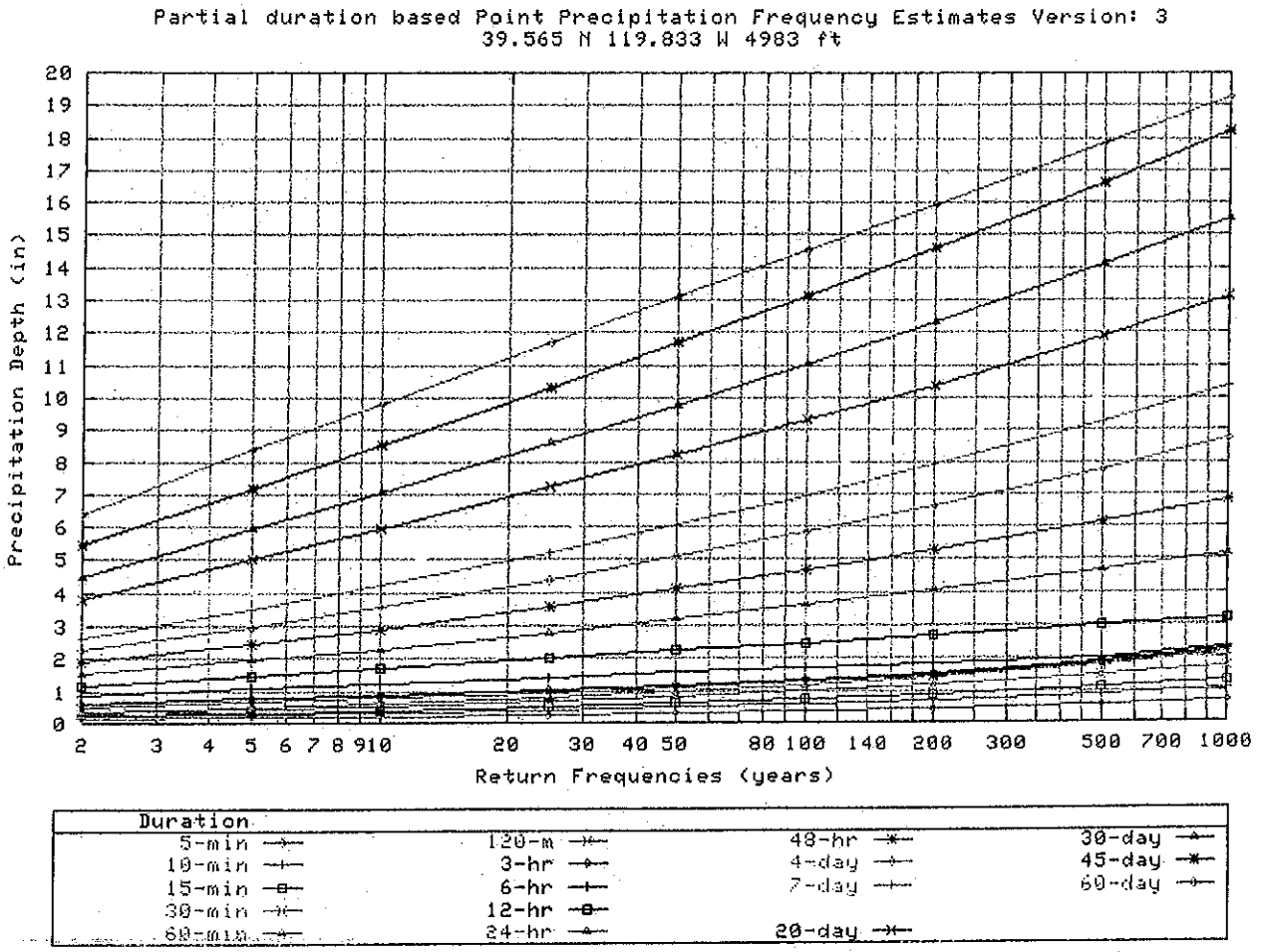
These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.



Subbasin E 3 - Evans Creek Watershed

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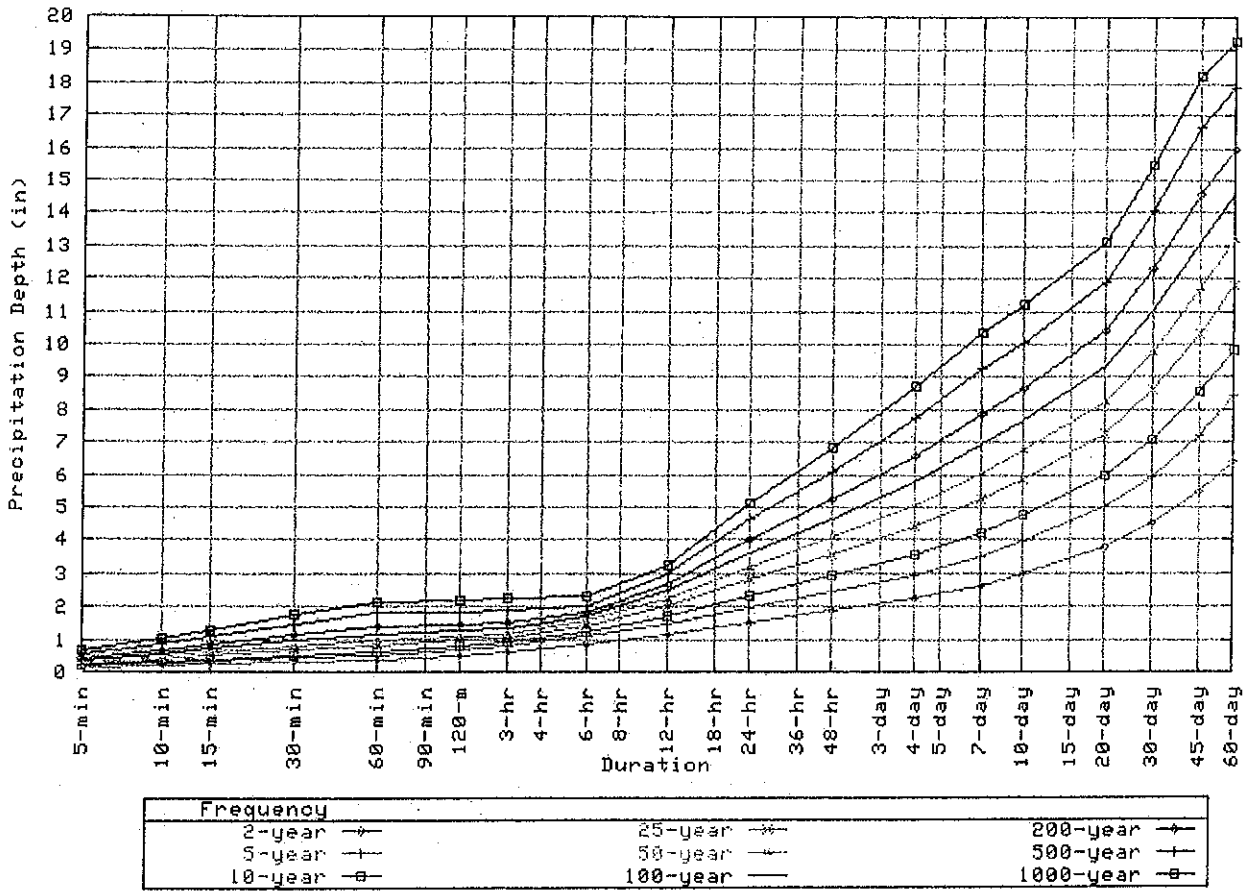


Subbasin E4 - Evans Creek Watershed

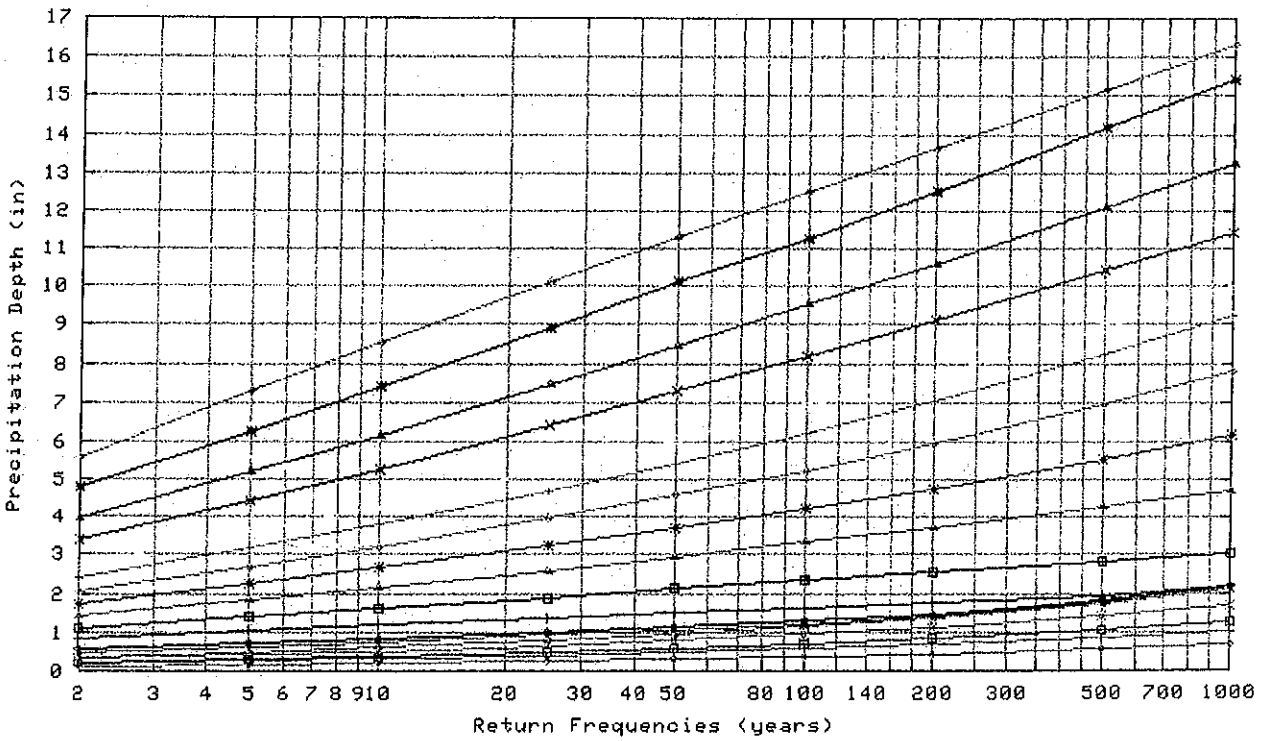
Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.12	0.17	0.22	0.29	0.36	0.49	0.59	0.84	1.10	1.40	1.73	2.05	2.41	2.72	3.39	3.96	4.79	5.57
5	0.16	0.24	0.29	0.40	0.49	0.63	0.74	1.03	1.39	1.80	2.23	2.68	3.18	3.59	4.46	5.19	6.27	7.29
10	0.19	0.29	0.36	0.48	0.60	0.74	0.85	1.18	1.61	2.12	2.65	3.21	3.81	4.28	5.28	6.15	7.40	8.53
25	0.25	0.38	0.47	0.63	0.78	0.92	1.00	1.36	1.90	2.57	3.24	3.96	4.70	5.26	6.41	7.46	8.92	10.13
50	0.30	0.46	0.57	0.76	0.95	1.06	1.12	1.49	2.11	2.94	3.72	4.57	5.43	6.04	7.28	8.47	10.09	11.33
100	0.36	0.55	0.68	0.92	1.14	1.22	1.28	1.62	2.33	3.31	4.22	5.22	6.21	6.86	8.20	9.53	11.29	12.51
200	0.43	0.66	0.82	1.10	1.36	1.40	1.46	1.76	2.54	3.71	4.76	5.93	7.04	7.72	9.13	10.61	12.51	13.66
500	0.55	0.84	1.04	1.40	1.73	1.77	1.83	1.92	2.81	4.27	5.53	6.93	8.23	8.93	10.43	12.09	14.17	15.20
1000	0.66	1.00	1.25	1.68	2.08	2.12	2.17	2.22	3.02	4.71	6.15	7.76	9.20	9.90	11.44	13.25	15.46	16.34

Text version of table

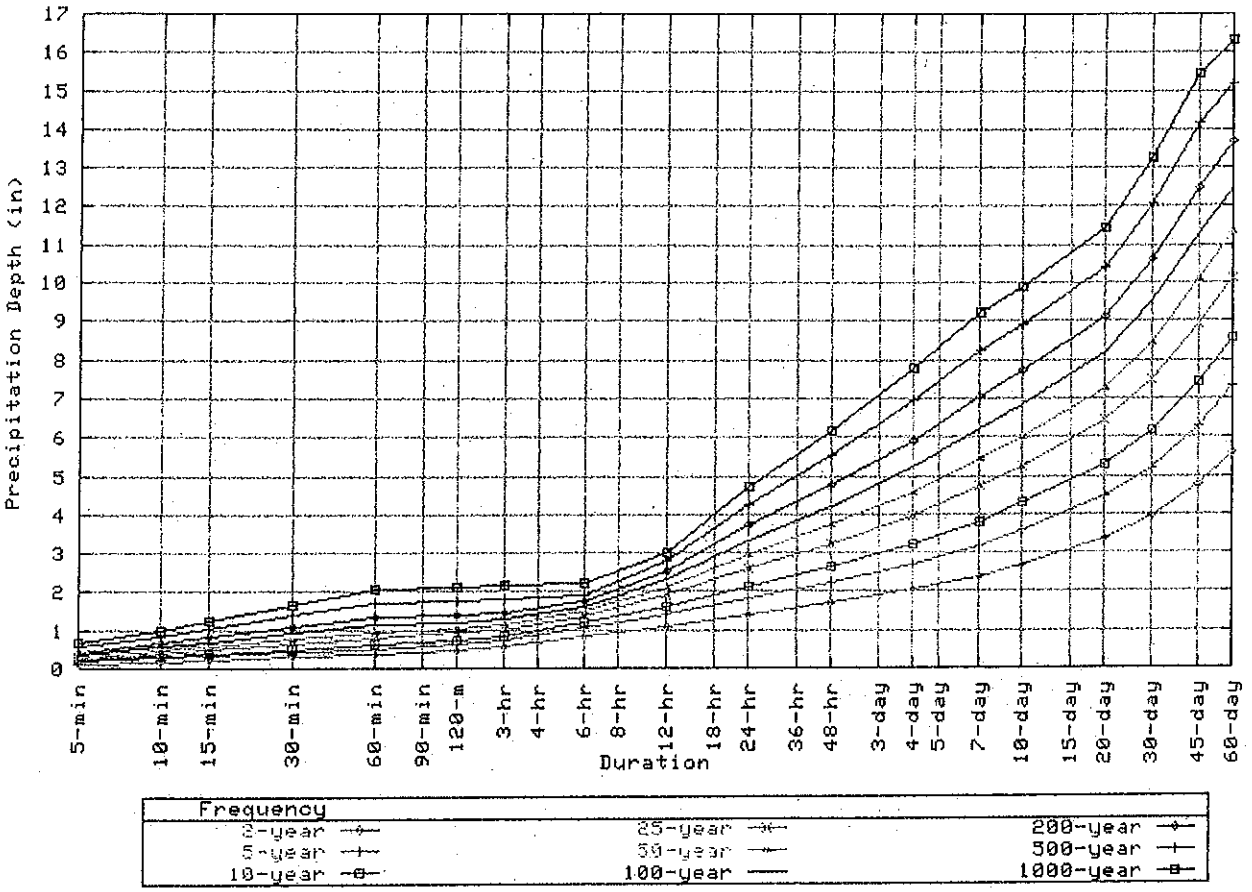
These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.55 N 119.833 W 4753 ft



Subbasin E4 - Evans Creek Watershed

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.55 N 119.833 W 4753 ft



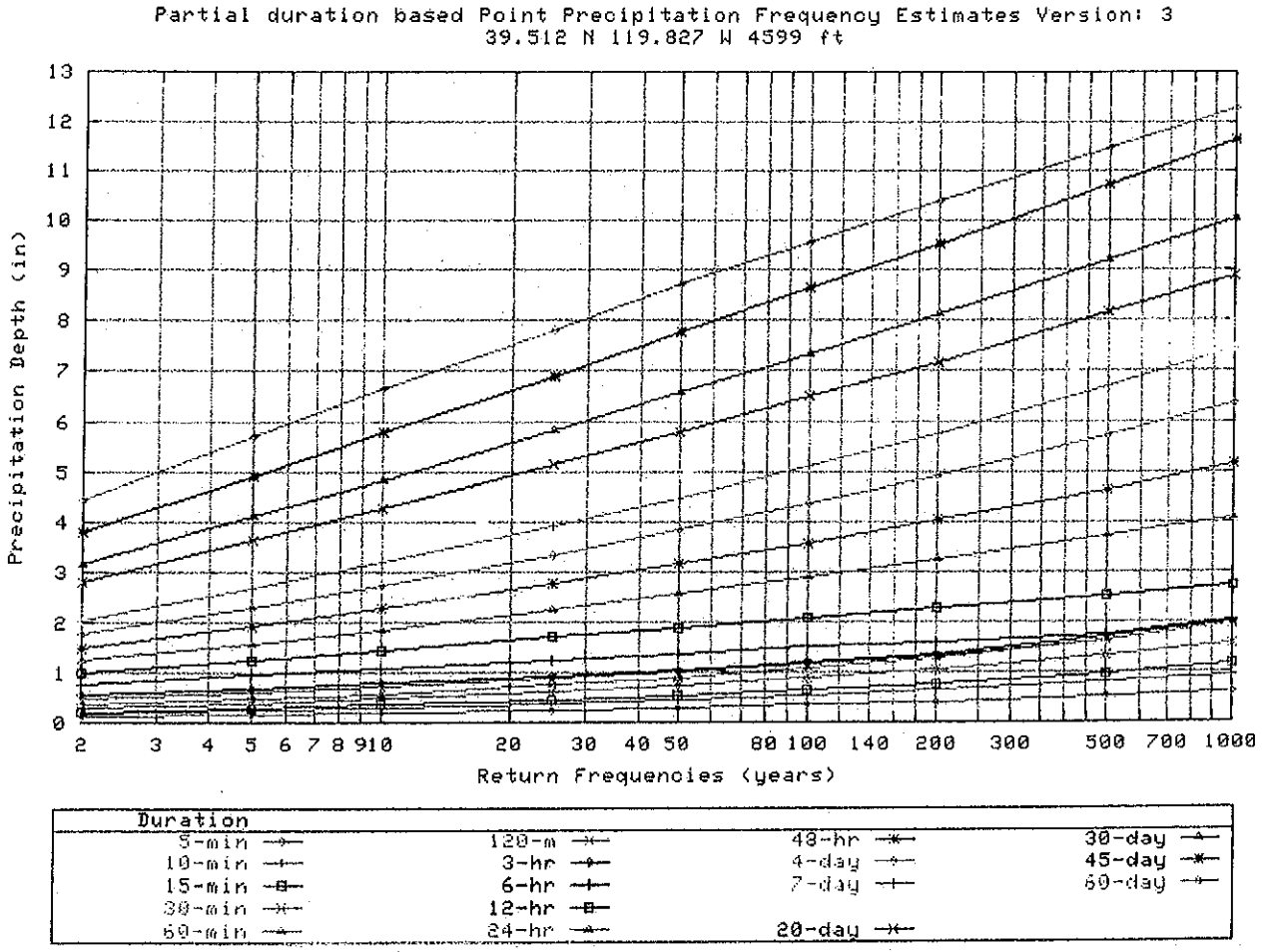
Subbasin E5 - Evans Creek Watershed

Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.11	0.17	0.21	0.28	0.34	0.47	0.56	0.77	0.99	1.22	1.48	1.75	2.04	2.29	2.78	3.17	3.80	4.41
5	0.15	0.23	0.28	0.38	0.47	0.60	0.69	0.95	1.25	1.57	1.91	2.27	2.67	2.99	3.61	4.11	4.92	5.71
10	0.18	0.28	0.34	0.46	0.57	0.70	0.80	1.08	1.45	1.85	2.26	2.70	3.18	3.55	4.26	4.83	5.77	6.64
25	0.23	0.36	0.44	0.60	0.74	0.86	0.94	1.25	1.70	2.24	2.75	3.32	3.90	4.33	5.13	5.81	6.91	7.83
50	0.28	0.43	0.54	0.72	0.89	0.99	1.05	1.38	1.89	2.55	3.15	3.81	4.49	4.94	5.79	6.57	7.78	8.72
100	0.34	0.52	0.64	0.86	1.07	1.14	1.19	1.50	2.09	2.87	3.57	4.34	5.11	5.60	6.49	7.35	8.66	9.58
200	0.41	0.62	0.77	1.03	1.28	1.30	1.35	1.61	2.27	3.22	4.01	4.89	5.76	6.27	7.19	8.14	9.54	10.41
500	0.52	0.79	0.97	1.31	1.62	1.64	1.70	1.75	2.52	3.69	4.64	5.68	6.70	7.21	8.16	9.21	10.73	11.50
1000	0.61	0.94	1.16	1.56	1.94	1.96	2.00	2.03	2.70	4.06	5.14	6.33	7.45	7.95	8.90	10.04	11.64	12.29

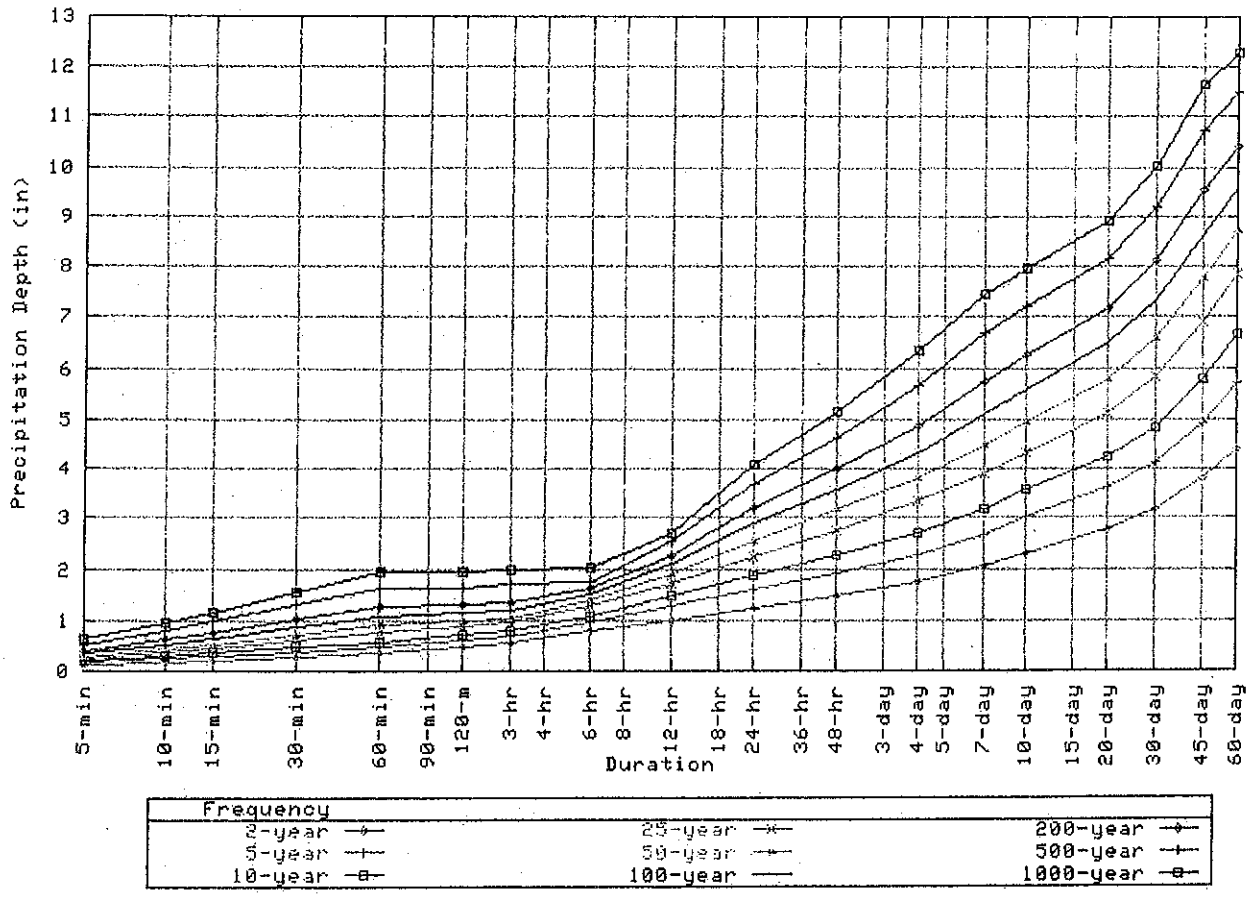
Text version of table

These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.



Subbasin E5 - Evans Creek Watershed

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.512 N 119.827 W 4599 ft



Subbasin Ele - Evans Creek watershed

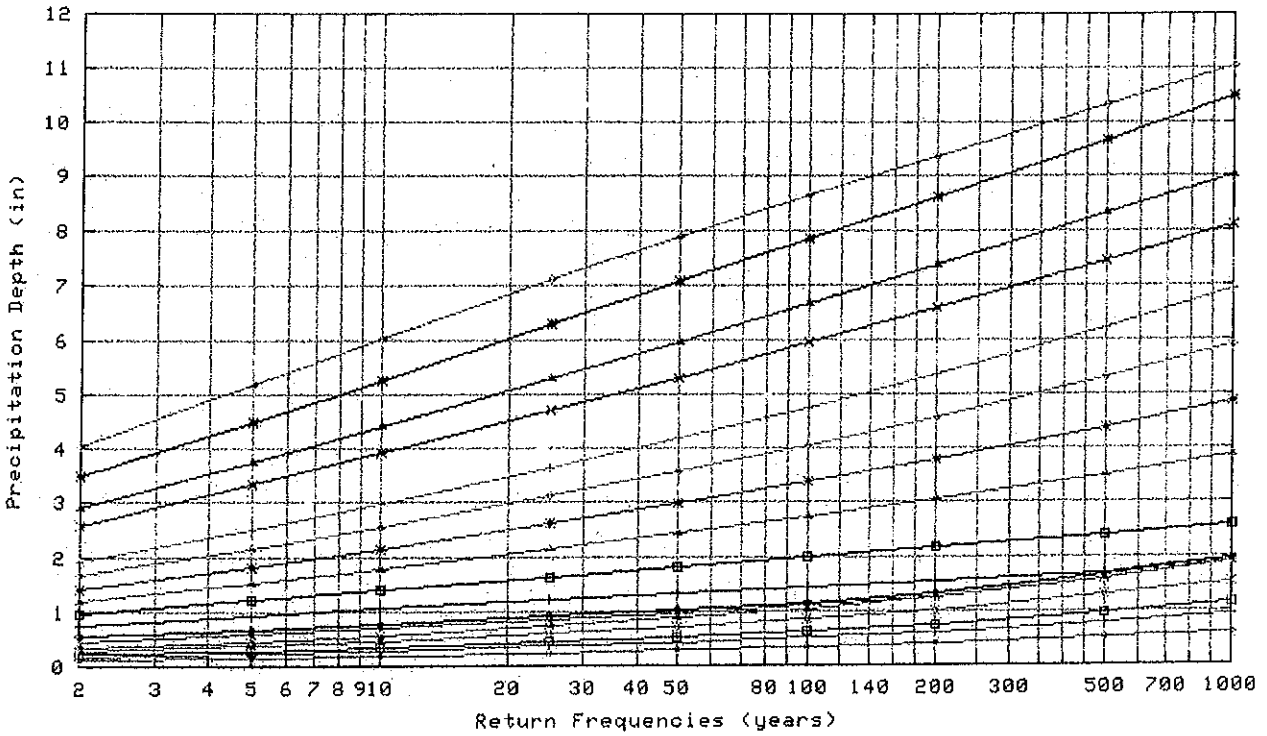
Precipitation Frequency Estimates (inches)

return period	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.11	0.16	0.20	0.27	0.34	0.46	0.54	0.75	0.95	1.16	1.40	1.65	1.93	2.15	2.58	2.91	3.48	4.04
5	0.14	0.22	0.27	0.37	0.46	0.59	0.68	0.92	1.20	1.50	1.81	2.14	2.50	2.80	3.34	3.76	4.49	5.20
10	0.18	0.27	0.33	0.45	0.56	0.69	0.78	1.05	1.39	1.76	2.14	2.55	2.98	3.31	3.93	4.41	5.26	6.04
25	0.23	0.35	0.43	0.58	0.72	0.84	0.91	1.22	1.63	2.13	2.61	3.12	3.65	4.03	4.72	5.29	6.28	7.11
50	0.28	0.42	0.52	0.70	0.87	0.97	1.02	1.33	1.81	2.43	2.99	3.58	4.19	4.60	5.32	5.97	7.06	7.89
100	0.33	0.51	0.63	0.84	1.04	1.11	1.16	1.45	2.00	2.73	3.37	4.07	4.76	5.20	5.95	6.66	7.84	8.66
200	0.40	0.60	0.75	1.01	1.25	1.26	1.31	1.56	2.17	3.06	3.79	4.58	5.36	5.82	6.58	7.37	8.63	9.39
500	0.50	0.76	0.95	1.28	1.58	1.59	1.65	1.69	2.40	3.51	4.38	5.31	6.22	6.67	7.44	8.31	9.69	10.36
1000	0.60	0.91	1.13	1.52	1.88	1.90	1.94	1.96	2.58	3.86	4.85	5.90	6.91	7.35	8.10	9.03	10.49	11.05

Text version of table

These precipitation frequency estimates are based on a partial duration maxima series. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

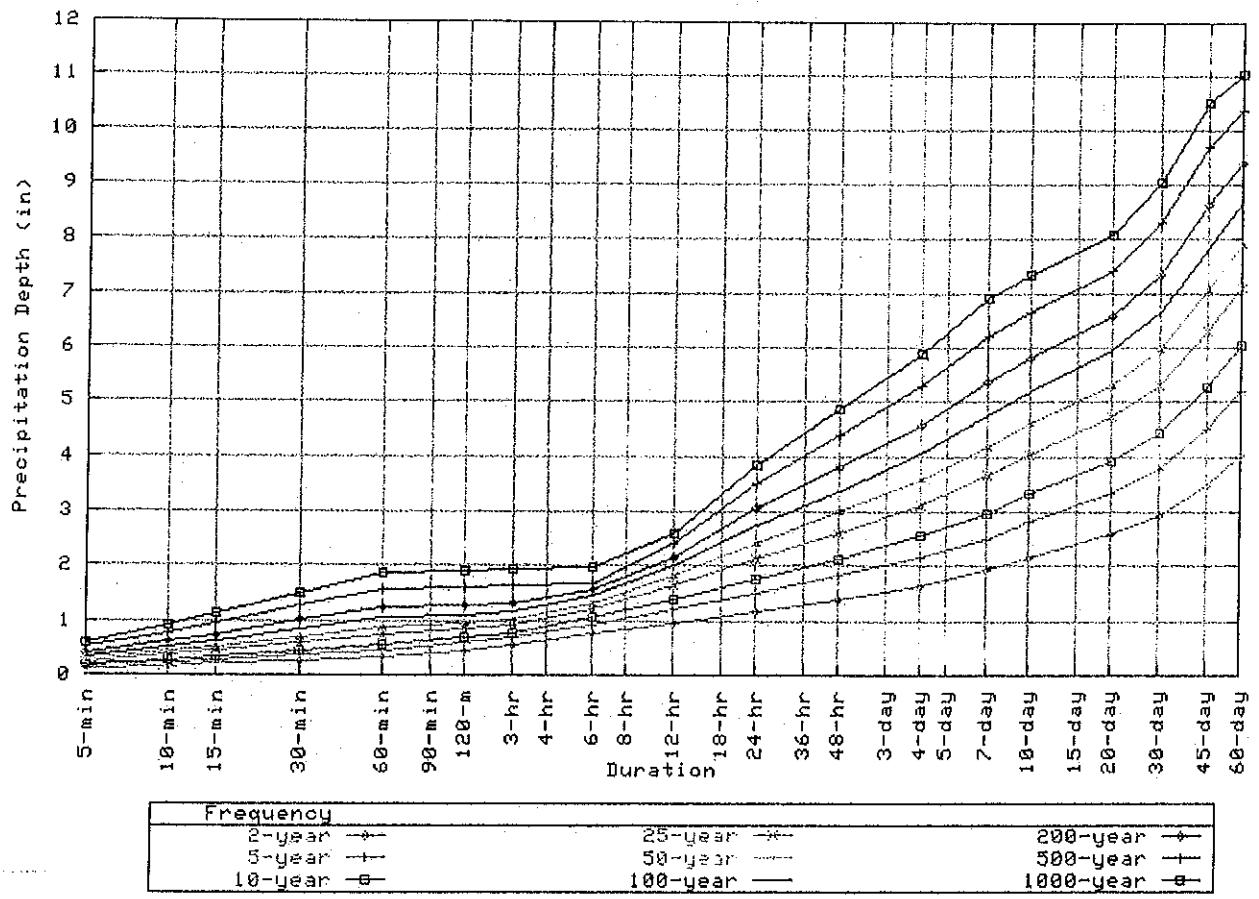
Partial duration based Point Precipitation Frequency Estimates Version: 3
39.512 N 119.808 W 4599 ft



Duration			
5-min	120-m	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr		
60-min	24-hr	20-day	

Subbasin E-Le Evans Creek Watershed

Partial duration based Point Precipitation Frequency Estimates Version: 3
39.512 N 119.808 W 4599 ft



LAG TIME/TIME OF CONCENTRATION

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E1

Area (mi^2)	0.772	<	1 mi^2	Use Equation 710 (Washoe County Manual)
Average Slope (%)	15	>	10%	

Weighted Kn

Land Use	Area (%)	Kn	Weighted Kn
Commercial	4	0.05	0.002
Residential	14	0.05	0.008
Undeveloped	82	0.09	0.075
		Kn=	**0.085**

S_E (ft/mi)	265
L_C (mi)	0.65

TLAG (hr)	**0.77**

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E2

Area (mi^2)	1.2	<	1 mi^2	Use Equation 710 (Washoe County Manual)
Average Slope (%)	10	=	10%	

Weighted Kn

Land Use	Area (%)	Kn	Weighted Kn
Commercial	5	0.05	0.0025
Industrial	3	0.05	0.0015
Residential	3	0.09	0.0027
Residential	22	0.05	0.011
Undeveloped	67	0.09	0.0603
		Kn=	**0.078**

S_E (ft/mi)	43
L_C (mi)	0.93

TLAG (hr)	**1.1**

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E3

Area (mi^2)	1.51	>	1 mi^2	Use Equation 710 (Washoe County Manual)
Average Slope (%)			10%	

Weighted Kn

Land Use	Area (%)	Kn	Weighted Kn
Residential	2	0.05	0.001
Residential	7	0.07	0.0049
Undeveloped	91	0.09	0.0819
		Kn=	**0.088**

S_E (ft/mi)	167
L_C (mi)	1.5

TLAG (hr)	**1.3**

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E4

Area (mi^2)	0.576	<	1 mi^2	Use Equation 710 (Washoe County Manual)
Average Slope (%)		>	10%	

Weighted Kn

Land Use	Area (%)	Kn	Weighted Kn
Residential	12	0.05	0.006
Agriculture	9	0.1	0.009
Undeveloped	79	0.09	0.0711
		Kn=	**0.086**

S_E (ft/mi)	273
L_C (mi)	0.46

TLAG (hr)	**0.57**

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E5

Area (mi^2)	0.31	<	1 mi^2	Use Equation 709 (Washoe County Manual)
Average Slope (%)	6	<	10%	

t_l	**10.4** min
Length of Overland Flow (Lo) (feet)	500 feet
Average Overland Slope(%)	5.8 %
Flow Runoff Coefficient	0.64

	t_c	**39** min
Reach 1	Velocity (ft/sec)	2.5 ft/sec
	Length (feet)	1500 ft
Reach 2	Velocity (ft/sec)	1.8 ft/sec
	Length (feet)	1500 ft
Reach 3	Velocity (ft/sec)	2.2 ft/sec
	Length (feet)	2000 ft

$t_c = t_l + t_t$	49.4 min

TLAG= 0.6*t_c	**0.5 hours**

Lag Time Calculations

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E6

Area (mi^2)	0.17	<	1 mi^2	Use Equation 709 (Washoe County Manual)
Average Slope (%)	4	<	10%	

t_l	**7.5** min
Length of Overland Flow (Lo) (feet)	500 feet
Average Overland Slope(%)	3.8 %
Flow Runoff Coefficient	0.81

t_c	**21** min
Velocity (ft/sec)	3.5 ft/sec
Length (feet)	4500 ft

$t_c = t_l + t_t$	28.5 min

TLAG= 0.6*t_c	**0.285 hours**

SCS CURVE NUMBERS

Curve Number Worksheet

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E1

Area (mi^2) 0.772

Hydrologic Soil Type	Cover Description	Curve Number	Area (%)	Weighted Curve Number
A	N/A	N/A	N/A	N/A
B	Sagebrush/grass with 40% vegetative cover density	56	7	3.92
C	Sagebrush/grass with 40% vegetative cover density	68	14	9.52
D	Sagebrush/grass with 40% vegetative cover density	76	79	60.04
		Total	**100**	**73.48**

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/3 acre	D	86	10.1	8.7
Residential 1/3 acre	D	86	6.61	5.7
Commercial	D	93	3.76	3.5
Undeveloped	D	73	79.53	58.1
		Total	**100**	**76**

Curve Number Worksheet

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E2

Area (mi^2) 1.2

Hydrologic Soil Type	Cover Description	Curve Number	Area (%)	Weighted Curve Number
A	N/A	N/A	N/A	N/A
B	Sagebrush/grass with 40% vegetative cover density	56	17	9.52
C	Sagebrush/grass with 40% vegetative cover density	68	6	4.08
D	Sagebrush/grass with 40% vegetative cover density	76	77	58.52
		Total	**100**	**72.12**

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/3 acre	D	86	21.33	18.3
Residential 1 acre	D	84	3.25	2.7
Industrial	D	92	3.08	2.8
Commercial	D	93	2.25	2.1
Commercial	D	93	2.42	2.2
Undeveloped	D	72	67.67	48.7
		Total	**100**	**77**

Curve Number Worksheet

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E3

Area (mi^2) 1.51

Hydrologic Soil Type	Cover Description	Curve Number	Area (%)	Weighted Curve Number
A	N/A	N/A	N/A	N/A
B	Sagebrush/grass with 25% vegetative cover density	63.5	7	4.45
C	Sagebrush/grass with 25% vegetative cover density	76	10	7.6
D	Sagebrush/grass with 25% vegetative cover density	82	83	68.06
		Total	**100**	**80.11**

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/8 acre	D	92	5.17	4.3
Residential 1 acre	D	84	3.38	3.1
Undeveloped	D	80	91.46	73.2
		Total	**100**	**81**

Curve Number Worksheet

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E4

Area (mi^2) 0.576

Hydrologic Soil Type	Cover Description	Curve Number	Area (%)	Weighted Curve Number
A	N/A	N/A	N/A	N/A
B	Sagebrush/grass with 40% vegetative cover density	56	1	0.56
C	Sagebrush/grass with 40% vegetative cover density	68	3	2.04
D	Sagebrush/grass with 40% vegetative cover density	76	96	72.96
		Total	**100**	**75.56**

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/3 acre	D	86	11.98	10.3
Irr. Pasture (good)	D	80	8.68	6.9
Undeveloped	D	76	79.34	60.3
		Total	**100**	**78**

Curve Number Worksheet

Project: University of Nevada, Reno Knowledge Center

Location: Sub-basin E5

Area (mi^2): 0.31

Hydrologic Soil Type	Cover Description	Curve Number	Area (%)	Weighted Curve Number
A	N/A	N/A	N/A	N/A
B	Sagebrush/grass with 40% vegetative cover density	N/A	N/A	N/A
C	Sagebrush/grass with 40% vegetative cover density	68	1	0.68
D	Sagebrush/grass with 40% vegetative cover density	76	99	75.24
		Total	**100**	**75.92**

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/3 acre	D	86	2.58	2.2
Residential 1/3 acre	D	86	10	8.6
Irr. Pasture/Park	D	80	54.84	43.9
Undeveloped	D	76	32.58	24.8
		Total	**100**	**80**

Curve Number Worksheet

Project University of Nevada, Reno Knowledge Center

Location Sub-basin E6

Area (mi^2) 0.17

Developed Land Use	Hydrologic Soil Type	Curve Number	Area (%)	Weighted Curve Number
Residential 1/4 acre	D	93	10	9
Commercial	D	87	31	27
University*	D	93	59	55
		Total	**100**	**91**

* Land use for universtiy area was determined to be 79% impervious, therefore the curve number was interpolated between the curve numbers given in Table 702 for Commercial Land Use for downtown areas and neighborhood areas.

APPENDIX B
HEC-1 MODEL SUMMARIES

Plan 1: 24 Hour Storm Duration
Plan 2: 12-Hour Storm Duration
Plan 3: 6-Hour Storm Duration
Plan 4: 1-Hour Storm Duration

10-Year Storms, 245 cfs Flow Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	76.
				TIME	12.83
			2	FLOW	40.
				TIME	7.00
			3	FLOW	16.
				TIME	6.00
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	83.
				TIME	13.08
			2	FLOW	45.
				TIME	7.33
			3	FLOW	21.
				TIME	6.08
			4	FLOW	0.
				TIME	.00
2 COMBINED AT					
+	CP1	1.97	1	FLOW	154.
				TIME	13.00
			2	FLOW	82.
				TIME	7.17
			3	FLOW	37.
				TIME	6.00
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	RCH1	1.97	1	FLOW	155.
				TIME	13.42
			2	FLOW	90.
				TIME	7.67
			3	FLOW	43.
				TIME	4.92
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	149.
				TIME	13.33
			2	FLOW	96.
				TIME	7.50
			3	FLOW	51.
				TIME	4.83
			4	FLOW	4.
				TIME	2.08
2 COMBINED AT					
+	CP2	3.48	1	FLOW	303.
				TIME	13.42
			2	FLOW	185.
				TIME	7.67
			3	FLOW	94.
				TIME	4.92
			4	FLOW	4.
				TIME	2.08

ROUTED TO					
+	RCH2	3.48	1	FLOW	307.
				TIME	13.58
			2	FLOW	188.
				TIME	7.75
			3	FLOW	91.
				TIME	5.25
			4	FLOW	5.
				TIME	3.00
HYDROGRAPH AT					
+	E4	.58	1	FLOW	63.
				TIME	12.58
			2	FLOW	35.
				TIME	6.75
			3	FLOW	15.
				TIME	3.92
			4	FLOW	0.
				TIME	1.50
2 COMBINED AT					
+	CP3	4.06	1	FLOW	331.
				TIME	13.58
			2	FLOW	204.
				TIME	7.75
			3	FLOW	102.
				TIME	5.25
			4	FLOW	5.
				TIME	3.00
ROUTED TO					
+	RCH3	4.06	1	FLOW	329.
				TIME	13.75
			2	FLOW	208.
				TIME	7.92
			3	FLOW	101.
				TIME	5.50
			4	FLOW	6.
				TIME	3.17
HYDROGRAPH AT					
+	E5	.31	1	FLOW	34.
				TIME	12.50
			2	FLOW	20.
				TIME	6.67
			3	FLOW	9.
				TIME	3.83
			4	FLOW	0.
				TIME	1.42
2 COMBINED AT					
+	CP4	4.37	1	FLOW	339.
				TIME	13.75
			2	FLOW	216.
				TIME	7.92
			3	FLOW	107.
				TIME	5.50
			4	FLOW	6.
				TIME	3.17
DIVERSION TO					
+	LOST	4.37	1	FLOW	245.
				TIME	13.33
			2	FLOW	216.
				TIME	7.92
			3	FLOW	107.
				TIME	5.50
			4	FLOW	6.
				TIME	3.17

HYDROGRAPH AT					
+	DIV.	4.37	1	FLOW	94.
				TIME	13.75
			2	FLOW	0.
				TIME	.00
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	SIERRA	4.37	1	FLOW	90.
				TIME	13.75
			2	FLOW	0.
				TIME	.00
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
			**	PEAK STAGES IN FEET	**
			1	STAGE	590.28
				TIME	13.75
			2	STAGE	587.00
				TIME	.00
			3	STAGE	587.00
				TIME	.00
			4	STAGE	587.00
				TIME	.00
ROUTED TO					
+	RCH4	4.37	1	FLOW	90.
				TIME	13.92
			2	FLOW	0.
				TIME	.00
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E6	.17	1	FLOW	74.
				TIME	12.17
			2	FLOW	63.
				TIME	6.25
			3	FLOW	48.
				TIME	3.25
			4	FLOW	21.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	98.
				TIME	13.92
			2	FLOW	63.
				TIME	6.25
			3	FLOW	48.
				TIME	3.25
			4	FLOW	21.
				TIME	.83

25-Year Storms, 245 cfs Flow Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	128.
				TIME	12.83
			2	FLOW	74.
				TIME	7.00
			3	FLOW	33.
				TIME	4.08
			4	FLOW	5.
				TIME	1.58
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	144.
				TIME	13.00
			2	FLOW	83.
				TIME	7.25
			3	FLOW	40.
				TIME	4.42
			4	FLOW	6.
				TIME	1.83
2 COMBINED AT					
+	CP1	1.97	1	FLOW	267.
				TIME	12.92
			2	FLOW	153.
				TIME	7.08
			3	FLOW	72.
				TIME	4.25
			4	FLOW	10.
				TIME	1.75
ROUTED TO					
+	RCH1	1.97	1	FLOW	267.
				TIME	13.33
			2	FLOW	153.
				TIME	7.67
			3	FLOW	78.
				TIME	4.75
			4	FLOW	16.
				TIME	2.92
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	228.
				TIME	13.25
			2	FLOW	154.
				TIME	7.42
			3	FLOW	86.
				TIME	4.58
			4	FLOW	22.
				TIME	2.00
2 COMBINED AT					
+	CP2	3.48	1	FLOW	495.
				TIME	13.33
			2	FLOW	304.
				TIME	7.42
			3	FLOW	163.
				TIME	4.75
			4	FLOW	26.
				TIME	2.92

ROUTED TO					
+	RCH2	3.48	1	FLOW	495.
				TIME	13.42
			2	FLOW	309.
				TIME	7.75
			3	FLOW	161.
				TIME	4.92
			4	FLOW	22.
				TIME	2.42
HYDROGRAPH AT					
+	E4	.58	1	FLOW	108.
				TIME	12.58
			2	FLOW	66.
				TIME	6.75
			3	FLOW	32.
				TIME	3.83
			4	FLOW	6.
				TIME	1.42
2 COMBINED AT					
+	CP3	4.06	1	FLOW	532.
				TIME	13.42
			2	FLOW	330.
				TIME	7.58
			3	FLOW	175.
				TIME	4.92
			4	FLOW	23.
				TIME	2.42
ROUTED TO					
+	RCH3	4.06	1	FLOW	533.
				TIME	13.50
			2	FLOW	344.
				TIME	7.67
			3	FLOW	176.
				TIME	5.08
			4	FLOW	23.
				TIME	2.58
HYDROGRAPH AT					
+	E5	.31	1	FLOW	58.
				TIME	12.50
			2	FLOW	37.
				TIME	6.67
			3	FLOW	19.
				TIME	3.75
			4	FLOW	5.
				TIME	1.33
2 COMBINED AT					
+	CP4	4.37	1	FLOW	547.
				TIME	13.50
			2	FLOW	354.
				TIME	7.67
			3	FLOW	183.
				TIME	5.08
			4	FLOW	23.
				TIME	2.58
DIVERSION TO					
+	LOST	4.37	1	FLOW	245.
				TIME	12.75
			2	FLOW	245.
				TIME	7.58
			3	FLOW	183.
				TIME	5.08
			4	FLOW	23.
				TIME	2.58

HYDROGRAPH AT					
+	DIVERT	4.37	1	FLOW	302.
				TIME	13.50
			2	FLOW	109.
				TIME	7.67
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	SIERRA	4.37	1	FLOW	230.
				TIME	13.92
			2	FLOW	90.
				TIME	7.75
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
			**	PEAK STAGES IN FEET	**
			1	STAGE	598.07
				TIME	13.92
			2	STAGE	590.25
				TIME	7.75
			3	STAGE	587.00
				TIME	.00
			4	STAGE	587.00
				TIME	.00
ROUTED TO					
+	RCH4	4.37	1	FLOW	230.
				TIME	14.08
			2	FLOW	91.
				TIME	8.00
			3	FLOW	0.
				TIME	.00
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E6	.17	1	FLOW	105.
				TIME	12.17
			2	FLOW	90.
				TIME	6.25
			3	FLOW	72.
				TIME	3.25
			4	FLOW	40.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	239.
				TIME	14.08
			2	FLOW	101.
				TIME	8.00
			3	FLOW	72.
				TIME	3.25
			4	FLOW	40.
				TIME	.83

50-Year Storms, 245 cfs Flow Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	179.
				TIME	12.83
			2	FLOW	108.
				TIME	6.92
			3	FLOW	52.
				TIME	4.00
			4	FLOW	16.
				TIME	1.58
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	202.
				TIME	13.00
			2	FLOW	122.
				TIME	7.17
			3	FLOW	62.
				TIME	4.25
			4	FLOW	20.
				TIME	1.75
2 COMBINED AT					
+	CP1	1.97	1	FLOW	373.
				TIME	12.92
			2	FLOW	224.
				TIME	7.08
			3	FLOW	112.
				TIME	4.17
			4	FLOW	35.
				TIME	1.67
ROUTED TO					
+	RCH1	1.97	1	FLOW	375.
				TIME	13.25
			2	FLOW	230.
				TIME	7.33
			3	FLOW	116.
				TIME	4.58
			4	FLOW	42.
				TIME	2.33
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	299.
				TIME	13.25
			2	FLOW	206.
				TIME	7.42
			3	FLOW	118.
				TIME	4.50
			4	FLOW	48.
				TIME	1.92
2 COMBINED AT					
+	CP2	3.48	1	FLOW	674.
				TIME	13.25
			2	FLOW	436.
				TIME	7.33
			3	FLOW	233.
				TIME	4.58
			4	FLOW	83.
				TIME	2.33

ROUTED TO					
+	RCH2	3.48	1	FLOW	671.
				TIME	13.42
			2	FLOW	443.
				TIME	7.67
			3	FLOW	233.
				TIME	4.92
			4	FLOW	81.
				TIME	2.67
HYDROGRAPH AT					
+	E4	.58	1	FLOW	153.
				TIME	12.58
			2	FLOW	96.
				TIME	6.67
			3	FLOW	50.
				TIME	3.75
			4	FLOW	18.
				TIME	1.33
2 COMBINED AT					
+	CP3	4.06	1	FLOW	720.
				TIME	13.33
			2	FLOW	470.
				TIME	7.42
			3	FLOW	248.
				TIME	4.75
			4	FLOW	82.
				TIME	2.67
ROUTED TO					
+	RCH3	4.06	1	FLOW	723.
				TIME	13.42
			2	FLOW	472.
				TIME	7.50
			3	FLOW	257.
				TIME	4.83
			4	FLOW	83.
				TIME	2.92
HYDROGRAPH AT					
+	E5	.31	1	FLOW	82.
				TIME	12.50
			2	FLOW	54.
				TIME	6.67
			3	FLOW	30.
				TIME	3.67
			4	FLOW	12.
				TIME	1.25
2 COMBINED AT					
+	CP4	4.37	1	FLOW	740.
				TIME	13.42
			2	FLOW	485.
				TIME	7.50
			3	FLOW	264.
				TIME	4.83
			4	FLOW	83.
				TIME	2.92
DIVERSION TO					
+	LOST	4.37	1	FLOW	245.
				TIME	12.42
			2	FLOW	245.
				TIME	7.33
			3	FLOW	245.
				TIME	4.83
			4	FLOW	83.
				TIME	2.92

HYDROGRAPH AT					
+	DIVERT	4.37	1	FLOW	495.
				TIME	13.42
			2	FLOW	240.
				TIME	7.50
			3	FLOW	19.
				TIME	4.83
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	SIERRA	4.37	1	FLOW	437.
				TIME	13.67
			2	FLOW	201.
				TIME	7.83
			3	FLOW	11.
				TIME	4.92
			4	FLOW	0.
				TIME	.00
			**	PEAK STAGES IN FEET	**
			1	STAGE	600.98
				TIME	13.67
			2	STAGE	594.87
				TIME	7.83
			3	STAGE	587.41
				TIME	4.92
			4	STAGE	587.00
				TIME	.00
ROUTED TO					
+	RCH4	4.37	1	FLOW	440.
				TIME	13.75
			2	FLOW	202.
				TIME	7.75
			3	FLOW	8.
				TIME	5.33
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E6	.17	1	FLOW	134.
				TIME	12.17
			2	FLOW	116.
				TIME	6.25
			3	FLOW	93.
				TIME	3.25
			4	FLOW	60.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	449.
				TIME	13.75
			2	FLOW	211.
				TIME	7.92
			3	FLOW	93.
				TIME	3.25
			4	FLOW	60.
				TIME	.83

100-Year Storms, 245 cfs Flow Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	238.
				TIME	12.83
			2	FLOW	150.
				TIME	6.92
			3	FLOW	77.
				TIME	4.00
			4	FLOW	36.
				TIME	1.50
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	272.
				TIME	13.00
			2	FLOW	169.
				TIME	7.17
			3	FLOW	91.
				TIME	4.25
			4	FLOW	44.
				TIME	1.75
2 COMBINED AT					
+	CP1	1.97	1	FLOW	500.
				TIME	12.92
			2	FLOW	311.
				TIME	7.00
			3	FLOW	165.
				TIME	4.08
			4	FLOW	79.
				TIME	1.58
ROUTED TO					
+	RCH1	1.97	1	FLOW	500.
				TIME	13.25
			2	FLOW	317.
				TIME	7.42
			3	FLOW	166.
				TIME	4.58
			4	FLOW	93.
				TIME	2.00
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	384.
				TIME	13.25
			2	FLOW	269.
				TIME	7.33
			3	FLOW	160.
				TIME	4.42
			4	FLOW	88.
				TIME	1.92
2 COMBINED AT					
+	CP2	3.48	1	FLOW	883.
				TIME	13.25
			2	FLOW	586.
				TIME	7.42
			3	FLOW	324.
				TIME	4.42
			4	FLOW	180.
				TIME	2.00

ROUTED TO					
+	RCH2	3.48	1	FLOW	881.
				TIME	13.42
			2	FLOW	596.
				TIME	7.50
			3	FLOW	321.
				TIME	4.58
			4	FLOW	175.
				TIME	2.33
HYDROGRAPH AT					
+	E4	.58	1	FLOW	218.
				TIME	12.58
			2	FLOW	144.
				TIME	6.67
			3	FLOW	79.
				TIME	3.75
			4	FLOW	41.
				TIME	1.33
2 COMBINED AT					
+	CP3	4.06	1	FLOW	949.
				TIME	13.25
			2	FLOW	636.
				TIME	7.50
			3	FLOW	344.
				TIME	4.58
			4	FLOW	180.
				TIME	2.33
ROUTED TO					
+	RCH3	4.06	1	FLOW	953.
				TIME	13.33
			2	FLOW	633.
				TIME	7.67
			3	FLOW	356.
				TIME	4.67
			4	FLOW	182.
				TIME	2.50
HYDROGRAPH AT					
+	E5	.31	1	FLOW	110.
				TIME	12.50
			2	FLOW	75.
				TIME	6.58
			3	FLOW	44.
				TIME	3.67
			4	FLOW	25.
				TIME	1.25
2 COMBINED AT					
+	CP4	4.37	1	FLOW	976.
				TIME	13.33
			2	FLOW	650.
				TIME	7.42
			3	FLOW	364.
				TIME	4.67
			4	FLOW	183.
				TIME	2.50
DIVERSION TO					
+	LOST	4.37	1	FLOW	245.
				TIME	12.33
			2	FLOW	245.
				TIME	6.75
			3	FLOW	245.
				TIME	4.58
			4	FLOW	183.
				TIME	2.50

HYDROGRAPH AT					
+	DIVERT	4.37	1	FLOW	731.
				TIME	13.33
			2	FLOW	405.
				TIME	7.42
			3	FLOW	119.
				TIME	4.67
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	SIERRA	4.37	1	FLOW	679.
				TIME	13.58
			2	FLOW	288.
				TIME	8.00
			3	FLOW	100.
				TIME	4.75
			4	FLOW	0.
				TIME	.00
			**	PEAK STAGES IN FEET	**
			1	STAGE	602.23
				TIME	13.58
			2	STAGE	600.22
				TIME	8.00
			3	STAGE	590.62
				TIME	4.75
			4	STAGE	587.00
				TIME	.00
ROUTED TO					
+	RCH4	4.37	1	FLOW	679.
				TIME	13.58
			2	FLOW	289.
				TIME	8.08
			3	FLOW	98.
				TIME	5.08
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E6	.17	1	FLOW	169.
				TIME	12.17
			2	FLOW	147.
				TIME	6.25
			3	FLOW	118.
				TIME	3.25
			4	FLOW	86.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	686.
				TIME	13.58
			2	FLOW	299.
				TIME	8.08
			3	FLOW	118.
				TIME	3.25
			4	FLOW	86.
				TIME	.83

10-Year Storms, No Flow Allowed Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	76.
				TIME	12.83
			2	FLOW	40.
				TIME	7.00
			3	FLOW	16.
				TIME	6.00
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	83.
				TIME	13.08
			2	FLOW	45.
				TIME	7.33
			3	FLOW	21.
				TIME	6.08
			4	FLOW	0.
				TIME	.00
2 COMBINED AT					
+	CP1	1.97	1	FLOW	154.
				TIME	13.00
			2	FLOW	82.
				TIME	7.17
			3	FLOW	37.
				TIME	6.00
			4	FLOW	0.
				TIME	.00
ROUTED TO					
+	RCH1	1.97	1	FLOW	155.
				TIME	13.42
			2	FLOW	90.
				TIME	7.67
			3	FLOW	43.
				TIME	4.92
			4	FLOW	0.
				TIME	.00
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	149.
				TIME	13.33
			2	FLOW	96.
				TIME	7.50
			3	FLOW	51.
				TIME	4.83
			4	FLOW	4.
				TIME	2.08
2 COMBINED AT					
+	CP2	3.48	1	FLOW	303.
				TIME	13.42
			2	FLOW	185.
				TIME	7.67
			3	FLOW	94.
				TIME	4.92
			4	FLOW	4.
				TIME	2.08

ROUTED TO					
+	RCH2	3.48	1	FLOW	307.
				TIME	13.58
			2	FLOW	188.
				TIME	7.75
			3	FLOW	91.
				TIME	5.25
			4	FLOW	5.
				TIME	3.00
HYDROGRAPH AT					
+	E4	.58	1	FLOW	63.
				TIME	12.58
			2	FLOW	35.
				TIME	6.75
			3	FLOW	15.
				TIME	3.92
			4	FLOW	0.
				TIME	1.50
2 COMBINED AT					
+	CP3	4.06	1	FLOW	331.
				TIME	13.58
			2	FLOW	204.
				TIME	7.75
			3	FLOW	102.
				TIME	5.25
			4	FLOW	5.
				TIME	3.00
ROUTED TO					
+	RCH3	4.06	1	FLOW	329.
				TIME	13.75
			2	FLOW	208.
				TIME	7.92
			3	FLOW	101.
				TIME	5.50
			4	FLOW	6.
				TIME	3.17
HYDROGRAPH AT					
+	E5	.31	1	FLOW	34.
				TIME	12.50
			2	FLOW	20.
				TIME	6.67
			3	FLOW	9.
				TIME	3.83
			4	FLOW	0.
				TIME	1.42
2 COMBINED AT					
+	CP4	4.37	1	FLOW	339.
				TIME	13.75
			2	FLOW	216.
				TIME	7.92
			3	FLOW	107.
				TIME	5.50
			4	FLOW	6.
				TIME	3.17
ROUTED TO					
+	RCH4	4.37	1	FLOW	343.
				TIME	13.58
			2	FLOW	214.
				TIME	8.08
			3	FLOW	108.
				TIME	5.58
			4	FLOW	6.
				TIME	3.92

HYDROGRAPH AT					
+	E6	.17	1	FLOW	74.
				TIME	12.17
			2	FLOW	63.
				TIME	6.25
			3	FLOW	48.
				TIME	3.25
			4	FLOW	21.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	351.
				TIME	13.58
			2	FLOW	221.
				TIME	8.08
			3	FLOW	115.
				TIME	5.58
			4	FLOW	21.
				TIME	.83

25-Year Storms, No Flow Allowed Thought Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	128.
				TIME	12.83
			2	FLOW	74.
				TIME	7.00
			3	FLOW	33.
				TIME	4.08
			4	FLOW	5.
				TIME	1.58
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	144.
				TIME	13.00
			2	FLOW	83.
				TIME	7.25
			3	FLOW	40.
				TIME	4.42
			4	FLOW	6.
				TIME	1.83
2 COMBINED AT					
+	CP1	1.97	1	FLOW	267.
				TIME	12.92
			2	FLOW	153.
				TIME	7.08
			3	FLOW	72.
				TIME	4.25
			4	FLOW	10.
				TIME	1.75
ROUTED TO					
+	RCH1	1.97	1	FLOW	267.
				TIME	13.33
			2	FLOW	153.
				TIME	7.67
			3	FLOW	78.
				TIME	4.75
			4	FLOW	16.
				TIME	2.92
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	228.
				TIME	13.25
			2	FLOW	154.
				TIME	7.42
			3	FLOW	86.
				TIME	4.58
			4	FLOW	22.
				TIME	2.00
2 COMBINED AT					
+	CP2	3.48	1	FLOW	495.
				TIME	13.33
			2	FLOW	304.
				TIME	7.42
			3	FLOW	163.
				TIME	4.75
			4	FLOW	26.
				TIME	2.92

ROUTED TO					
+	RCH2	3.48	1	FLOW	495.
				TIME	13.42
			2	FLOW	309.
				TIME	7.75
			3	FLOW	161.
				TIME	4.92
			4	FLOW	22.
				TIME	2.42
HYDROGRAPH AT					
+	E4	.58	1	FLOW	108.
				TIME	12.58
			2	FLOW	66.
				TIME	6.75
			3	FLOW	32.
				TIME	3.83
			4	FLOW	6.
				TIME	1.42
2 COMBINED AT					
+	CP3	4.06	1	FLOW	532.
				TIME	13.42
			2	FLOW	330.
				TIME	7.58
			3	FLOW	175.
				TIME	4.92
			4	FLOW	23.
				TIME	2.42
ROUTED TO					
+	RCH3	4.06	1	FLOW	533.
				TIME	13.50
			2	FLOW	344.
				TIME	7.67
			3	FLOW	176.
				TIME	5.08
			4	FLOW	23.
				TIME	2.58
HYDROGRAPH AT					
+	E5	.31	1	FLOW	58.
				TIME	12.50
			2	FLOW	37.
				TIME	6.67
			3	FLOW	19.
				TIME	3.75
			4	FLOW	5.
				TIME	1.33
2 COMBINED AT					
+	CP4	4.37	1	FLOW	547.
				TIME	13.50
			2	FLOW	354.
				TIME	7.67
			3	FLOW	183.
				TIME	5.08
			4	FLOW	23.
				TIME	2.58
ROUTED TO					
+	RCH4	4.37	1	FLOW	544.
				TIME	13.58
			2	FLOW	353.
				TIME	7.75
			3	FLOW	189.
				TIME	5.17
			4	FLOW	24.
				TIME	2.67
HYDROGRAPH AT					

+	E6	.17	1	FLOW	105.
				TIME	12.17
			2	FLOW	90.
				TIME	6.25
			3	FLOW	72.
				TIME	3.25
			4	FLOW	40.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	552.
				TIME	13.67
			2	FLOW	361.
				TIME	7.75
			3	FLOW	198.
				TIME	5.17
			4	FLOW	40.
				TIME	.83

50-Year Storms, No Flow Allowed Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	179.
				TIME	12.83
			2	FLOW	108.
				TIME	6.92
			3	FLOW	52.
				TIME	4.00
			4	FLOW	16.
				TIME	1.58
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	202.
				TIME	13.00
			2	FLOW	122.
				TIME	7.17
			3	FLOW	62.
				TIME	4.25
			4	FLOW	30.
				TIME	2.33
2 COMBINED AT					
+	CP1	1.97	1	FLOW	373.
				TIME	12.92
			2	FLOW	224.
				TIME	7.08
			3	FLOW	112.
				TIME	4.17
			4	FLOW	36.
				TIME	2.17
ROUTED TO					
+	RCH1	1.97	1	FLOW	375.
				TIME	13.25
			2	FLOW	230.
				TIME	7.33
			3	FLOW	116.
				TIME	4.58
			4	FLOW	43.
				TIME	2.75
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	299.
				TIME	13.25
			2	FLOW	206.
				TIME	7.42
			3	FLOW	118.
				TIME	4.50
			4	FLOW	48.
				TIME	1.92
2 COMBINED AT					
+	CP2	3.48	1	FLOW	674.
				TIME	13.25
			2	FLOW	436.
				TIME	7.33
			3	FLOW	233.
				TIME	4.58
			4	FLOW	75.
				TIME	2.50

ROUTED TO					
+	RCH2	3.48	1	FLOW	671.
				TIME	13.42
			2	FLOW	443.
				TIME	7.67
			3	FLOW	233.
				TIME	4.92
			4	FLOW	68.
				TIME	2.92
HYDROGRAPH AT					
+	E4	.58	1	FLOW	153.
				TIME	12.58
			2	FLOW	96.
				TIME	6.67
			3	FLOW	50.
				TIME	3.75
			4	FLOW	18.
				TIME	1.33
2 COMBINED AT					
+	CP3	4.06	1	FLOW	720.
				TIME	13.33
			2	FLOW	470.
				TIME	7.42
			3	FLOW	248.
				TIME	4.75
			4	FLOW	69.
				TIME	2.92
ROUTED TO					
+	RCH3	4.06	1	FLOW	723.
				TIME	13.42
			2	FLOW	472.
				TIME	7.50
			3	FLOW	257.
				TIME	4.83
			4	FLOW	67.
				TIME	3.08
HYDROGRAPH AT					
+	E5	.31	1	FLOW	82.
				TIME	12.50
			2	FLOW	54.
				TIME	6.67
			3	FLOW	30.
				TIME	3.67
			4	FLOW	12.
				TIME	1.25
2 COMBINED AT					
+	CP4	4.37	1	FLOW	740.
				TIME	13.42
			2	FLOW	485.
				TIME	7.50
			3	FLOW	264.
				TIME	4.83
			4	FLOW	67.
				TIME	3.08
ROUTED TO					
+	RCH4	4.37	1	FLOW	741.
				TIME	13.50
			2	FLOW	487.
				TIME	7.67
			3	FLOW	267.
				TIME	5.00
			4	FLOW	68.
				TIME	3.33

HYDROGRAPH AT					
+	E6	.17	1	FLOW	134.
				TIME	12.17
			2	FLOW	116.
				TIME	6.25
			3	FLOW	93.
				TIME	3.25
			4	FLOW	60.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	746.
				TIME	13.50
			2	FLOW	493.
				TIME	7.67
			3	FLOW	276.
				TIME	5.00
			4	FLOW	68.
				TIME	3.33

100-Year Storms, No Flow Allowed Through Sierra Street Culvert/Stormdrain

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .99
HYDROGRAPH AT					
+	E1	.77	1	FLOW	238.
				TIME	12.83
			2	FLOW	150.
				TIME	6.92
			3	FLOW	77.
				TIME	4.00
			4	FLOW	36.
				TIME	1.50
HYDROGRAPH AT					
+	E2	1.20	1	FLOW	272.
				TIME	13.00
			2	FLOW	169.
				TIME	7.17
			3	FLOW	91.
				TIME	4.25
			4	FLOW	44.
				TIME	1.75
2 COMBINED AT					
+	CP1	1.97	1	FLOW	500.
				TIME	12.92
			2	FLOW	311.
				TIME	7.00
			3	FLOW	165.
				TIME	4.08
			4	FLOW	79.
				TIME	1.58
ROUTED TO					
+	RCH1	1.97	1	FLOW	500.
				TIME	13.25
			2	FLOW	317.
				TIME	7.42
			3	FLOW	166.
				TIME	4.58
			4	FLOW	93.
				TIME	2.00
HYDROGRAPH AT					
+	E3	1.51	1	FLOW	384.
				TIME	13.25
			2	FLOW	269.
				TIME	7.33
			3	FLOW	160.
				TIME	4.42
			4	FLOW	88.
				TIME	1.92
2 COMBINED AT					
+	CP2	3.48	1	FLOW	883.
				TIME	13.25
			2	FLOW	586.
				TIME	7.42
			3	FLOW	324.
				TIME	4.42
			4	FLOW	180.
				TIME	2.00

ROUTED TO					
+	RCH2	3.48	1	FLOW	881.
				TIME	13.42
			2	FLOW	596.
				TIME	7.50
			3	FLOW	321.
				TIME	4.58
			4	FLOW	175.
				TIME	2.33
HYDROGRAPH AT					
+	E4	.58	1	FLOW	218.
				TIME	12.58
			2	FLOW	144.
				TIME	6.67
			3	FLOW	79.
				TIME	3.75
			4	FLOW	41.
				TIME	1.33
2 COMBINED AT					
+	CP3	4.06	1	FLOW	949.
				TIME	13.25
			2	FLOW	636.
				TIME	7.50
			3	FLOW	344.
				TIME	4.58
			4	FLOW	180.
				TIME	2.33
ROUTED TO					
+	RCH3	4.06	1	FLOW	953.
				TIME	13.33
			2	FLOW	633.
				TIME	7.67
			3	FLOW	356.
				TIME	4.67
			4	FLOW	182.
				TIME	2.50
HYDROGRAPH AT					
+	E5	.31	1	FLOW	110.
				TIME	12.50
			2	FLOW	75.
				TIME	6.58
			3	FLOW	44.
				TIME	3.67
			4	FLOW	25.
				TIME	1.25
2 COMBINED AT					
+	CP4	4.37	1	FLOW	976.
				TIME	13.33
			2	FLOW	650.
				TIME	7.42
			3	FLOW	364.
				TIME	4.67
			4	FLOW	183.
				TIME	2.50
ROUTED TO					
+	RCH4	4.37	1	FLOW	975.
				TIME	13.42
			2	FLOW	660.
				TIME	7.50
			3	FLOW	363.
				TIME	4.83
			4	FLOW	180.
				TIME	2.67

HYDROGRAPH AT					
+	E6	.17	1	FLOW	169.
				TIME	12.17
			2	FLOW	147.
				TIME	6.25
			3	FLOW	118.
				TIME	3.25
			4	FLOW	86.
				TIME	.83
2 COMBINED AT					
+	CP5	4.54	1	FLOW	980.
				TIME	13.42
			2	FLOW	665.
				TIME	7.50
			3	FLOW	372.
				TIME	4.83
			4	FLOW	180.
				TIME	2.67

APPENDIX C
HEC-RAS MODEL RESULTS

HEC-RAS Plan: 1WC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	98.00	4595.53	4595.86	4596.09	4596.85	0.045081	7.98	12.29	65.21	3.24
Reach-1	18	25 Year	239.00	4595.53	4596.40	4596.40	4596.72	0.002914	4.57	52.33	82.13	1.01
Reach-1	18	50 Year	449.00	4595.53	4596.15	4596.76	4599.12	0.044970	13.84	32.43	75.09	3.71
Reach-1	18	100 Year	686.00	4595.53	4596.28	4597.07	4600.30	0.045081	16.09	42.63	78.86	3.86
Reach-1	17	10 Year	98.00	4586.00	4586.16	4586.37	4587.20	0.063867	8.18	11.98	79.43	3.71
Reach-1	17	25 Year	239.00	4586.00	4586.15	4586.65	4592.67	0.413588	20.49	11.67	79.30	9.41
Reach-1	17	50 Year	449.00	4586.00	4586.43	4586.98	4588.99	0.044305	12.85	34.93	89.43	3.62
Reach-1	17	100 Year	686.00	4586.00	4586.55	4587.23	4590.04	0.044960	15.01	45.71	93.79	3.79
Reach-1	16	10 Year	98.00	4578.28	4578.88	4579.18	4579.91	0.020485	8.17	12.00	33.99	2.42
Reach-1	16	25 Year	239.00	4578.28	4579.19	4579.59	4580.54	0.017637	9.32	25.64	53.23	2.37
Reach-1	16	50 Year	449.00	4578.28	4579.37	4580.01	4581.77	0.025409	12.42	36.14	64.10	2.92
Reach-1	16	100 Year	686.00	4578.28	4579.56	4580.27	4582.56	0.026081	13.88	49.41	75.67	3.03
Reach-1	15	10 Year	98.00	4578.00	4578.77	4578.77	4578.97	0.003555	3.59	27.34	71.63	1.02
Reach-1	15	25 Year	239.00	4578.00	4579.10	4579.10	4579.36	0.003094	4.26	56.13	102.40	1.01
Reach-1	15	50 Year	449.00	4578.00	4579.41	4579.41	4579.77	0.002865	4.85	92.56	131.07	1.02
Reach-1	15	100 Year	686.00	4578.00	4579.67	4579.67	4580.10	0.002678	5.25	130.55	155.87	1.01
Reach-1	14	10 Year	98.00	4564.07	4564.37	4564.76	4571.74	0.464835	21.79	4.50	30.40	9.99
Reach-1	14	25 Year	239.00	4564.07	4564.51	4564.96	4572.82	0.447050	23.14	10.33	62.00	9.99
Reach-1	14	50 Year	449.00	4564.07	4564.61	4565.17	4574.73	0.365643	25.53	17.58	78.30	9.49
Reach-1	14	100 Year	686.00	4564.07	4564.69	4565.38	4577.29	0.428661	28.49	24.08	102.51	10.36
Reach-1	13	10 Year	98.00	4558.26	4558.60	4558.66	4558.81	0.010325	3.66	26.75	151.02	1.53
Reach-1	13	25 Year	239.00	4558.26	4558.72	4558.85	4559.14	0.011239	5.22	45.77	161.77	1.73
Reach-1	13	50 Year	449.00	4558.26	4558.79	4559.05	4559.75	0.020172	7.66	57.15	169.74	2.39
Reach-1	13	100 Year	686.00	4558.26	4558.90	4559.24	4560.13	0.019662	8.92	76.94	185.40	2.44
Reach-1	12	10 Year	98.00	4550.00	4551.58	4552.34	4554.34	0.018052	13.34	7.35	8.44	2.52
Reach-1	12	25 Year	239.00	4550.00	4552.53	4553.45	4555.48	0.010455	13.79	17.33	12.46	2.06
Reach-1	12	50 Year	449.00	4550.00	4554.17	4554.47	4555.13	0.011147	7.89	56.91	105.87	1.90
Reach-1	12	100 Year	686.00	4550.00	4554.34	4554.74	4555.60	0.011001	9.02	76.02	114.58	1.95
Reach-1	11	10 Year	98.00	4546.00	4546.85	4547.46	4549.04	0.016775	11.87	8.26	10.98	2.41
Reach-1	11	25 Year	239.00	4546.00	4547.41	4548.58	4551.44	0.017554	16.12	14.82	12.63	2.62
Reach-1	11	50 Year	449.00	4546.00	4548.45	4549.51	4551.80	0.009898	14.68	30.58	19.50	2.07
Reach-1	11	100 Year	686.00	4546.00	4549.14	4550.16	4552.47	0.008997	14.65	46.83	28.26	2.01
Reach-1	10	10 Year	98.00	4542.00	4542.12	4542.21	4542.41	0.023773	4.30	22.81	189.36	2.18
Reach-1	10	25 Year	239.00	4542.00	4542.17	4542.37	4543.05	0.047329	7.54	31.69	189.55	3.25
Reach-1	10	50 Year	449.00	4542.00	4542.20	4542.57	4544.49	0.100066	12.15	36.97	189.66	4.85
Reach-1	10	100 Year	686.00	4542.00	4542.25	4542.75	4545.41	0.097421	14.27	48.09	189.89	5.00
Reach-1	9	10 Year	98.00	4540.80	4541.47	4541.47	4541.64	0.003754	3.35	29.23	87.58	1.02
Reach-1	9	25 Year	239.00	4540.80	4541.77	4541.77	4542.00	0.003086	3.91	61.19	125.87	0.99
Reach-1	9	50 Year	449.00	4540.80	4542.03	4542.03	4542.36	0.002801	4.59	97.72	146.38	0.99
Reach-1	9	100 Year	686.00	4540.80	4542.25	4542.25	4542.68	0.002589	5.28	129.91	148.69	1.00
Reach-1	8	10 Year	98.00	4533.18	4533.51	4533.98	4536.01	0.186893	17.03	5.76	28.13	6.63
Reach-1	8	25 Year	239.00	4533.18	4533.72	4534.38	4538.97	0.115836	18.38	13.00	39.47	6.64
Reach-1	8	50 Year	449.00	4533.18	4533.96	4534.60	4539.63	0.080396	19.11	23.49	51.09	4.97
Reach-1	8	100 Year	686.00	4533.18	4534.16	4535.22	4540.17	0.057967	19.67	34.87	56.70	4.42
Reach-1	7	10 Year	98.00	4532.00	4532.30	4532.47	4532.91	0.020644	6.27	15.63	66.24	2.27
Reach-1	7	25 Year	239.00	4532.00	4532.45	4532.78	4533.69	0.026258	8.93	26.76	79.92	2.72
Reach-1	7	50 Year	449.00	4532.00	4532.60	4533.07	4534.57	0.030310	11.27	39.84	93.46	3.04
Reach-1	7	100 Year	686.00	4532.00	4532.72	4533.32	4535.47	0.034587	13.30	51.56	104.12	3.33
Reach-1	6	10 Year	98.00	4530.00	4530.53	4530.61	4530.90	0.004984	4.88	20.10	42.25	1.25
Reach-1	6	25 Year	239.00	4530.00	4530.91	4531.06	4531.55	0.004549	6.40	37.35	48.43	1.28
Reach-1	6	50 Year	449.00	4530.00	4531.30	4531.56	4532.25	0.004492	7.80	57.56	54.68	1.34
Reach-1	6	100 Year	686.00	4530.00	4531.64	4532.01	4532.88	0.004581	8.95	76.68	59.98	1.39
Reach-1	5	10 Year	98.00	4530.00	4530.31	4530.32	4530.47	0.003672	3.15	31.06	100.71	1.00
Reach-1	5	25 Year	239.00	4530.00	4530.40	4530.57	4530.98	0.009507	5.98	40.00	101.46	1.68
Reach-1	5	50 Year	449.00	4530.00	4530.54	4530.86	4531.61	0.012474	8.30	54.10	102.62	2.01
Reach-1	5	100 Year	686.00	4530.00	4530.69	4531.13	4532.21	0.013084	9.92	69.17	103.84	2.14
Reach-1	4	10 Year	98.00	4528.19	4528.67	4528.94	4529.73	0.035424	8.26	11.87	49.89	2.98
Reach-1	4	25 Year	239.00	4528.19	4529.00	4529.32	4530.07	0.012406	8.31	28.78	64.25	2.01
Reach-1	4	50 Year	449.00	4528.19	4529.32	4529.76	4530.74	0.009592	9.57	46.90	58.62	1.89
Reach-1	4	100 Year	666.00	4528.19	4529.60	4530.17	4531.38	0.008719	10.72	63.97	62.52	1.87

HEC-RAS Plan: 1WC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3	10 Year	98.00	4522.00	4522.70	4522.89	4523.31	0.010585	6.28	15.60	39.94	1.77
Reach-1	3	25 Year	239.00	4522.00	4522.88	4523.30	4524.46	0.020386	10.08	23.70	46.76	2.55
Reach-1	3	50 Year	449.00	4522.00	4523.11	4523.63	4525.39	0.026030	12.10	37.10	69.71	2.92
Reach-1	3	100 Year	686.00	4522.00	4523.28	4523.89	4525.98	0.031499	13.18	52.08	99.19	3.21
Reach-1	2	10 Year	98.00	4520.00	4520.57	4520.74	4521.10	0.008698	5.85	16.76	40.89	1.61
Reach-1	2	25 Year	239.00	4520.00	4520.94	4521.19	4521.73	0.006825	7.15	33.42	49.94	1.54
Reach-1	2	50 Year	449.00	4520.00	4521.30	4521.64	4522.41	0.006476	8.48	52.98	58.78	1.57
Reach-1	2	100 Year	686.00	4520.00	4521.63	4522.04	4522.96	0.005897	9.25	74.14	67.03	1.55
Reach-1	1	10 Year	98.00	4520.00	4520.31	4520.59	4521.31	0.025412	8.00	12.26	41.84	2.60
Reach-1	1	25 Year	239.00	4520.00	4520.80	4521.01	4521.54	0.006121	6.91	34.60	50.15	1.47
Reach-1	1	50 Year	449.00	4520.00	4521.32	4521.50	4522.11	0.003682	7.13	62.96	59.04	1.22
Reach-1	1	100 Year	686.00	4520.00	4521.72	4521.90	4522.66	0.003266	7.78	88.20	65.95	1.19

HEC-RAS Plan: 6WC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	48.00	4595.53	4595.93	4595.93	4596.06	0.003839	2.63	16.98	67.30	0.99
Reach-1	18	25 Year	72.00	4595.53	4596.01	4596.01	4596.17	0.003797	3.25	22.13	70.44	1.02
Reach-1	18	50 Year	93.00	4595.53	4595.85	4596.08	4596.80	0.044939	7.81	11.91	65.03	3.22
Reach-1	18	100 Year	118.00	4595.53	4596.14	4596.14	4596.35	0.003380	3.74	31.65	74.70	1.01
Reach-1	17	10 Year	48.00	4586.00	4586.02	4586.23	4608.28	25.068200	37.87	1.27	74.48	51.15
Reach-1	17	25 Year	72.00	4586.00	4586.15	4586.30	4586.80	0.044292	6.49	11.09	79.03	3.06
Reach-1	17	50 Year	93.00	4586.00	4586.17	4586.36	4586.95	0.042554	7.08	13.14	79.96	3.08
Reach-1	17	100 Year	118.00	4586.00	4586.12	4586.41	4588.89	0.250142	13.37	8.82	78.01	7.01
Reach-1	16	10 Year	48.00	4578.28	4578.65	4578.93	4579.86	0.043582	8.84	5.43	24.03	3.28
Reach-1	16	25 Year	72.00	4578.28	4578.78	4579.06	4579.78	0.024184	8.03	8.97	29.54	2.57
Reach-1	16	50 Year	93.00	4578.28	4578.84	4579.16	4580.00	0.024553	8.64	10.76	32.06	2.63
Reach-1	16	100 Year	118.00	4578.28	4578.97	4579.25	4579.87	0.015049	7.59	15.55	38.99	2.12
Reach-1	15	10 Year	48.00	4578.00	4578.58	4578.58	4578.73	0.003818	3.09	15.53	53.65	1.01
Reach-1	15	25 Year	72.00	4578.00	4578.69	4578.69	4578.85	0.003337	3.24	22.19	64.39	0.97
Reach-1	15	50 Year	93.00	4578.00	4578.76	4578.76	4578.95	0.003381	3.47	26.78	70.68	1.00
Reach-1	15	100 Year	118.00	4578.00	4578.83	4578.83	4579.04	0.003308	3.65	32.30	77.97	1.00
Reach-1	14	10 Year	48.00	4564.07	4564.27	4564.62	4572.36	0.720539	22.82	2.10	18.43	11.91
Reach-1	14	25 Year	72.00	4564.07	4564.28	4564.72	4579.79	1.312738	31.61	2.28	19.21	16.17
Reach-1	14	50 Year	93.00	4564.07	4564.35	4564.76	4573.15	0.622043	23.82	3.91	28.75	11.39
Reach-1	14	100 Year	118.00	4564.07	4564.40	4564.80	4571.83	0.406439	21.89	5.39	32.74	9.51
Reach-1	13	10 Year	48.00	4558.26	4558.49	4558.67	4558.74	0.024653	4.02	11.94	112.63	2.18
Reach-1	13	25 Year	72.00	4558.26	4558.57	4558.81	4558.73	0.009720	3.22	22.36	146.77	1.45
Reach-1	13	50 Year	93.00	4558.26	4558.55	4558.65	4558.89	0.022728	4.64	20.05	143.48	2.19
Reach-1	13	100 Year	118.00	4558.26	4558.61	4558.68	4558.87	0.011324	4.04	29.20	152.45	1.63
Reach-1	12	10 Year	48.00	4550.00	4551.24	4551.73	4552.84	0.014156	10.17	4.72	6.81	2.15
Reach-1	12	25 Year	72.00	4550.00	4551.34	4552.05	4554.07	0.021956	13.27	5.43	7.29	2.71
Reach-1	12	50 Year	93.00	4550.00	4551.68	4552.29	4553.67	0.011985	11.31	8.22	8.89	2.07
Reach-1	12	100 Year	118.00	4550.00	4551.76	4552.54	4554.46	0.015496	13.23	8.92	9.23	2.37
Reach-1	11	10 Year	48.00	4546.00	4546.54	4546.94	4547.98	0.018931	9.63	4.98	10.07	2.41
Reach-1	11	25 Year	72.00	4546.00	4546.73	4547.21	4548.39	0.015224	10.35	6.96	10.63	2.25
Reach-1	11	50 Year	93.00	4546.00	4546.78	4547.42	4549.15	0.019900	12.33	7.54	10.79	2.60
Reach-1	11	100 Year	118.00	4546.00	4546.93	4547.64	4549.52	0.017999	12.93	9.12	11.21	2.53
Reach-1	10	10 Year	48.00	4542.00	4542.18	4542.12	4542.21	0.001552	1.42	33.73	189.59	0.59
Reach-1	10	25 Year	72.00	4542.00	4542.10	4542.17	4542.32	0.022755	3.75	19.20	189.29	2.07
Reach-1	10	50 Year	93.00	4542.00	4542.12	4542.20	4542.37	0.020293	4.01	23.18	189.37	2.02
Reach-1	10	100 Year	118.00	4542.00	4542.15	4542.23	4542.43	0.018855	4.32	27.34	189.46	2.00
Reach-1	9	10 Year	48.00	4540.80	4541.31	4541.31	4541.43	0.003871	2.84	16.92	66.63	0.99
Reach-1	9	25 Year	72.00	4540.80	4541.39	4541.39	4541.54	0.003919	3.15	22.83	77.40	1.02
Reach-1	9	50 Year	93.00	4540.80	4541.47	4541.47	4541.63	0.003303	3.15	29.49	87.97	0.96
Reach-1	9	100 Year	118.00	4540.80	4541.53	4541.53	4541.71	0.003389	3.38	34.91	95.72	0.99
Reach-1	8	10 Year	48.00	4533.18	4533.40	4533.76	4537.56	0.308991	16.38	2.93	22.18	7.94
Reach-1	8	25 Year	72.00	4533.18	4533.46	4533.88	4537.74	0.225416	16.61	4.33	25.31	7.07
Reach-1	8	50 Year	93.00	4533.18	4533.51	4533.98	4537.72	0.177684	16.47	5.65	27.92	6.45
Reach-1	8	100 Year	118.00	4533.18	4533.54	4534.07	4538.35	0.176577	17.60	6.70	29.86	6.55
Reach-1	7	10 Year	48.00	4532.00	4532.21	4532.31	4532.56	0.017457	4.71	10.18	58.39	1.99
Reach-1	7	25 Year	72.00	4532.00	4532.26	4532.41	4532.73	0.019004	5.53	13.02	62.60	2.14
Reach-1	7	50 Year	93.00	4532.00	4532.29	4532.46	4532.87	0.019753	6.08	15.31	65.80	2.22
Reach-1	7	100 Year	118.00	4532.00	4532.32	4532.54	4533.04	0.022025	6.79	17.37	68.56	2.38
Reach-1	6	10 Year	48.00	4530.00	4530.44	4530.38	4530.57	0.002291	2.95	16.29	40.75	0.82
Reach-1	6	25 Year	72.00	4530.00	4530.44	4530.51	4530.74	0.005233	4.44	16.21	40.72	1.24
Reach-1	6	50 Year	93.00	4530.00	4530.51	4530.59	4530.87	0.005071	4.81	19.32	41.95	1.25
Reach-1	6	100 Year	118.00	4530.00	4530.60	4530.68	4531.01	0.004845	5.15	22.90	43.31	1.25
Reach-1	5	10 Year	48.00	4530.00	4530.19	4530.19	4530.29	0.004335	2.50	19.17	99.72	1.01
Reach-1	5	25 Year	72.00	4530.00	4530.17	4530.26	4530.47	0.016359	4.39	16.40	99.48	1.91
Reach-1	5	50 Year	93.00	4530.00	4530.30	4530.31	4530.45	0.003990	3.17	29.34	100.57	1.03
Reach-1	5	100 Year	118.00	4530.00	4530.33	4530.36	4530.53	0.004614	3.64	32.44	100.83	1.13
Reach-1	4	10 Year	48.00	4528.19	4528.54	4528.75	4529.45	0.042746	7.63	6.29	34.30	3.14
Reach-1	4	25 Year	72.00	4528.19	4528.66	4528.85	4529.20	0.016153	5.76	12.50	50.06	2.03
Reach-1	4	50 Year	93.00	4528.19	4528.66	4528.92	4529.68	0.035302	8.08	11.50	49.79	2.96
Reach-1	4	100 Year	118.00	4528.19	4528.73	4529.00	4529.74	0.026337	8.09	14.59	50.62	2.65

HEC-RAS Plan: 6WC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3	10 Year	48.00	4522.00	4522.62	4522.66	4522.94	0.009806	5.22	9.19	29.27	1.64
Reach-1	3	25 Year	72.00	4522.00	4522.55	4522.79	4523.30	0.016977	6.92	10.40	32.79	2.17
Reach-1	3	50 Year	93.00	4522.00	4522.68	4522.88	4523.28	0.010597	6.20	15.00	39.21	1.77
Reach-1	3	100 Year	118.00	4522.00	4522.73	4522.99	4523.48	0.012338	6.98	16.91	41.49	1.93
Reach-1	2	10 Year	48.00	4520.00	4520.65	4520.51	4520.74	0.001224	2.39	20.05	42.83	0.62
Reach-1	2	25 Year	72.00	4520.00	4520.78	4520.62	4520.90	0.001325	2.80	25.71	45.97	0.66
Reach-1	2	50 Year	93.00	4520.00	4520.86	4520.72	4521.07	0.008699	5.76	16.19	40.54	1.60
Reach-1	2	100 Year	118.00	4520.00	4520.64	4520.81	4521.20	0.007945	6.03	19.57	42.55	1.57
Reach-1	1	10 Year	48.00	4520.00	4520.36	4520.36	4520.54	0.003647	3.33	14.42	42.71	1.01
Reach-1	1	25 Year	72.00	4520.00	4520.47	4520.47	4520.69	0.003395	3.76	19.13	44.56	1.01
Reach-1	1	50 Year	93.00	4520.00	4520.28	4520.57	4521.41	0.033036	8.52	10.92	41.28	2.92
Reach-1	1	100 Year	118.00	4520.00	4520.37	4520.65	4521.37	0.020511	8.00	14.76	42.86	2.40

HEC-RAS Plan: 12WC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	63.00	4595.63	4595.81	4595.97	4596.52	0.044935	6.73	9.36	63.86	3.10
Reach-1	18	25 Year	101.00	4595.63	4596.10	4596.10	4596.29	0.003386	3.54	28.52	73.36	1.00
Reach-1	18	50 Year	211.00	4595.63	4595.97	4596.35	4597.73	0.045084	10.62	19.86	68.55	3.48
Reach-1	18	100 Year	299.00	4595.63	4596.05	4596.51	4598.28	0.045034	11.99	24.94	71.74	3.58
Reach-1	17	10 Year	63.00	4586.00	4586.12	4586.28	4586.85	0.062957	6.87	9.17	78.17	3.54
Reach-1	17	25 Year	101.00	4586.00	4586.10	4586.37	4588.71	0.274386	12.95	7.80	77.54	7.20
Reach-1	17	50 Year	211.00	4586.00	4586.27	4586.60	4587.86	0.049861	10.12	20.84	83.39	3.57
Reach-1	17	100 Year	299.00	4586.00	4586.34	4586.75	4588.23	0.043607	11.04	27.09	86.12	3.47
Reach-1	16	10 Year	63.00	4578.28	4578.77	4579.01	4579.60	0.020530	7.29	8.64	29.08	2.36
Reach-1	16	25 Year	101.00	4578.28	4578.93	4579.19	4579.75	0.014647	7.24	13.95	36.83	2.07
Reach-1	16	50 Year	211.00	4578.28	4579.10	4579.52	4580.69	0.023239	10.14	20.81	46.85	2.68
Reach-1	16	100 Year	299.00	4578.28	4579.21	4579.71	4581.17	0.024930	11.24	26.61	54.11	2.82
Reach-1	15	10 Year	63.00	4578.00	4578.65	4578.65	4578.81	0.003593	3.23	19.51	60.29	1.00
Reach-1	15	25 Year	101.00	4578.00	4578.78	4578.78	4578.98	0.003529	3.60	28.04	72.56	1.02
Reach-1	15	50 Year	211.00	4578.00	4579.04	4579.04	4579.31	0.003164	4.16	50.72	97.40	1.02
Reach-1	15	100 Year	299.00	4578.00	4579.20	4579.20	4579.51	0.003009	4.46	67.06	111.81	1.01
Reach-1	14	10 Year	63.00	4564.07	4564.30	4564.67	4572.76	0.640949	23.34	2.70	20.85	11.46
Reach-1	14	25 Year	101.00	4564.07	4564.36	4564.77	4573.02	0.568361	23.62	4.28	29.80	10.99
Reach-1	14	50 Year	211.00	4564.07	4564.47	4564.93	4575.16	0.549502	26.24	8.04	46.65	11.14
Reach-1	14	100 Year	299.00	4564.07	4564.55	4565.03	4572.73	0.367997	22.95	13.03	68.41	9.27
Reach-1	13	10 Year	63.00	4558.26	4558.64	4558.59	4558.73	0.014677	3.56	17.71	137.42	1.75
Reach-1	13	25 Year	101.00	4558.26	4558.68	4558.67	4558.85	0.015329	4.20	24.04	148.66	1.84
Reach-1	13	50 Year	211.00	4558.26	4558.83	4558.81	4559.33	0.029053	6.74	31.29	153.68	2.63
Reach-1	13	100 Year	299.00	4558.26	4558.71	4558.92	4559.43	0.020185	8.83	43.80	160.69	2.30
Reach-1	12	10 Year	63.00	4550.00	4551.33	4551.94	4553.48	0.017442	11.77	5.35	7.24	2.41
Reach-1	12	25 Year	101.00	4550.00	4551.68	4552.37	4554.03	0.014135	12.29	8.22	8.89	2.25
Reach-1	12	50 Year	211.00	4550.00	4552.54	4553.26	4554.82	0.008079	12.14	17.38	12.48	1.81
Reach-1	12	100 Year	299.00	4550.00	4552.96	4554.23	4555.68	0.007586	12.99	23.01	14.18	1.80
Reach-1	11	10 Year	63.00	4546.00	4546.66	4547.12	4548.27	0.016740	10.19	6.18	10.41	2.33
Reach-1	11	25 Year	101.00	4546.00	4546.84	4547.50	4549.24	0.018758	12.44	8.12	10.94	2.55
Reach-1	11	50 Year	211.00	4546.00	4547.28	4548.40	4551.19	0.018724	15.85	13.31	12.26	2.68
Reach-1	11	100 Year	299.00	4546.00	4547.61	4548.92	4552.16	0.017165	17.11	17.47	13.33	2.63
Reach-1	10	10 Year	63.00	4542.00	4542.10	4542.15	4542.28	0.019855	3.41	18.47	189.27	1.93
Reach-1	10	25 Year	101.00	4542.00	4542.11	4542.21	4542.48	0.034976	4.88	20.68	189.32	2.60
Reach-1	10	50 Year	211.00	4542.00	4542.17	4542.34	4542.81	0.032587	6.41	32.89	189.67	2.71
Reach-1	10	100 Year	299.00	4542.00	4542.20	4542.43	4543.20	0.043283	8.03	37.25	189.66	3.19
Reach-1	9	10 Year	63.00	4540.80	4541.36	4541.36	4541.51	0.003865	3.03	20.76	73.81	1.01
Reach-1	9	25 Year	101.00	4540.80	4541.48	4541.48	4541.65	0.003676	3.35	30.14	88.93	1.01
Reach-1	9	50 Year	211.00	4540.80	4541.72	4541.72	4541.94	0.003128	3.79	55.64	120.84	0.98
Reach-1	9	100 Year	299.00	4540.80	4541.85	4541.85	4542.12	0.002961	4.12	72.62	133.77	0.98
Reach-1	8	10 Year	63.00	4533.18	4533.44	4533.84	4537.70	0.250937	16.57	3.80	24.17	7.36
Reach-1	8	25 Year	101.00	4533.18	4533.62	4534.00	4538.08	0.185708	17.14	5.89	28.38	6.63
Reach-1	8	50 Year	211.00	4533.18	4533.69	4534.30	4538.87	0.124817	18.28	11.55	37.48	5.80
Reach-1	8	100 Year	299.00	4533.18	4533.80	4534.49	4539.21	0.102544	18.67	16.01	43.33	5.41
Reach-1	7	10 Year	63.00	4532.00	4532.24	4532.36	4532.67	0.018529	5.25	11.99	61.11	2.09
Reach-1	7	25 Year	101.00	4532.00	4532.30	4532.48	4532.93	0.020903	6.38	15.89	66.59	2.29
Reach-1	7	50 Year	211.00	4532.00	4532.42	4532.73	4533.55	0.025511	8.62	24.76	77.64	2.66
Reach-1	7	100 Year	299.00	4532.00	4532.50	4532.88	4533.96	0.027712	9.72	30.77	84.30	2.83
Reach-1	6	10 Year	63.00	4530.00	4530.40	4530.46	4530.68	0.005311	4.25	14.81	40.16	1.23
Reach-1	6	25 Year	101.00	4530.00	4530.54	4530.62	4530.92	0.004957	4.92	20.53	42.41	1.25
Reach-1	6	50 Year	211.00	4530.00	4530.85	4530.99	4531.44	0.004585	6.16	34.26	47.39	1.28
Reach-1	6	100 Year	299.00	4530.00	4531.04	4531.23	4531.77	0.004505	6.88	43.57	50.44	1.30
Reach-1	5	10 Year	63.00	4530.00	4530.13	4530.24	4530.50	0.027700	4.88	12.91	99.19	2.38
Reach-1	5	25 Year	101.00	4530.00	4530.31	4530.31	4530.48	0.003860	3.24	31.18	100.72	1.03
Reach-1	5	50 Year	211.00	4530.00	4530.38	4530.53	4530.86	0.008571	5.51	38.26	101.31	1.56
Reach-1	5	100 Year	299.00	4530.00	4530.44	4530.66	4531.17	0.011195	6.85	43.62	101.76	1.85
Reach-1	4	10 Year	63.00	4528.19	4528.68	4528.60	4529.09	0.013098	5.13	12.28	50.00	1.82
Reach-1	4	25 Year	101.00	4528.19	4528.68	4528.95	4529.73	0.033449	8.21	12.31	50.01	2.91
Reach-1	4	50 Year	211.00	4528.19	4528.94	4529.25	4529.98	0.013594	6.17	25.83	63.52	2.07
Reach-1	4	100 Year	299.00	4528.19	4529.10	4529.45	4530.27	0.011089	6.69	34.41	55.63	1.95

HEC-RAS Plan: 12WC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3	10 Year	63.00	4522.00	4522.49	4522.74	4523.34	0.020209	7.41	8.50	27.55	2.35
Reach-1	3	25 Year	101.00	4522.00	4522.70	4522.92	4523.34	0.010871	6.39	15.80	40.17	1.80
Reach-1	3	50 Year	211.00	4522.00	4522.85	4523.28	4524.26	0.019107	9.53	22.13	47.18	2.45
Reach-1	3	100 Year	299.00	4522.00	4522.96	4523.41	4524.77	0.022459	10.82	27.64	55.04	2.69
Reach-1	2	10 Year	63.00	4520.00	4520.72	4520.57	4520.84	0.001335	2.69	23.41	44.72	0.68
Reach-1	2	25 Year	101.00	4520.00	4520.58	4520.74	4521.12	0.008549	5.87	17.20	41.16	1.60
Reach-1	2	50 Year	211.00	4520.00	4520.88	4521.11	4521.62	0.006827	6.88	30.65	48.55	1.53
Reach-1	2	100 Year	299.00	4520.00	4521.05	4521.34	4521.95	0.006690	7.60	39.33	52.78	1.55
Reach-1	1	10 Year	63.00	4520.00	4520.44	4520.44	4520.64	0.003222	3.53	17.86	44.07	0.98
Reach-1	1	25 Year	101.00	4520.00	4520.33	4520.60	4521.28	0.022775	7.81	12.93	42.11	2.48
Reach-1	1	50 Year	211.00	4520.00	4520.72	4520.94	4521.46	0.008966	6.91	30.52	48.74	1.54
Reach-1	1	100 Year	299.00	4520.00	4520.97	4521.17	4521.70	0.004794	6.85	43.63	53.14	1.33

HEC-RAS Plan: 24WC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	98.00	4595.53	4595.88	4596.09	4596.85	0.045081	7.98	12.29	65.21	3.24
Reach-1	18	25 Year	239.00	4595.53	4596.40	4596.40	4596.72	0.002914	4.57	52.33	82.13	1.01
Reach-1	18	50 Year	449.00	4595.53	4596.15	4596.76	4599.12	0.044970	13.84	32.43	75.09	3.71
Reach-1	18	100 Year	686.00	4595.53	4596.28	4597.07	4600.30	0.045061	16.09	42.63	78.86	3.86
Reach-1	17	10 Year	98.00	4586.00	4586.16	4586.37	4587.20	0.063867	8.18	11.98	79.43	3.71
Reach-1	17	25 Year	239.00	4586.00	4586.15	4586.65	4592.67	0.413588	20.49	11.67	79.30	9.41
Reach-1	17	50 Year	449.00	4586.00	4586.43	4586.96	4588.99	0.044305	12.85	34.93	89.43	3.62
Reach-1	17	100 Year	686.00	4586.00	4586.65	4587.23	4590.04	0.044960	15.01	45.71	93.79	3.79
Reach-1	16	10 Year	98.00	4578.28	4578.88	4579.18	4579.91	0.020485	8.17	12.00	33.99	2.42
Reach-1	16	25 Year	239.00	4578.28	4579.19	4579.59	4580.54	0.017637	9.32	25.64	53.23	2.37
Reach-1	16	50 Year	449.00	4578.28	4579.37	4580.01	4581.77	0.025409	12.42	38.14	64.10	2.92
Reach-1	16	100 Year	686.00	4578.28	4579.56	4580.27	4582.66	0.026081	13.88	49.41	75.67	3.03
Reach-1	15	10 Year	98.00	4576.00	4576.77	4576.77	4576.97	0.003555	3.59	27.34	71.63	1.02
Reach-1	15	25 Year	239.00	4576.00	4579.10	4579.10	4579.38	0.003094	4.26	56.13	102.40	1.01
Reach-1	15	50 Year	449.00	4576.00	4579.41	4579.41	4579.77	0.002865	4.85	92.56	131.07	1.02
Reach-1	15	100 Year	686.00	4576.00	4579.67	4579.67	4580.10	0.002678	5.26	130.55	155.87	1.01
Reach-1	14	10 Year	98.00	4564.07	4564.37	4564.76	4571.74	0.464835	21.79	4.50	30.40	9.99
Reach-1	14	25 Year	239.00	4564.07	4564.51	4564.96	4572.82	0.447050	23.14	10.33	62.00	9.99
Reach-1	14	50 Year	449.00	4564.07	4564.81	4565.17	4574.73	0.365643	25.53	17.58	78.30	9.49
Reach-1	14	100 Year	686.00	4564.07	4564.69	4565.36	4577.29	0.428661	28.49	24.08	102.51	10.36
Reach-1	13	10 Year	98.00	4558.26	4558.60	4558.66	4558.81	0.010325	3.66	26.75	151.02	1.53
Reach-1	13	25 Year	239.00	4558.26	4558.72	4558.85	4559.14	0.011239	5.22	45.77	161.77	1.73
Reach-1	13	50 Year	449.00	4558.26	4558.79	4559.05	4559.75	0.020172	7.66	67.15	169.74	2.39
Reach-1	13	100 Year	686.00	4558.26	4558.90	4559.24	4560.13	0.019662	8.92	76.94	185.40	2.44
Reach-1	12	10 Year	98.00	4550.00	4551.58	4552.34	4554.34	0.018052	13.34	7.35	8.44	2.52
Reach-1	12	25 Year	239.00	4550.00	4552.53	4553.45	4555.48	0.010455	13.79	17.33	12.46	2.06
Reach-1	12	50 Year	449.00	4550.00	4554.17	4554.47	4555.13	0.011147	7.89	56.91	105.87	1.90
Reach-1	12	100 Year	686.00	4550.00	4554.34	4554.74	4555.60	0.011001	9.02	76.02	114.58	1.95
Reach-1	11	10 Year	98.00	4546.00	4546.85	4547.46	4549.04	0.016775	11.87	8.26	10.98	2.41
Reach-1	11	25 Year	239.00	4546.00	4547.41	4548.58	4551.44	0.017554	16.12	14.82	12.63	2.62
Reach-1	11	50 Year	449.00	4546.00	4548.45	4549.51	4551.80	0.009898	14.68	30.58	19.50	2.07
Reach-1	11	100 Year	686.00	4546.00	4549.14	4550.16	4552.47	0.008997	14.65	46.83	28.26	2.01
Reach-1	10	10 Year	98.00	4542.00	4542.12	4542.21	4542.41	0.023773	4.30	22.81	189.36	2.18
Reach-1	10	25 Year	239.00	4542.00	4542.17	4542.37	4543.05	0.047329	7.54	31.69	189.55	3.25
Reach-1	10	50 Year	449.00	4542.00	4542.20	4542.57	4544.49	0.100066	12.15	36.97	189.66	4.85
Reach-1	10	100 Year	686.00	4542.00	4542.25	4542.75	4545.41	0.097421	14.27	48.09	189.69	5.00
Reach-1	9	10 Year	98.00	4540.80	4541.47	4541.47	4541.64	0.003754	3.35	29.23	87.58	1.02
Reach-1	9	25 Year	239.00	4540.80	4541.77	4541.77	4542.00	0.003086	3.91	61.19	125.87	0.99
Reach-1	9	50 Year	449.00	4540.80	4542.03	4542.03	4542.36	0.002801	4.59	97.72	146.38	0.99
Reach-1	9	100 Year	686.00	4540.80	4542.25	4542.25	4542.68	0.002589	5.28	129.91	148.69	1.00
Reach-1	8	10 Year	98.00	4533.18	4533.51	4533.98	4538.01	0.186893	17.03	5.76	28.13	6.63
Reach-1	8	25 Year	239.00	4533.18	4533.72	4534.38	4538.97	0.115836	18.38	13.00	39.47	5.64
Reach-1	8	50 Year	449.00	4533.18	4533.96	4534.80	4539.63	0.080396	19.11	23.49	51.09	4.97
Reach-1	8	100 Year	686.00	4533.18	4534.16	4535.22	4540.17	0.057967	19.67	34.87	56.70	4.42
Reach-1	7	10 Year	98.00	4532.00	4532.30	4532.47	4532.91	0.020644	6.27	15.63	66.24	2.27
Reach-1	7	25 Year	239.00	4532.00	4532.45	4532.76	4533.69	0.026256	8.93	26.76	79.92	2.72
Reach-1	7	50 Year	449.00	4532.00	4532.60	4533.07	4534.57	0.030310	11.27	39.84	93.46	3.04
Reach-1	7	100 Year	686.00	4532.00	4532.72	4533.32	4536.47	0.034587	13.30	51.56	104.12	3.33
Reach-1	6	10 Year	98.00	4530.00	4530.53	4530.61	4530.90	0.004984	4.88	20.10	42.25	1.25
Reach-1	6	25 Year	239.00	4530.00	4530.91	4531.08	4531.55	0.004549	6.40	37.35	48.43	1.28
Reach-1	6	50 Year	449.00	4530.00	4531.30	4531.56	4532.25	0.004492	7.80	57.56	54.68	1.34
Reach-1	6	100 Year	686.00	4530.00	4531.64	4532.01	4532.88	0.004581	8.95	76.68	59.98	1.39
Reach-1	5	10 Year	98.00	4530.00	4530.31	4530.32	4530.47	0.003672	3.15	31.06	100.71	1.00
Reach-1	5	25 Year	239.00	4530.00	4530.40	4530.57	4530.96	0.009507	5.98	40.00	101.46	1.68
Reach-1	5	50 Year	449.00	4530.00	4530.54	4530.86	4531.61	0.012474	8.30	54.10	102.62	2.01
Reach-1	5	100 Year	686.00	4530.00	4530.69	4531.13	4532.21	0.013064	9.92	69.17	103.84	2.14
Reach-1	4	10 Year	98.00	4528.19	4528.67	4528.94	4529.73	0.035424	8.26	11.87	49.69	2.98
Reach-1	4	25 Year	239.00	4528.19	4529.00	4529.32	4530.07	0.012406	8.31	28.78	54.25	2.01
Reach-1	4	50 Year	449.00	4528.19	4529.32	4529.76	4530.74	0.009592	9.67	46.90	58.62	1.89
Reach-1	4	100 Year	686.00	4528.19	4529.60	4530.17	4531.38	0.008719	10.72	63.97	62.52	1.87

HEC-RAS Plan: 24WC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3	10 Year	98.00	4522.00	4522.70	4522.89	4523.31	0.010585	6.28	15.60	39.94	1.77
Reach-1	3	25 Year	239.00	4522.00	4522.88	4523.30	4524.46	0.020386	10.08	23.70	48.76	2.55
Reach-1	3	50 Year	449.00	4522.00	4523.11	4523.63	4525.39	0.026030	12.10	37.10	69.71	2.92
Reach-1	3	100 Year	686.00	4522.00	4523.28	4523.89	4525.98	0.031499	13.18	52.06	99.19	3.21
Reach-1	2	10 Year	98.00	4520.00	4520.67	4520.74	4521.10	0.008698	5.85	16.76	40.89	1.61
Reach-1	2	25 Year	239.00	4520.00	4520.94	4521.19	4521.73	0.006825	7.16	33.42	49.94	1.54
Reach-1	2	50 Year	449.00	4520.00	4521.30	4521.64	4522.41	0.006476	8.48	62.98	68.78	1.57
Reach-1	2	100 Year	686.00	4520.00	4521.63	4522.04	4522.96	0.005897	9.25	74.14	67.03	1.55
Reach-1	1	10 Year	98.00	4520.00	4520.31	4520.59	4521.31	0.025412	8.00	12.26	41.84	2.60
Reach-1	1	25 Year	239.00	4520.00	4520.80	4521.01	4521.54	0.006121	6.91	34.60	60.16	1.47
Reach-1	1	50 Year	449.00	4520.00	4521.32	4521.50	4522.11	0.003682	7.13	62.96	59.04	1.22
Reach-1	1	100 Year	686.00	4520.00	4521.72	4521.90	4522.66	0.003256	7.78	88.20	65.95	1.19

HEC-RAS Plan: 1NC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	18	10 Year	21.00	4595.53	4595.82	4595.82	4595.89	0.004536	2.18	9.64	63.99	0.99
Reach-1	18	25 Year	40.00	4595.53	4595.90	4595.90	4596.01	0.004140	2.70	14.79	66.33	1.01
Reach-1	18	50 Year	83.00	4595.53	4596.04	4596.04	4596.22	0.003758	3.41	24.31	71.45	1.03
Reach-1	18	100 Year	179.00	4595.53	4596.26	4596.26	4596.55	0.003017	4.18	42.86	78.94	1.00
Reach-1	17	10 Year	21.00	4586.00	4586.14	4586.14	4586.20	0.004328	1.98	10.62	78.83	0.95
Reach-1	17	25 Year	40.00	4586.00	4586.17	4586.20	4586.31	0.007505	3.00	13.34	80.04	1.29
Reach-1	17	50 Year	83.00	4586.00	4586.02	4586.33	4665.71	101.071100	71.64	1.16	74.43	101.19
Reach-1	17	100 Year	179.00	4586.00	4586.08	4586.55	4598.36	1.675900	28.11	6.37	76.88	17.22
Reach-1	16	10 Year	21.00	4578.28	4578.44	4578.72	4582.61	0.541929	16.39	1.28	14.89	9.85
Reach-1	16	25 Year	40.00	4578.28	4578.53	4578.87	4581.51	0.181736	13.84	2.89	19.07	6.27
Reach-1	16	50 Year	83.00	4578.28	4578.78	4579.12	4580.10	0.031854	9.22	9.00	29.58	2.95
Reach-1	16	100 Year	179.00	4578.28	4579.07	4579.44	4580.37	0.019163	9.13	19.61	44.69	2.43
Reach-1	15	10 Year	21.00	4578.00	4578.42	4578.42	4578.52	0.004071	2.58	8.14	38.69	0.99
Reach-1	15	25 Year	40.00	4578.00	4578.54	4578.54	4578.68	0.003880	2.97	13.46	49.90	1.01
Reach-1	15	50 Year	83.00	4578.00	4578.72	4578.72	4578.90	0.003518	3.43	24.21	67.33	1.01
Reach-1	15	100 Year	179.00	4578.00	4578.98	4578.98	4579.23	0.003180	4.00	44.76	91.58	1.01
Reach-1	14	10 Year	21.00	4564.07	4564.22	4564.48	4568.52	0.539055	16.66	1.26	14.26	9.87
Reach-1	14	25 Year	40.00	4564.07	4564.21	4564.58	4583.39	2.598229	35.14	1.14	13.66	21.45
Reach-1	14	50 Year	83.00	4564.07	4564.32	4564.74	4574.81	0.762664	25.99	3.19	24.02	12.56
Reach-1	14	100 Year	179.00	4564.07	4564.42	4564.89	4576.96	0.660495	28.41	6.30	37.24	12.17
Reach-1	13	10 Year	21.00	4558.26	4558.45	4558.49	4558.57	0.017818	2.72	7.72	102.64	1.75
Reach-1	13	25 Year	40.00	4558.26	4558.50	4558.55	4558.64	0.012618	3.03	13.22	115.53	1.58
Reach-1	13	50 Year	83.00	4558.26	4558.59	4558.63	4558.75	0.007811	3.16	26.31	150.77	1.33
Reach-1	13	100 Year	179.00	4558.26	4558.66	4558.76	4559.03	0.012567	4.87	36.75	156.76	1.77
Reach-1	12	10 Year	21.00	4550.00	4550.79	4551.20	4552.25	0.021829	9.71	2.16	4.65	2.51
Reach-1	12	25 Year	40.00	4550.00	4551.03	4551.59	4553.17	0.023461	11.74	3.41	5.80	2.70
Reach-1	12	50 Year	83.00	4550.00	4551.40	4552.18	4554.50	0.023622	14.13	5.87	7.58	2.83
Reach-1	12	100 Year	179.00	4550.00	4552.20	4553.04	4554.97	0.011809	13.36	13.40	11.12	2.14
Reach-1	11	10 Year	21.00	4546.00	4546.36	4546.56	4547.00	0.013561	6.42	3.27	9.56	1.93
Reach-1	11	25 Year	40.00	4546.00	4546.53	4546.84	4547.57	0.014030	8.20	4.88	10.04	2.07
Reach-1	11	50 Year	83.00	4546.00	4546.79	4547.33	4548.61	0.015068	10.83	7.87	10.82	2.27
Reach-1	11	100 Year	179.00	4546.00	4547.18	4548.15	4550.62	0.016216	14.69	12.02	11.94	2.62
Reach-1	10	10 Year	21.00	4542.00	4542.11	4542.07	4542.12	0.001655	1.04	20.13	189.31	0.56
Reach-1	10	25 Year	40.00	4542.00	4542.16	4542.11	4542.19	0.001587	1.33	30.02	189.51	0.59
Reach-1	10	50 Year	83.00	4542.00	4542.28	4542.18	4542.30	0.001373	1.71	48.64	189.90	0.59
Reach-1	10	100 Year	179.00	4542.00	4542.16	4542.29	4542.70	0.030198	5.87	30.49	189.52	2.58
Reach-1	9	10 Year	21.00	4540.80	4541.16	4541.16	4541.25	0.004617	2.46	8.52	47.28	1.02
Reach-1	9	25 Year	40.00	4540.80	4541.27	4541.27	4541.39	0.004029	2.75	14.54	61.76	1.00
Reach-1	9	50 Year	83.00	4540.80	4541.43	4541.43	4541.59	0.003746	3.21	25.83	82.33	1.01
Reach-1	9	100 Year	179.00	4540.80	4541.66	4541.66	4541.87	0.003215	3.68	48.67	113.02	0.99
Reach-1	8	10 Year	21.00	4533.18	4533.32	4533.68	4536.67	0.496747	14.68	1.43	18.25	9.24
Reach-1	8	25 Year	40.00	4533.18	4533.38	4533.72	4537.36	0.342469	16.02	2.50	21.12	8.21
Reach-1	8	50 Year	83.00	4533.18	4533.48	4533.93	4537.93	0.210941	16.93	4.90	26.47	6.93
Reach-1	8	100 Year	179.00	4533.18	4533.64	4534.23	4538.71	0.137254	18.07	9.91	35.08	5.99
Reach-1	7	10 Year	21.00	4532.00	4532.13	4532.19	4532.33	0.017879	3.59	5.85	51.28	1.88
Reach-1	7	25 Year	40.00	4532.00	4532.19	4532.29	4532.49	0.016571	4.36	9.17	56.81	1.91
Reach-1	7	50 Year	83.00	4532.00	4532.27	4532.44	4532.81	0.019856	5.87	14.13	64.17	2.21
Reach-1	7	100 Year	179.00	4532.00	4532.39	4532.67	4533.39	0.024490	8.00	22.38	74.83	2.58
Reach-1	6	10 Year	21.00	4530.00	4530.33	4530.22	4530.38	0.001157	1.76	11.95	38.98	0.66
Reach-1	6	25 Year	40.00	4530.00	4530.41	4530.34	4530.52	0.002055	2.67	15.00	40.24	0.77
Reach-1	6	50 Year	83.00	4530.00	4530.48	4530.54	4530.81	0.005082	4.63	17.93	41.41	1.24
Reach-1	6	100 Year	179.00	4530.00	4530.77	4530.90	4531.30	0.004637	5.85	30.58	46.11	1.27
Reach-1	5	10 Year	21.00	4530.00	4530.10	4530.10	4530.17	0.006833	2.07	10.15	98.96	1.14
Reach-1	5	25 Year	40.00	4530.00	4530.17	4530.17	4530.26	0.004291	2.32	17.23	99.55	0.98
Reach-1	5	50 Year	83.00	4530.00	4530.25	4530.29	4530.43	0.005964	3.42	24.25	100.14	1.23
Reach-1	5	100 Year	179.00	4530.00	4530.37	4530.47	4530.74	0.007246	4.91	36.44	101.16	1.44
Reach-1	4	10 Year	21.00	4528.19	4528.44	4528.60	4529.04	0.044125	6.21	3.38	25.65	3.02
Reach-1	4	25 Year	40.00	4528.19	4528.51	4528.70	4529.41	0.044185	7.60	5.26	29.57	3.17
Reach-1	4	50 Year	83.00	4528.19	4528.66	4528.87	4529.49	0.029511	7.32	11.33	49.74	2.70
Reach-1	4	100 Year	179.00	4528.19	4528.87	4529.17	4529.88	0.015863	8.07	22.16	52.59	2.19

HEC-RAS Plan: 1NC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev. (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3	10 Year	21.00	4522.00	4522.35	4522.44	4522.62	0.009581	4.21	4.98	21.56	1.54
Reach-1	3	25 Year	40.00	4522.00	4522.47	4522.61	4522.86	0.009700	5.02	7.97	26.73	1.62
Reach-1	3	50 Year	83.00	4522.00	4522.64	4522.83	4523.24	0.011604	6.20	13.38	37.16	1.82
Reach-1	3	100 Year	179.00	4522.00	4522.81	4523.19	4524.01	0.017194	8.79	20.37	45.34	2.31
Reach-1	2	10 Year	21.00	4520.00	4520.46	4520.33	4520.51	0.000961	1.68	12.53	36.25	0.52
Reach-1	2	25 Year	40.00	4520.00	4520.60	4520.46	4520.67	0.001185	2.23	17.93	41.59	0.60
Reach-1	2	50 Year	83.00	4520.00	4520.63	4520.68	4520.99	0.008235	5.43	15.28	39.99	1.55
Reach-1	2	100 Year	179.00	4520.00	4520.81	4521.02	4521.48	0.006979	6.59	27.16	46.74	1.52
Reach-1	1	10 Year	21.00	4520.00	4520.20	4520.20	4520.32	0.004932	2.69	7.80	39.97	1.07
Reach-1	1	25 Year	40.00	4520.00	4520.33	4520.33	4520.48	0.003739	3.14	12.75	42.04	1.00
Reach-1	1	50 Year	83.00	4520.00	4520.52	4520.52	4520.76	0.003362	3.94	21.04	45.29	1.02
Reach-1	1	100 Year	179.00	4520.00	4520.64	4520.86	4521.33	0.007373	6.66	26.88	47.44	1.56

HEC-RAS Plan: 6NC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	115.00	4595.63	4596.13	4596.13	4596.34	0.003401	3.71	30.97	74.45	1.01
Reach-1	18	25 Year	198.00	4595.63	4595.96	4596.31	4597.63	0.044963	10.37	19.10	68.22	3.45
Reach-1	18	50 Year	276.00	4595.63	4596.47	4596.47	4596.82	0.002826	4.75	58.14	84.12	1.01
Reach-1	18	100 Year	372.00	4595.63	4596.10	4596.64	4596.71	0.045054	12.96	28.70	73.44	3.65
Reach-1	17	10 Year	115.00	4586.00	4586.07	4586.41	4592.94	1.140233	21.03	5.47	76.46	13.86
Reach-1	17	25 Year	198.00	4586.00	4586.25	4586.58	4587.83	0.053198	10.09	19.62	82.65	3.65
Reach-1	17	50 Year	276.00	4586.00	4586.16	4586.71	4593.90	0.456795	22.32	12.37	79.61	9.98
Reach-1	17	100 Year	372.00	4586.00	4586.37	4586.86	4588.77	0.049120	12.41	29.97	87.35	3.73
Reach-1	16	10 Year	115.00	4578.28	4578.96	4579.24	4579.89	0.016177	7.75	14.83	38.04	2.19
Reach-1	16	25 Year	198.00	4578.28	4579.08	4579.49	4580.61	0.022522	9.92	19.96	45.33	2.63
Reach-1	16	50 Year	276.00	4578.28	4579.24	4579.67	4580.76	0.018671	9.90	27.89	55.25	2.45
Reach-1	16	100 Year	372.00	4578.28	4579.30	4579.84	4581.43	0.023973	11.69	31.81	59.16	2.81
Reach-1	15	10 Year	115.00	4578.00	4578.82	4578.82	4579.03	0.003325	3.64	31.62	77.14	1.00
Reach-1	15	25 Year	198.00	4578.00	4579.01	4579.01	4579.28	0.003237	4.13	47.95	94.74	1.02
Reach-1	15	50 Year	276.00	4578.00	4579.16	4579.16	4579.46	0.003007	4.37	63.19	108.58	1.01
Reach-1	15	100 Year	372.00	4578.00	4579.31	4579.31	4579.65	0.002950	4.68	79.54	121.62	1.02
Reach-1	14	10 Year	115.00	4564.07	4564.37	4564.80	4574.93	0.676802	26.09	4.41	30.16	12.02
Reach-1	14	25 Year	198.00	4564.07	4564.47	4564.91	4573.72	0.477394	24.41	8.11	47.18	10.38
Reach-1	14	50 Year	276.00	4564.07	4564.52	4565.00	4574.16	0.503833	24.92	11.07	65.01	10.64
Reach-1	14	100 Year	372.00	4564.07	4564.59	4565.09	4573.35	0.337650	23.76	15.66	73.14	9.05
Reach-1	13	10 Year	115.00	4558.26	4558.58	4558.69	4558.94	0.020442	4.83	23.83	148.42	2.12
Reach-1	13	25 Year	198.00	4558.26	4558.64	4558.79	4559.21	0.022364	6.07	32.64	154.43	2.32
Reach-1	13	50 Year	276.00	4558.26	4558.69	4558.89	4559.38	0.020681	6.68	41.30	159.31	2.31
Reach-1	13	100 Year	372.00	4558.26	4558.75	4558.99	4559.59	0.020074	7.37	50.46	164.31	2.34
Reach-1	12	10 Year	115.00	4550.00	4551.65	4552.51	4554.01	0.011609	11.81	9.74	9.62	2.07
Reach-1	12	25 Year	198.00	4550.00	4552.42	4553.18	4554.81	0.008956	12.40	15.97	12.01	1.89
Reach-1	12	50 Year	276.00	4550.00	4552.84	4553.67	4555.42	0.007849	12.69	21.42	13.72	1.82
Reach-1	12	100 Year	372.00	4550.00	4553.31	4554.36	4556.00	0.006765	13.18	28.23	15.59	1.73
Reach-1	11	10 Year	115.00	4546.00	4546.89	4547.62	4549.59	0.019550	13.18	8.73	11.11	2.62
Reach-1	11	25 Year	198.00	4546.00	4547.24	4548.30	4550.98	0.018734	15.63	12.75	12.12	2.67
Reach-1	11	50 Year	276.00	4546.00	4547.53	4548.79	4551.92	0.017474	16.81	16.42	13.06	2.64
Reach-1	11	100 Year	372.00	4546.00	4547.85	4549.26	4552.83	0.016248	17.90	20.78	14.16	2.60
Reach-1	10	10 Year	115.00	4542.00	4542.14	4542.23	4542.45	0.022612	4.51	25.49	189.42	2.17
Reach-1	10	25 Year	198.00	4542.00	4542.17	4542.32	4542.76	0.031252	6.18	32.06	189.55	2.65
Reach-1	10	50 Year	276.00	4542.00	4542.19	4542.41	4543.09	0.040444	7.62	36.23	189.64	3.07
Reach-1	10	100 Year	372.00	4542.00	4542.21	4542.50	4543.55	0.052334	9.27	40.12	189.72	3.55
Reach-1	9	10 Year	115.00	4540.80	4541.52	4541.62	4541.70	0.003409	3.37	34.17	94.70	0.99
Reach-1	9	25 Year	198.00	4540.80	4541.69	4541.69	4541.92	0.003311	3.81	51.93	116.74	1.01
Reach-1	9	50 Year	276.00	4540.80	4541.82	4541.82	4542.07	0.003074	4.07	67.84	130.86	1.00
Reach-1	9	100 Year	372.00	4540.80	4541.92	4541.92	4542.24	0.003352	4.60	80.93	138.69	1.06
Reach-1	8	10 Year	115.00	4533.18	4533.54	4534.06	4538.31	0.178314	17.53	6.56	29.60	6.56
Reach-1	8	25 Year	198.00	4533.18	4533.67	4534.27	4538.71	0.126052	18.01	10.99	36.68	5.80
Reach-1	8	50 Year	276.00	4533.18	4533.77	4534.45	4539.08	0.105766	18.49	14.93	41.98	5.46
Reach-1	8	100 Year	372.00	4533.18	4533.89	4534.66	4539.16	0.084460	18.43	20.19	48.16	5.01
Reach-1	7	10 Year	115.00	4532.00	4532.32	4532.52	4533.02	0.021878	6.72	17.11	68.21	2.37
Reach-1	7	25 Year	198.00	4532.00	4532.41	4532.71	4533.48	0.024858	8.29	23.90	76.63	2.61
Reach-1	7	50 Year	276.00	4532.00	4532.48	4532.84	4533.86	0.027099	9.42	29.30	82.72	2.79
Reach-1	7	100 Year	372.00	4532.00	4532.56	4532.97	4534.24	0.028291	10.42	35.69	89.39	2.91
Reach-1	6	10 Year	115.00	4530.00	4530.59	4530.66	4530.99	0.004857	5.11	22.50	43.16	1.25
Reach-1	6	25 Year	198.00	4530.00	4530.81	4530.94	4531.38	0.004614	6.04	32.76	46.87	1.27
Reach-1	6	50 Year	276.00	4530.00	4530.99	4531.17	4531.69	0.004522	6.69	41.23	49.70	1.30
Reach-1	6	100 Year	372.00	4530.00	4531.17	4531.39	4532.01	0.004473	7.34	50.67	52.63	1.32
Reach-1	5	10 Year	115.00	4530.00	4530.32	4530.34	4530.52	0.004494	3.57	32.19	100.81	1.11
Reach-1	5	25 Year	198.00	4530.00	4530.38	4530.51	4530.81	0.008190	5.30	37.32	101.24	1.54
Reach-1	5	50 Year	276.00	4530.00	4530.42	4530.63	4531.09	0.010858	6.58	41.93	101.62	1.81
Reach-1	5	100 Year	372.00	4530.00	4530.49	4530.76	4531.39	0.012038	7.63	48.75	102.16	1.95
Reach-1	4	10 Year	115.00	4528.19	4528.72	4528.99	4529.74	0.027483	8.11	14.17	50.51	2.70
Reach-1	4	25 Year	198.00	4528.19	4528.92	4529.23	4529.94	0.014291	8.11	24.42	53.16	2.11
Reach-1	4	50 Year	276.00	4528.19	4529.06	4529.42	4530.19	0.011484	8.54	32.33	55.12	1.96
Reach-1	4	100 Year	372.00	4528.19	4529.21	4529.60	4530.51	0.010177	9.14	40.71	57.14	1.91

HEC-RAS Plan: 6NC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3	10 Year	116.00	4522.00	4522.72	4522.97	4523.46	0.012068	6.87	16.73	41.28	1.90
Reach-1	3	25 Year	198.00	4522.00	4522.83	4523.25	4524.16	0.018471	9.26	21.38	46.40	2.40
Reach-1	3	50 Year	276.00	4522.00	4522.92	4523.39	4524.69	0.021491	10.67	25.86	50.85	2.64
Reach-1	3	100 Year	372.00	4522.00	4523.04	4523.53	4525.10	0.024191	11.54	32.22	61.54	2.81
Reach-1	2	10 Year	116.00	4520.00	4520.63	4520.81	4521.19	0.008041	6.00	19.16	42.31	1.57
Reach-1	2	25 Year	198.00	4520.00	4520.85	4521.08	4521.56	0.006860	6.76	29.29	47.85	1.52
Reach-1	2	50 Year	276.00	4520.00	4521.00	4521.26	4521.87	0.006838	7.48	36.91	51.63	1.56
Reach-1	2	100 Year	372.00	4520.00	4521.17	4521.49	4522.19	0.006624	8.08	46.01	55.79	1.57
Reach-1	1	10 Year	116.00	4520.00	4520.38	4520.65	4521.28	0.017919	7.59	15.16	43.00	2.25
Reach-1	1	25 Year	198.00	4520.00	4520.68	4520.90	4521.42	0.007503	6.93	28.56	48.04	1.58
Reach-1	1	50 Year	276.00	4520.00	4520.89	4521.10	4521.66	0.005553	7.01	39.35	51.74	1.42
Reach-1	1	100 Year	372.00	4520.00	4521.13	4521.32	4521.92	0.004365	7.12	52.22	55.84	1.30

HEC-RAS Plan: 12NC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	221.00	4595.53	4595.98	4596.37	4597.79	0.044968	10.80	20.47	68.61	3.49
Reach-1	18	25 Year	361.00	4595.53	4596.09	4596.62	4598.64	0.044989	12.62	28.16	73.20	3.64
Reach-1	18	50 Year	493.00	4595.53	4596.17	4596.82	4599.35	0.044986	14.31	34.46	76.97	3.74
Reach-1	18	100 Year	665.00	4595.53	4596.27	4597.05	4600.20	0.045046	15.92	41.76	78.57	3.85
Reach-1	17	10 Year	221.00	4586.00	4586.30	4586.82	4587.65	0.036494	9.34	23.67	84.64	3.11
Reach-1	17	25 Year	361.00	4586.00	4586.38	4586.84	4588.56	0.043861	11.84	30.48	87.57	3.54
Reach-1	17	50 Year	493.00	4586.00	4586.45	4587.01	4589.20	0.044350	13.29	37.08	90.32	3.66
Reach-1	17	100 Year	665.00	4586.00	4586.54	4587.21	4589.96	0.044960	14.84	44.80	93.43	3.78
Reach-1	16	10 Year	221.00	4578.28	4579.09	4579.55	4580.89	0.026344	10.77	20.52	46.33	2.85
Reach-1	16	25 Year	361.00	4578.28	4579.28	4579.83	4581.46	0.025055	11.84	30.48	57.48	2.87
Reach-1	16	50 Year	493.00	4578.28	4579.41	4580.06	4581.93	0.025507	12.72	38.75	66.54	2.94
Reach-1	16	100 Year	665.00	4578.28	4579.55	4580.24	4582.49	0.026007	13.77	48.31	74.78	3.02
Reach-1	15	10 Year	221.00	4578.00	4579.06	4579.06	4579.34	0.003119	4.19	52.78	99.34	1.01
Reach-1	15	25 Year	361.00	4578.00	4579.29	4579.29	4579.63	0.002945	4.64	77.83	120.32	1.02
Reach-1	15	50 Year	493.00	4578.00	4579.47	4579.47	4579.84	0.002774	4.91	100.46	136.48	1.01
Reach-1	15	100 Year	665.00	4578.00	4579.66	4579.66	4580.08	0.002672	5.21	127.60	154.00	1.01
Reach-1	14	10 Year	221.00	4564.07	4564.48	4564.95	4573.91	0.500234	24.64	8.97	53.29	10.58
Reach-1	14	25 Year	361.00	4564.07	4564.59	4565.08	4572.24	0.289085	22.19	16.27	74.96	8.39
Reach-1	14	50 Year	493.00	4564.07	4564.61	4565.21	4576.82	0.440818	28.04	17.58	78.30	10.43
Reach-1	14	100 Year	665.00	4564.07	4564.68	4565.35	4577.23	0.423555	28.43	23.39	98.99	10.31
Reach-1	13	10 Year	221.00	4558.26	4558.67	4558.83	4559.16	0.016313	5.72	38.67	157.84	2.04
Reach-1	13	25 Year	361.00	4558.26	4558.77	4558.97	4559.47	0.015763	6.73	53.62	166.63	2.09
Reach-1	13	50 Year	493.00	4558.26	4558.79	4559.09	4559.91	0.023103	8.48	58.15	170.55	2.56
Reach-1	13	100 Year	665.00	4558.26	4558.89	4559.23	4560.10	0.019866	8.84	75.23	183.66	2.43
Reach-1	12	10 Year	221.00	4550.00	4552.50	4553.34	4555.13	0.009451	13.02	16.98	12.35	1.96
Reach-1	12	25 Year	361.00	4550.00	4553.22	4554.34	4556.02	0.007257	13.42	26.90	15.24	1.78
Reach-1	12	50 Year	493.00	4550.00	4554.21	4554.51	4555.20	0.010365	7.95	62.03	108.28	1.85
Reach-1	12	100 Year	665.00	4550.00	4554.33	4554.71	4555.67	0.011040	8.95	74.34	113.84	1.95
Reach-1	11	10 Year	221.00	4546.00	4547.33	4548.47	4551.25	0.018041	15.88	13.91	12.40	2.64
Reach-1	11	25 Year	361.00	4546.00	4547.82	4549.22	4552.72	0.016335	17.78	20.31	14.04	2.60
Reach-1	11	50 Year	493.00	4546.00	4548.59	4549.66	4551.97	0.009833	14.75	33.41	21.12	2.07
Reach-1	11	100 Year	665.00	4546.00	4549.09	4550.11	4552.41	0.009035	14.64	45.44	27.52	2.01
Reach-1	10	10 Year	221.00	4542.00	4542.18	4542.36	4542.86	0.034443	6.64	33.26	189.58	2.80
Reach-1	10	25 Year	361.00	4542.00	4542.20	4542.49	4543.64	0.062062	9.64	37.43	189.67	3.83
Reach-1	10	50 Year	493.00	4542.00	4542.21	4542.59	4544.71	0.102532	12.70	38.82	189.69	4.95
Reach-1	10	100 Year	665.00	4542.00	4542.25	4542.74	4545.38	0.100286	14.21	46.79	189.86	5.05
Reach-1	9	10 Year	221.00	4540.80	4541.73	4541.73	4541.97	0.003354	3.94	56.11	121.35	1.02
Reach-1	9	25 Year	361.00	4540.80	4541.94	4541.94	4542.22	0.002836	4.30	84.00	140.48	0.98
Reach-1	9	50 Year	493.00	4540.80	4542.07	4542.07	4542.42	0.002793	4.76	103.51	146.66	1.00
Reach-1	9	100 Year	665.00	4540.80	4542.24	4542.24	4542.66	0.002537	5.19	128.24	148.58	0.98
Reach-1	8	10 Year	221.00	4533.18	4533.71	4534.33	4538.77	0.116865	18.06	12.24	38.44	5.64
Reach-1	8	25 Year	361.00	4533.18	4533.87	4534.61	4539.43	0.092807	18.92	19.08	46.92	5.23
Reach-1	8	50 Year	493.00	4533.18	4534.00	4534.69	4539.71	0.074951	19.19	25.70	52.70	4.84
Reach-1	8	100 Year	665.00	4533.18	4534.14	4535.19	4540.15	0.060340	19.68	33.80	56.62	4.49
Reach-1	7	10 Year	221.00	4532.00	4532.44	4532.76	4533.59	0.025460	8.63	25.60	78.60	2.67
Reach-1	7	25 Year	361.00	4532.00	4532.64	4532.95	4534.23	0.028946	10.42	34.65	88.33	2.93
Reach-1	7	50 Year	493.00	4532.00	4532.83	4533.13	4534.74	0.031046	11.67	42.24	95.74	3.10
Reach-1	7	100 Year	665.00	4532.00	4532.71	4533.30	4535.39	0.034145	13.13	50.65	103.33	3.30
Reach-1	6	10 Year	221.00	4530.00	4530.87	4531.02	4531.48	0.004571	6.25	35.37	47.77	1.28
Reach-1	6	25 Year	361.00	4530.00	4531.15	4531.37	4531.98	0.004486	7.28	49.59	52.31	1.32
Reach-1	6	50 Year	493.00	4530.00	4531.37	4531.60	4532.37	0.004468	8.02	61.50	55.81	1.35
Reach-1	6	100 Year	665.00	4530.00	4531.61	4531.96	4532.83	0.004564	8.85	75.13	59.57	1.39
Reach-1	5	10 Year	221.00	4530.00	4530.39	4530.54	4530.69	0.008901	5.68	38.91	101.37	1.62
Reach-1	5	25 Year	361.00	4530.00	4530.48	4530.75	4531.36	0.011986	7.53	47.95	102.11	1.94
Reach-1	5	50 Year	493.00	4530.00	4530.57	4530.91	4531.73	0.012600	8.63	57.11	102.86	2.04
Reach-1	5	100 Year	665.00	4530.00	4530.67	4531.11	4532.16	0.013069	9.80	67.85	103.74	2.14
Reach-1	4	10 Year	221.00	4528.19	4528.96	4529.27	4530.01	0.013113	8.21	26.90	53.79	2.05
Reach-1	4	25 Year	361.00	4528.19	4529.19	4529.59	4530.47	0.010285	9.07	39.80	56.91	1.91
Reach-1	4	50 Year	493.00	4528.19	4529.37	4529.84	4530.87	0.009351	9.81	50.27	59.41	1.88
Reach-1	4	100 Year	665.00	4528.19	4529.58	4530.12	4531.33	0.008772	10.63	62.54	62.20	1.87

HEC-RAS Plan: 12NC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3	10 Year	221.00	4522.00	4522.66	4523.30	4524.33	0.019606	9.74	22.69	47.74	2.49
Reach-1	3	25 Year	361.00	4522.00	4523.02	4523.51	4525.06	0.023984	11.45	31.54	60.61	2.60
Reach-1	3	50 Year	493.00	4522.00	4523.18	4523.68	4525.44	0.028221	12.14	40.62	80.72	3.02
Reach-1	3	100 Year	665.00	4522.00	4523.27	4523.89	4525.92	0.031164	13.06	50.90	97.47	3.19
Reach-1	2	10 Year	221.00	4520.00	4520.90	4521.14	4521.66	0.006824	6.98	31.65	49.06	1.53
Reach-1	2	25 Year	361.00	4520.00	4521.16	4521.47	4522.16	0.006630	8.02	45.04	65.36	1.57
Reach-1	2	50 Year	493.00	4520.00	4521.38	4521.72	4522.51	0.006103	8.53	57.82	80.77	1.54
Reach-1	2	100 Year	665.00	4520.00	4521.61	4522.02	4522.92	0.005909	9.18	72.45	66.41	1.55
Reach-1	1	10 Year	221.00	4520.00	4520.77	4520.98	4521.46	0.006000	6.68	33.07	49.62	1.44
Reach-1	1	25 Year	361.00	4520.00	4521.14	4521.32	4521.87	0.004030	6.87	52.58	55.95	1.25
Reach-1	1	50 Year	493.00	4520.00	4521.40	4521.58	4522.22	0.003617	7.30	67.57	60.36	1.22
Reach-1	1	100 Year	665.00	4520.00	4521.71	4521.89	4522.61	0.003174	7.64	87.07	65.65	1.17

HEC-RAS Plan: 24NC River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18	10 Year	351.00	4595.53	4596.08	4596.60	4598.59	0.044961	12.69	27.66	72.97	3.83
Reach-1	18	25 Year	552.00	4595.53	4596.21	4596.91	4599.66	0.045089	14.90	37.04	76.92	3.79
Reach-1	18	50 Year	746.00	4595.53	4596.31	4597.14	4600.57	0.045013	16.67	45.03	79.68	3.88
Reach-1	18	100 Year	980.00	4595.53	4596.42	4597.40	4601.57	0.044993	18.21	53.82	82.64	3.98
Reach-1	17	10 Year	351.00	4586.00	4586.37	4586.83	4588.51	0.043927	11.73	29.93	87.34	3.53
Reach-1	17	25 Year	552.00	4586.00	4586.48	4587.08	4589.46	0.044527	13.86	39.83	91.44	3.70
Reach-1	17	50 Year	746.00	4586.00	4586.57	4587.28	4590.29	0.045186	15.48	48.20	94.77	3.82
Reach-1	17	100 Year	980.00	4586.00	4586.67	4587.51	4591.18	0.045874	17.05	57.49	98.90	3.94
Reach-1	16	10 Year	351.00	4578.28	4579.27	4579.61	4581.42	0.025044	11.75	29.86	56.96	2.86
Reach-1	16	25 Year	552.00	4578.28	4579.46	4580.14	4582.13	0.025715	13.11	42.11	69.54	2.97
Reach-1	16	50 Year	746.00	4578.28	4579.60	4580.33	4582.74	0.026253	14.20	52.53	78.14	3.05
Reach-1	16	100 Year	980.00	4578.28	4579.74	4580.54	4583.39	0.026984	15.32	63.95	86.56	3.14
Reach-1	15	10 Year	351.00	4578.00	4579.28	4579.28	4579.61	0.002953	4.61	76.13	119.02	1.02
Reach-1	15	25 Year	552.00	4578.00	4579.53	4579.53	4579.93	0.002752	5.03	109.66	142.53	1.01
Reach-1	15	50 Year	746.00	4578.00	4579.73	4579.73	4580.17	0.002650	5.34	139.69	161.52	1.01
Reach-1	15	100 Year	980.00	4578.00	4579.70	4579.93	4580.53	0.005103	7.31	134.00	158.03	1.40
Reach-1	14	10 Year	351.00	4564.07	4564.59	4565.07	4572.32	0.296746	22.32	15.73	73.27	8.49
Reach-1	14	25 Year	552.00	4564.07	4564.66	4565.25	4575.02	0.345111	25.84	21.36	89.49	9.32
Reach-1	14	50 Year	746.00	4564.07	4564.75	4565.40	4572.66	0.300633	22.65	32.64	148.22	8.58
Reach-1	14	100 Year	980.00	4564.07	4564.80	4565.56	4574.25	0.291082	24.67	39.72	156.94	8.64
Reach-1	13	10 Year	351.00	4558.26	4558.76	4558.97	4559.45	0.015812	6.66	52.56	165.95	2.09
Reach-1	13	25 Year	552.00	4558.26	4558.86	4559.14	4559.82	0.016428	7.86	70.19	178.43	2.21
Reach-1	13	50 Year	746.00	4558.26	4558.96	4559.28	4560.09	0.015635	8.55	87.25	188.67	2.21
Reach-1	13	100 Year	980.00	4558.26	4559.03	4559.44	4560.47	0.017007	9.62	101.83	196.27	2.35
Reach-1	12	10 Year	351.00	4550.00	4553.17	4554.34	4555.97	0.007380	13.41	26.18	15.05	1.79
Reach-1	12	25 Year	552.00	4550.00	4554.23	4554.57	4555.40	0.012102	8.68	63.67	108.99	2.00
Reach-1	12	50 Year	746.00	4550.00	4554.36	4554.77	4555.78	0.012041	9.56	78.04	115.46	2.05
Reach-1	12	100 Year	980.00	4550.00	4554.51	4554.99	4556.13	0.011357	10.22	95.91	122.99	2.04
Reach-1	11	10 Year	351.00	4546.00	4547.79	4549.18	4552.63	0.016438	17.67	19.86	13.93	2.61
Reach-1	11	25 Year	552.00	4546.00	4548.79	4549.83	4552.09	0.009234	14.55	37.95	23.46	2.02
Reach-1	11	50 Year	746.00	4546.00	4549.29	4550.30	4552.58	0.008743	14.66	51.22	30.59	1.98
Reach-1	11	100 Year	980.00	4546.00	4549.73	4550.79	4553.21	0.007657	14.99	65.38	33.87	1.90
Reach-1	10	10 Year	351.00	4542.00	4542.21	4542.47	4543.45	0.049963	8.94	39.28	189.70	3.46
Reach-1	10	25 Year	552.00	4542.00	4542.21	4542.65	4545.13	0.113481	13.70	40.30	189.73	5.24
Reach-1	10	50 Year	746.00	4542.00	4542.25	4542.79	4545.98	0.114473	15.48	48.18	189.89	5.42
Reach-1	10	100 Year	980.00	4542.00	4542.29	4542.93	4547.10	0.122038	17.60	55.69	190.04	5.73
Reach-1	9	10 Year	351.00	4540.80	4541.91	4541.91	4542.21	0.003035	4.36	80.46	136.42	1.01
Reach-1	9	25 Year	552.00	4540.80	4542.14	4542.14	4542.51	0.002584	4.85	113.71	147.53	0.97
Reach-1	9	50 Year	746.00	4540.80	4542.29	4542.29	4542.76	0.002643	5.49	135.95	149.13	1.01
Reach-1	9	100 Year	980.00	4540.80	4542.44	4542.50	4543.04	0.002777	6.18	158.49	150.73	1.06
Reach-1	8	10 Year	351.00	4533.18	4533.86	4534.62	4539.28	0.091559	16.69	18.78	46.58	5.19
Reach-1	8	25 Year	552.00	4533.18	4534.05	4535.01	4539.92	0.073581	19.46	28.37	56.19	4.83
Reach-1	8	50 Year	746.00	4533.18	4534.21	4535.32	4540.25	0.052560	19.71	37.84	56.94	4.26
Reach-1	8	100 Year	980.00	4533.18	4534.41	4535.66	4540.56	0.038662	19.90	49.25	57.82	3.80
Reach-1	7	10 Year	351.00	4532.00	4532.64	4532.95	4534.18	0.028440	10.27	34.18	87.85	2.90
Reach-1	7	25 Year	552.00	4532.00	4532.66	4533.19	4534.94	0.031534	12.11	45.57	98.81	3.14
Reach-1	7	50 Year	746.00	4532.00	4532.74	4533.41	4535.68	0.035574	13.75	54.24	108.40	3.40
Reach-1	7	100 Year	980.00	4532.00	4532.83	4533.63	4536.59	0.038332	15.57	62.96	108.42	3.60
Reach-1	6	10 Year	351.00	4530.00	4531.14	4531.35	4531.94	0.004487	7.21	48.65	62.02	1.31
Reach-1	6	25 Year	552.00	4530.00	4531.46	4531.75	4532.53	0.004469	8.30	66.49	67.21	1.36
Reach-1	6	50 Year	746.00	4530.00	4531.71	4532.10	4533.03	0.004642	9.22	80.94	61.10	1.41
Reach-1	6	100 Year	980.00	4530.00	4531.93	4532.41	4533.58	0.005087	10.32	94.93	64.64	1.50
Reach-1	5	10 Year	351.00	4530.00	4530.47	4530.74	4531.33	0.011869	7.43	47.25	102.06	1.92
Reach-1	5	25 Year	552.00	4530.00	4530.60	4530.98	4531.89	0.012869	9.08	60.78	103.16	2.09
Reach-1	5	50 Year	746.00	4530.00	4530.72	4531.17	4532.35	0.013067	10.24	72.82	104.14	2.18
Reach-1	5	100 Year	980.00	4530.00	4530.85	4531.44	4532.86	0.013145	11.39	86.01	105.20	2.22
Reach-1	4	10 Year	351.00	4528.19	4529.18	4529.58	4530.43	0.010290	8.98	39.07	56.74	1.91
Reach-1	4	25 Year	552.00	4528.19	4529.45	4529.94	4531.03	0.009100	10.10	54.63	60.42	1.87
Reach-1	4	50 Year	746.00	4528.19	4529.67	4530.24	4531.53	0.008534	10.95	68.12	63.43	1.86
Reach-1	4	100 Year	980.00	4528.19	4529.89	4530.56	4532.06	0.008180	11.82	82.94	66.59	1.87

HEC-RAS Plan: 24NC River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3	10 Year	351.00	4522.00	4523.01	4523.49	4525.02	0.023928	11.38	30.83	59.64	2.79
Reach-1	3	25 Year	552.00	4522.00	4523.20	4523.74	4525.61	0.029649	12.45	44.34	87.98	3.09
Reach-1	3	50 Year	746.00	4522.00	4523.31	4523.96	4526.16	0.031965	13.54	55.12	101.98	3.24
Reach-1	3	100 Year	980.00	4522.00	4523.42	4524.19	4526.85	0.031364	14.87	65.89	104.24	3.30
Reach-1	2	10 Year	351.00	4520.00	4521.14	4521.45	4522.12	0.006633	7.95	44.15	64.97	1.56
Reach-1	2	25 Year	552.00	4520.00	4521.46	4521.85	4522.65	0.005979	8.74	63.14	62.88	1.54
Reach-1	2	50 Year	746.00	4520.00	4521.70	4522.14	4523.09	0.005897	9.47	78.75	68.70	1.56
Reach-1	2	100 Year	980.00	4520.00	4521.91	4522.42	4523.61	0.006266	10.45	93.82	73.89	1.63
Reach-1	1	10 Year	351.00	4520.00	4521.09	4521.28	4521.86	0.004487	7.06	49.73	55.07	1.31
Reach-1	1	25 Year	552.00	4520.00	4521.50	4521.68	4522.37	0.003488	7.46	74.00	62.15	1.20
Reach-1	1	50 Year	746.00	4520.00	4521.82	4522.00	4522.78	0.003137	7.87	94.82	67.73	1.17
Reach-1	1	100 Year	980.00	4520.00	4522.15	4522.31	4523.22	0.002836	8.32	117.72	71.37	1.14

1 Hour Storm Events
245 cfs Flow Through Sierra
Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4578.42
25	40	4578.54
50	60	4578.64
100	86	4578.72

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4541.16
25	40	4541.27
50	60	4541.36
100	86	4541.44

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4533.32
25	40	4533.38
50	60	4533.42
100	86	4533.48

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4530.33
25	40	4530.41
50	60	4530.39
100	86	4530.49

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4528.44
25	40	4528.51
50	60	4528.68
100	86	4528.67

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4520.46
25	40	4520.6
50	60	4520.71
100	86	4520.54

*Taken from cross section 2

6 Hour Storm Events
245 cfs Flow Through Sierra
Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4578.58
25	72	4578.69
50	93	4578.76
100	118	4578.83

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4541.31
25	72	4541.39
50	93	4541.47
100	118	4541.53

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4533.4
25	72	4533.46
50	93	4533.51
100	118	4533.54

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4530.44
25	72	4530.44
50	93	4530.51
100	118	4530.6

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4528.54
25	72	4528.68
50	93	4528.66
100	118	4528.73

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
10	48	4520.65
25	72	4520.78
50	93	4520.56
100	118	4520.64

*Taken from cross section 2

12 Hour Storm Events
245 cfs Flow Through Sierra
Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4578.65
25	101	4578.78
50	211	4579.04
100	299	4579.2

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4541.36
25	101	4541.48
50	211	4541.72
100	299	4541.85

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4533.44
25	101	4533.52
50	211	4533.69
100	299	4533.8

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4530.4
25	101	4530.54
50	211	4530.85
100	299	4531.04

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4528.68
25	101	4528.68
50	211	4528.94
100	299	4529.1

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
10	63	4520.72
25	101	4520.58
50	211	4520.88
100	299	4521.05

*Taken from cross section 2

24 Hour Storm Events
245 cfs Flow Through Sierra
Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4578.77
25	239	4579.1
50	449	4579.41
100	686	4579.67

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4541.47
25	239	4541.77
50	449	4542.03
100	686	4542.25

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4533.51
25	239	4533.72
50	449	4533.96
100	686	4534.16

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4530.53
25	239	4530.91
50	449	4531.3
100	686	4531.64

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4528.67
25	239	4529
50	449	4529.32
100	686	4529.6

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
10	98	4520.57
25	239	4520.94
50	449	4521.3
100	686	4521.63

*Taken from cross section 2

1 Hour Storm Events
Assumed No Flow Through
Sierra Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4578.42
25	40	4578.54
50	83	4578.72
100	179	4578.98

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4541.16
25	40	4541.27
50	83	4541.43
100	179	4541.66

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4533.32
25	40	4533.38
50	83	4533.48
100	179	4533.64

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4530.33
25	40	4530.41
50	83	4530.48
100	179	4530.77

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4528.44
25	40	4528.51
50	83	4528.66
100	179	4528.87

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
5	21	4520.46
25	40	4520.6
50	83	4520.53
100	179	4520.81

*Taken from cross section 2

6 Hour Storm Events
Assumed No Flow Through
Sierra Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4578.82
25	198	4579.01
50	276	4579.16
100	372	4579.31

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4541.52
25	198	4541.69
50	276	4541.82
100	372	4541.92

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4533.54
25	198	4533.67
50	276	4533.77
100	372	4533.89

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4530.59
25	198	4530.81
50	276	4530.99
100	372	4531.17

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4528.72
25	198	4528.92
50	276	4529.06
100	372	4529.21

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
10	115	4520.63
25	198	4520.85
50	276	4521
100	372	4521.17

*Taken from cross section 2

12 Hour Storm Events
Assumed No Flow Through
Sierra Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4579.06
25	361	4579.29
50	493	4573.47
100	665	4579.66

*Taken from cross section 15

Ansari Business Building, Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4541.73
25	361	4541.94
50	493	4542.07
100	665	4542.24

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4533.71
25	361	4533.87
50	493	4534
100	665	4534.14

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4530.87
25	361	4531.15
50	493	4531.37
100	665	4531.61

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4528.96
25	361	4529.19
50	493	4529.37
100	665	4529.58

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
10	221	4520.9
25	361	4521.16
50	493	4521.38
100	665	4521.61

*Taken from cross section 2

24 Hour Storm Events
Assumed No Flow Through
Sierra Street Culvert/Stormdrain

Lawlor Events Center, Elevation=4596		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4579.28
25	552	4579.53
50	746	4579.73
100	980	4579.7

*Taken from cross section 15

Ansari Business Building , Elevation=4542		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4541.91
25	552	4542.14
50	746	4542.29
100	980	4542.44

*Taken from cross section 9

Central Heat Plant, Elevation=4534		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4533.86
25	552	4534.05
50	746	4534.21
100	980	4534.41

*Taken from cross section 8

Scrugham Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4531.14
25	552	4531.46
50	746	4531.71
100	980	4531.93

*Taken from cross section 6

Palmer Engineering Building, Elevation=4530		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4529.18
25	552	4529.45
50	746	4529.67
100	980	4529.89

*Taken from cross section 4

Fleischmann Agriculture Building, Elevation=4520		
Return Period (yr)	Flow (cfs)	WS Elev
5	351	4521.14
25	552	4521.46
50	746	4521.7
100	980	4521.91

*Taken from cross section 2