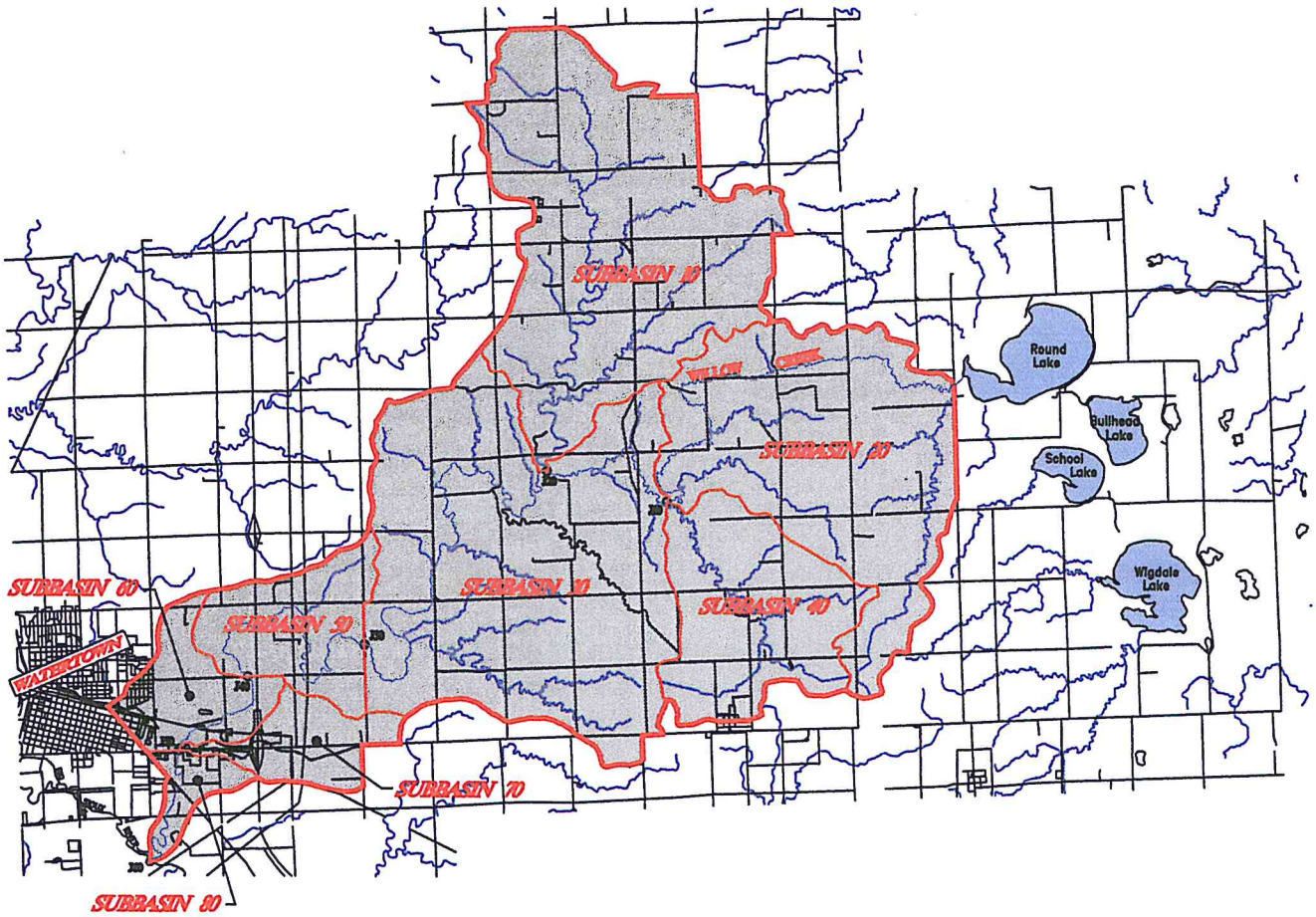
WILLOW CREEK FLOODPLAIN STUDY



Prepared For

CITY OF WATERTOWN, SD

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Brookings, South Dakota

SEPTEMBER 2004

(REVISION OF MARCH 2001 REPORT)

#7927

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WILLOW CREEK FLOOD PLAIN STUDY

1. INTRODUCTION

1.1 Purpose of Study

The purpose of this Willow Creek Flood Plain Study is to investigate the existence and severity of flood hazards along Willow Creek within the City of Watertown and Codington County in South Dakota. The area studied begins at the confluence of Willow Creek and the Big Sioux River then follows Willow Creek upstream approximately 7.5 miles. This study has developed flood risk data along Willow Creek. As the area develops this study can be used as a tool to restrict development in certain areas along the floodplain. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

1.2 Coordination

The storm events to be studied were established in a Coordination meeting held on July 30, 1997. Two other flood plain studies within the City of Watertown have been completed by other Agencies including the Corps of Engineers and Federal Emergency Management Agency (FEMA). The floodway elevations were not the same at the confluence with Willow Creek. A subsequent coordination meeting was set up in Watertown with FEMA to discuss the differences and to determine what elevation should be used for Willow Creek Floodplain. At this meeting with FEMA, the City of Watertown was informed that the Big Sioux River Floodplain Study would be redone. However at the time of this Willow Creek Floodplain Study, the City of Watertown is actively searching for flood control alternatives that will reduce Big Sioux River flow rates that enter Lake Kampeska and the Watertown reach of the Big Sioux River. However it was also noted that the water level of the Big Sioux River is dependent on a

variety of factors which are independent of a storm event which would cause flooding on Willow Creek. Therefore, it is unlikely that the two peak flows will occur at the same time. Based on this information it was decided that normal water depth would be calculated and used for the first cross section on Willow Creek at the confluence with the Big Sioux River. FEMA also stated that gauging station information is the preferred method for establishing flows within a study area. A gauging station existed on Willow Creek from 1972 to 1986. Comparisons have been made to USGS regionalized equations.

1.3 Authority and Acknowledgments

The source of authority for the Willow Creek Floodplain Study is the City Council for the City of Watertown.

The hydrologic and hydraulic analyses for this study were performed by Banner Associates, Inc., for the City of Watertown under a Contract dated September 9, 1997. This work, which was originally completed in August of 1999 and revised in December of 2000, covered all significant flooding sources affecting the City of Watertown along Willow Creek.

2. AREA STUDIED

2.1 Scope of Study

This Flood Plain Study covers the incorporated areas of the City of Watertown, South Dakota and the unincorporated areas of Codington County upstream from the confluence of Willow Creek and the Big Sioux River to the 459th Avenue bridge 1-1/2 miles east of Interstate 29. The area of study is shown on Figure 1 - Drainage Basin Area and Detailed Study Area Map.

Floods caused by precipitation in the Willow Creek drainage basin were studied in detail. The City of Watertown has other flooding sources within the City that have had detailed studies including the Big Sioux River. Those flooding sources are not a part of the scope of services for this flood plain study.

The Willow Creek Flood Plain Study was chosen for detailed study due to the potential for development along the stream banks.

2.2 Community Description

Watertown is located in south central Codington County in northeastern South Dakota. It is situated approximately 100 miles north of Sioux Falls, South Dakota. Watertown is bordered on the northwest by Lake Kampeska and on the southwest by Lake Pelican. The Big Sioux River interconnects these two lakes and flows through Watertown. The 1990 census indicated that Watertown had a population of 17,592. (Reference 1)

The climate on northeastern South Dakota is continental temperate with large daily fluctuations in temperature. The average daily temperature is 42°F. Annual average precipitation of the region is 28 inches. (Reference 2)

2.3 Principal Flood Problems

The principal flood problems in the Willow Creek study area occur just upstream of Highway 212 to the confluence with the Big Sioux River. During the winter of 1996 and 1997 the Watertown area received several feet of snow. The snow pack in the area was approximately 4.9 feet on March 6, 1997 and dropped to 4.6 feet by March 14, 1997. On March 14, 1997 the National Weather Service forecasted major to near record breaking flooding along the Big Sioux River. The City of Watertown received 2.5 inches of rain during a twelve-hour period on April 4 and 5. The combination of the rain and the melting snow pack created a flood event with a recorded peak flow at the USGS gauging site of 3,650 cfs on April 5, 1997. The estimated return period for this flow, based on the log-Pearson Type III analysis is 20.7 years.

The gauging station also recorded flooding along Willow Creek in June of 1984 and March of 1986. The flow values for the events were 1,590 cfs and 2,300 cfs respectively. The estimated return periods for these flows, based on the log-Pearson Type III analyses in this report are 4 years and 7 years respectively. The estimated 100-year flow for Willow Creek at the confluence with the Big Sioux River is 5,575 cfs.

2.4 Flood Protection Measures

The City of Watertown has no flood protection structure on Willow Creek. Round Lake, Bullhead Lake, School Lake, and Wigdale Lake located approximately 13 miles northeast of Watertown provides some storage capacity for flood events. Three 48" diameter culverts control the discharge into Willow Creek from these lakes. The lakes provide a base flow into Willow Creek that ranges from 0 cfs to 450 cfs which is dependent on the water depths in the lakes.

Reference 1: US Census Bureau

Reference 2: Regional Precip.

3. ENGINEERING METHODS

3.1 Basin Description

The study area is located primarily in Codington County, South Dakota. Figure 1 illustrates the outline of the overall drainage boundary as well as the individual subbasins. The watershed has an overall approximate area of 110 square miles with 64.5 square miles below Round Lake. The area is characterized as agricultural land with row crop, small grain and range or pasture land in fair to good condition. The eastern fringe of the City of Watertown lies within the study area in the lower reach of the basin. Other small developments are scattered throughout the southwest portion of the study area. Maximum average channel slope in the basin is 0.6%. The maximum vertical relief is approximately 150 feet.

3.2 Hydrologic Analysis

Data necessary for the hydrologic analysis were obtained from a variety of sources including USGS 7½ minute quadrangle maps, USGS Gauging Station Information, SCS Soil Surveys, Department of Environment and Natural Resources, and field observations.

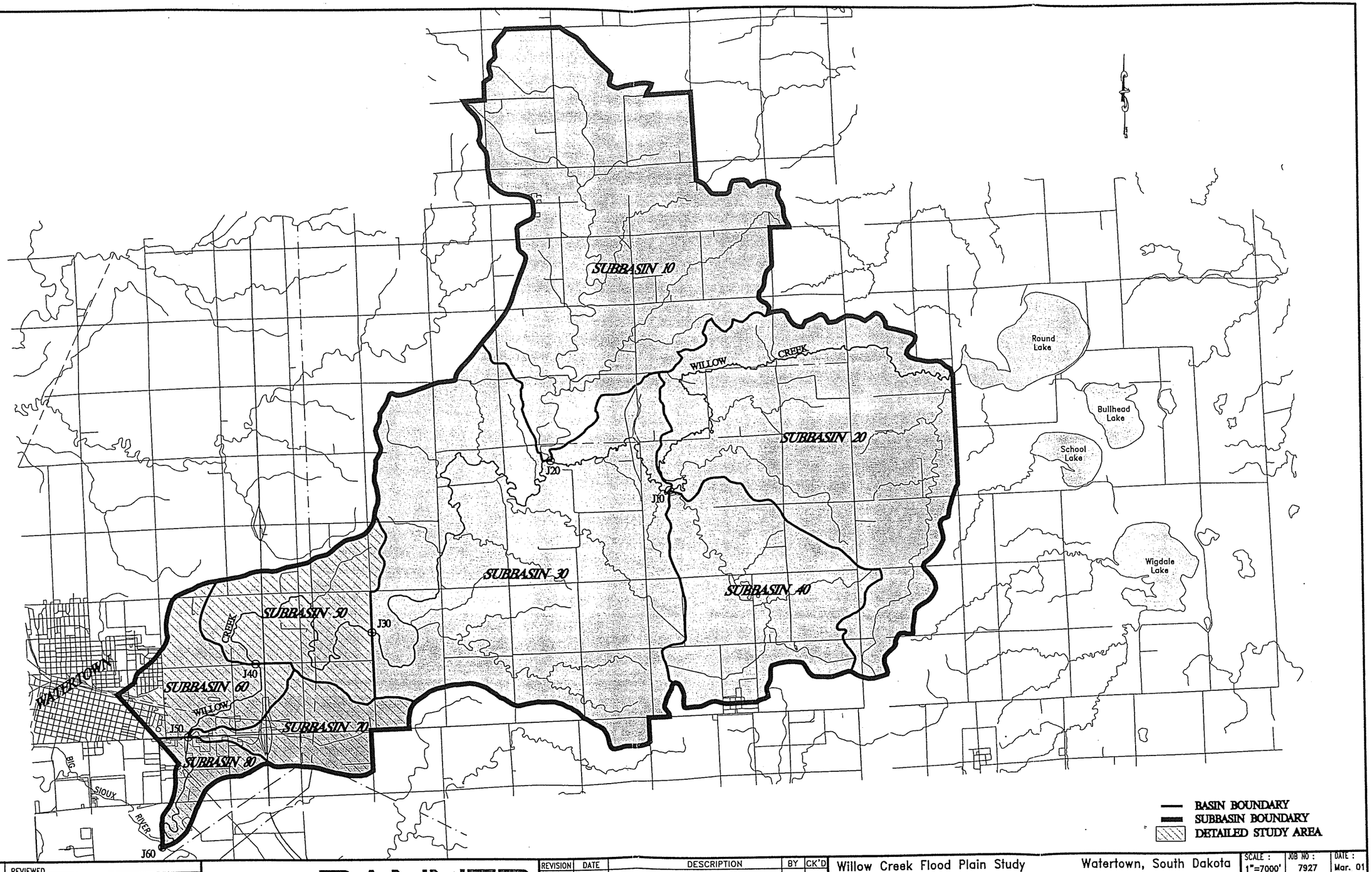
Figure 1 shows the overall watershed, individual subbasins and each junction used for identification in the model. These identifiers are used to develop the model structure within the HEC-1 program.

The analysis was performed utilizing the US Army Corps of Engineer's HEC-1 computer program. The specific HEC-1 program used for this study is an enhanced version called "ProHEC1 Plus 4.0.1PE" marketed by Dodson & Associates, Inc. 1995 and HEC-1E version 4.0.1E marketed by Haestad Methods, Inc.

3.2.1 General Basin Characteristics

The watershed was divided into 8 subbasins with appropriate stream reach routings. The goal of this process was to develop hydrographs at stream channel junctions and at specific design points within the basin. The model schematic diagram of the HEC-1 input is presented on **Figure 2.**

Digitized USGS quadrangle maps were used to determine the basin boundaries and areas, stream course lengths and stream channel slopes. A summary of the basin characteristics is given in Table 1.



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Willow Creek Flood Plain Study Watertown, South Dakota

DRAINAGE BASIN AREA & DETAILED STUDY AREA MAP

SCALE :	JOB NO :	DATE :
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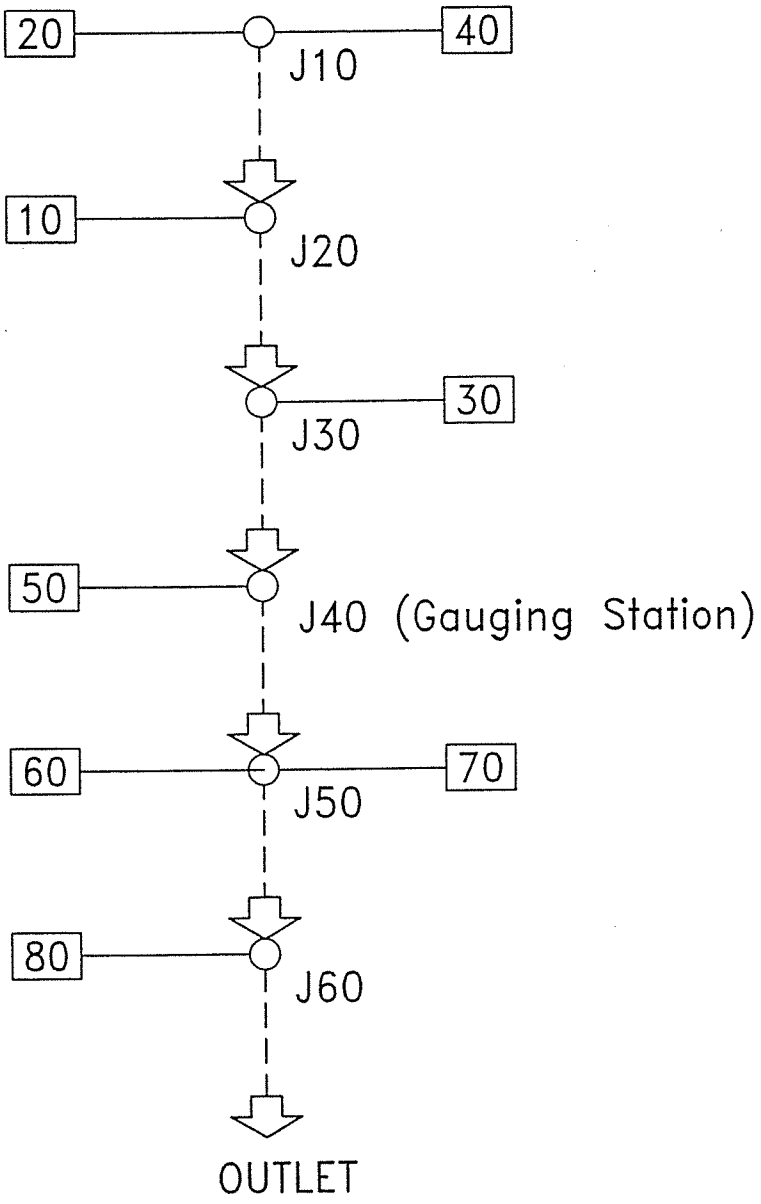
WILLOW CREEK FLOOD PLAIN STUDY



LEGEND

- 10 SUBBASIN
- J10 COMBINED HYDROGRAPH NODE
- FLOW PATH
- STREAM REACH ROUTING

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Willow Creek Flood Study
Watertown, South Dakota

BASIN SCHEMATIC DIAGRAM

Figure No. 2

TABLE 1

WILLOW CREEK
DRAINAGE BASIN CHARACTERISTICS

Description	Area (sq.mi.)	Channel Length (mi.)	Channel Slope (ft/ft)	Length to Centroid (mi.)	Lag Time (tp)	Peaking Coefficient
SUBBASIN 10	16.03	10.79	0.00346	6.76	4.98	0.53
J10 TO J20		3.36	0.00097			
SUBBASIN 20	12.95	15.9	0.00238	6.44	6.41	0.52
J20 TO J30		8.94	0.00097			
SUBBASIN 30	18.99	12.72	0.00296	4.15	4.42	0.55
J30 TO J40		3.75	0.00079			
SUBBASIN 40	6.6	6.77	0.00547	3.84	2.72	0.47
J40 TO J50		3.09	0.00158			
SUBBASIN 50	2.94	3.75	0.00079	1.08	1.77	0.41
J50 TO J60 (outlet)		2.41	0.00045			
SUBBASIN 60	3.72	3.09	0.00158	1.8	1.75	0.43
SUBBASIN 70	2.24	2.95	0.00614	2.16	1.35	0.40
SUBBASIN 80	1.03	2.41	0.00045	1.69	2.03	0.35
TOTAL	64.5					

Willow Creek is fed by the outlet to Round Lake producing a base stream flow that ranges from 0 cfs to 450 cfs depending on the lake levels and amount of rainfall that has occurred. There are four lakes in the chain of lakes that end at Round Lake. Depending on the lake levels, Willow Creek can either feed Round

Lake or receive water from Round Lake. There are three, four-foot diameter culverts under a county road that comprise the outlet to Round Lake which feeds Willow Creek. The county road running north-south at the Round Lake discharge apparently acts as a dam for the upstream lakes. According to Duel County Highway Department, when the lake levels rise the county road is not overtopped. Rather the water spreads to the north and south into low-lying areas adjacent to the lakes. Based on this observation and information received from the Department of Environment and Natural Resources, the maximum flow capacity for the outlet culverts, without overtopping the road, was estimated to be 450 cfs. For this analysis, the drainage area, precipitation data, and SCS curve numbers were input into the HEC-1 computer model and the base discharge from Round Lake was adjusted until the results of the HEC-1 analysis matched the USGS gauging station flow. When the base discharge was set at 70 cfs the output data most closely matched the gauging station data. Therefore for this Willow Creek Study it is assumed that Round Lake in not completely full and that the base flow from Round Lake is approximately 70 cfs.

3.2.2 Precipitation

This analysis is performed for a 5, 10, 50, 100 and 500 year-24 hour duration design storms. Since historical rainfall data were not available, HEC-1 calculates a synthetic storm based on point precipitation data. These values of precipitation are shown in Table 2. Point values were taken from National Weather Service maps HYDRO-35 and TP-40 for design storms from 5 year to 100-year frequencies.

Rainfall depths for the 500-year storm were developed from probability plotting of the frequency versus depth for each time increment of the 5-year to 100-year storm. The value for the 500-year storm was extrapolated from the probability plot.

The program input requires rainfall depths for each time interval up to and including the specified storm duration (24 hours for this analysis). The rainfall depths are assumed to be uniformly distributed over the entire watershed.

TABLE 2
Rainfall Intensity-Duration-Frequency Curves
Input for HEC 1 "PH" Record

FREQUENCY	2YR	5YR	10YR	50YR	100YR	500YR
TIME						
5MIN	0.4	0.51	0.58	0.77	0.85	1.07
15MIN	0.7	0.97	1.16	1.61	1.8	2.35
60MIN	1.45	1.92	2.24	3.03	3.38	4.4
2HR	1.58	2.1	2.45	3.2	3.6	4.55
3HR	1.7	2.2	2.6	3.45	3.85	4.9
6HR	1.9	2.54	2.97	3.9	4.35	5.45
12HR	2.3	2.9	3.35	4.5	5	6.3
24HR	2.48	3.34	3.85	5.1	5.7	7.2

NOTE: 5yr to 50yr values from 5 min to 60 min were developed from equations. All other values were taken from National Weather Service Maps, HYDRO-35, and TP-40.
500 yr. Values were developed from a Probability plotting of the Frequency versus Depth for each time increment

3.2.3 Precipitation Loss Rate

Loss of precipitation from runoff is dependent on the soil type within the drainage basin. The SCS (Soil Conservation Service) Soil Survey was used to determine that the soils within the basin are classified as Hydrologic Soils Group "B". The land use throughout the basin is generally agricultural land with row crop, small grain and range or pasture land in fair to good condition. Based on project photographs of the area and computer model calibration to match the USGS gauging station data, an average Curve Number of 64 was chosen for all

subbasins. The use of the Curve Number also depends on the Antecedent Moisture Condition (AMC) which reflects the amount of rainfall preceding a design storm. The Curve Number for this analysis is based on AMC II reflecting average conditions. The program requires input for the initial rainfall abstraction and the Curve Number. The initial abstraction is calculated from the formula:

Ia=0.2(1000-10*curve number)/curve number

An impervious area percentage was also applied to subbasin 60 and subbasin 80. These basins are located low in the drainage area and closest to the City of Watertown. Impervious area was estimated from quadrangle maps of the area influenced by city structure.

3.2.4 Unit Hydrograph

The unit hydrograph transforms rainfall excess into runoff from a particular drainage area. There are several synthetic unit hydrographs that are used throughout the United States, including Colorado unit hydrograph, Snyder unit hydrograph, Clark unit hydrograph, and the SCS dimensionless unit hydrograph. The Snyder unit hydrograph was developed for this region. Several studies have been completed to modify the Snyder unit hydrograph to fit their region, as is the case with the Colorado unit hydrograph. Colorado modified the Snyder unit hydrograph to match flow that they experience coming from the foothills of the Rocky Mountains. The SCS unit hydrograph generally results in lower flows than the Snyder unit hydrograph. Therefore, within the HEC-1 computer model, the Snyder Unit Hydrograph method was selected for this analysis. Two parameters are used in defining the unit hydrograph. The first is Snyder's lag time obtained from the formula:

$$tp=Ct\ ((LLca/(S)^{0.5}))^{0.48}$$

tp=lag time in hours

Ct=coeff. reflecting time to peak

L=length along stream from study point to upstream limits of the basin in miles

Lca=length along stream from study point to a point along stream adjacent to the centroid of the basin in miles

S=slope of the basin along the stream to upstream limits of the basin in feet/foot

The second parameter is the peaking coefficient given by the equation:

$$Cp=PCtA^{0.15}$$

P = peaking parameter

Ct = coefficient reflecting time to peak

A = basin area in square miles

The program requires input of Snyder's standard lag time and Snyder's peaking coefficient. These values for each subbasin are presented in **Table 1.**

3.2.5 Drainage Basin Run-Off

The Willow Creek drainage basin had a gauging station that recorded peak flow from 1972 to 1986. Analysis of this data can be used to predict the peak flow at any given return frequency. The accuracy or reliability of the calculated peak flow varies with the amount or length of data acquired. The type of analysis to use when determining the flood magnitudes with a 1% exceedance probability vary with the length of systematic record as shown in the table below:

	Length of Record Available		
Type of analysis to use	10 to 24	25 to 50	50 or more
Statistical Analysis	X	X	X
Comparison with Similar Watersheds	X	X	--
Flood Estimates from Precipitation	X	--	--

The length of record for the Willow Creek gauging station is 15 years, based on the above table, three types of analysis should be used for determining the flood magnitudes. USGS has published the statistical analysis for the Willow Creek Gauging Station. These values are included in Table 3.

The City of Watertown experienced a flood in the Spring of 1997, which was a combination of spring rain and snowmelt. USGS in cooperation with the Corp of Engineers took measurements at the gauging station site to monitor the flows for flood purposes. In computing of the peak flow it was determined that the upper end of the previous rating curve for the Willow Creek Gauging Station needed to be revised. Previous ratings were made from measurements below the 5-foot stage and the data was extended on a straight-line basis. The new data, which was taken above the 5-foot stage, did not match the existing rating curve. Thus a new rating curve was developed which revised the previous published data for this gauging station. The revised values are included in Table 3 for comparison.

A statistical analysis was also completed to compare the spring peak flows with summer flows. For this analysis it was assumed that the snow would be melted in a typical year before the end of the first three weeks of spring or April 10. Peak flows were recorded in the spring and summer with a greater number of peak flows recorded in the spring. By analyzing only spring date the calculated flow is skewed to the high side due to years of lower flow where the peaks occurred in the summer. Likewise summer flows are skewed to the low side because the spring data is ignored. For this analysis the goal is to predict peak flood flow (free flow) at various return frequencies regardless of the time frame in which

they happen. Thus for this report the most accurate statistical analysis would include all recorded peaks when predicting total watershed flooding.

TABLE 3
GAUGING STATION DATA

Gauging station statistical analysis	5-yr	10-yr	50-yr	100-yr	500-yr
USGS Published data '94	1,770	2,830	6,240	8,190	14,000
USGS Revised Data '97	1,454	2,148	4,109	5,111	7,815
Computed Spring flows	1,845	2,981	5,940	7,260	10,246
Computed Summer flows	1,354	1,686	2,368	2,635	3,208
Two-Station Comparison					
Low outlier adjusted	2,081	3,425	7,529	9,694	15,556
Low outlier included	1,662	2,390	3,787	4,253	5,068
Precipitation Analysis					
HEC-1 computer model	1,453	2,147	4,108	5,111	7,816

The second type of analysis completed to the Willow Creek Gauging Station was the comparison with similar watershed. An analysis of other gauging stations in the region was completed. The analysis revealed that there were three gauging stations that had a reasonable or best statistical fit for the data from the Willow Creek Gauging Station. These stations are the Big Sioux River Gauging Station at Brookings, Hidewood Creek Gauging Station at Estelline and the Big Sioux River Gauging Station at Watertown. A two-station comparison was completed for each of these sites to extend the data for Willow Creek Gauging Station. The results of the two station comparisons are shown in Table 3. The two-station comparison that produced a curve with the "best fit" to the observed data is Willow Creek and the Big Sioux River at Brookings gauging stations. One data point met the criteria for a low outlier. Thus two analysis were performed to determine the affect of the low outlier. If the low outlier is adjusted upward so

that it is no longer meets the criteria for a low outlier, the curve moves upward and is skewed such that the 500-year flood flow increases significantly.

3.2.6 HEC-1 Analysis Results

The third type of analysis performed was a precipitation analysis using HEC-1 computer program written by the US Corps of Engineers. HEC-1 analysis was executed for the 5, 10, 50, 100 and 500-year precipitation events. The only difference between each of the frequency models is the precipitation input. Peak flow rate for each design point and each design storm are summarized in **Table 4.**

TABLE 4

HEC-1 PEAK FLOW SUMMARY-WILLOW CREEK

Storm Frequency	HEC-RAS	5 YEAR	10 YEAR	50 YEAR	100 YEAR	500 YEAR
Design Point	X-SEC	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
SUBBASIN 20		301	448	847	1048	1589
SUBBASIN 40		261	396	758	949	1458
J10	--	521	755	1403	1724	2570
SUBBASIN10		420	651	1265	1583	2446
J20	--	922	1371	2599	3225	4904
SUBBASIN 30		536	850	1672	2107	3286
J30	106	1342	2017	3902	4867	7483
SUBBASIN 50		203	300	566	703	1074
J40 (gauging Sta.)	**57**	**1453**	**2147**	**4108**	**5111**	**7816**
SUBBASIN 60		226	307	527	637	922
SUBBASIN 70		210	284	481	580	839
J50	27	1659	2387	4472	5529	8357
SUBBASIN 80		102	120	182	208	259
J60 (OUTLET)	2	1725	2444	4525	5575	8355

The flows generated for each drainage basin by HEC-1 will be used as input for the HEC-RAS stream flow analysis computer model.

An input and output summary of each computer run is presented a technical document that accompanies this report. Only a portion of the output is included in this report due to the shear volume of data generated from the computer run.

3.3 Hydraulic Analysis

Standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 5-, 10-, 50-, 100-, and 500-year period (recurrence interval) have been selected as having special significance for flood plain management. These events, commonly referred to as 5-, 10-, 50-, 100-, and 500-year floods, have a 20, 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year.

The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will have to be updated periodically to reflect changes that are made in the drainage way.

3.3.1 Project Area

The project area is comprised of the reach of Willow Creek from its confluence with the Big Sioux River upstream to the 459th Avenue bridge crossing located approximately three miles east of the City of Watertown, South Dakota. Figure 1 presents the vicinity map and location of the project area.

The reach of Willow Creek encompassed in the flood study is approximately 7.5 miles long. Willow creek is a mature stream with a meandering character. Its sinuosity, as measured by the ratio of channel length to valley length, is approximately 1.7 and has an average channel slope of approximately 5 feet per mile.

The natural channel and floodplain of Willow Creek have been modified at several locations throughout the study reach. The floodplain is predominantly covered with native grasses and light brush. Deciduous trees and patches of heavier brush are also sparsely located in some areas of the floodplain. At several locations gravel pit operations are evident within the floodplain. In other areas the floodplain is cultivated with row crops. Commercial development exists in limited areas of the floodplain, principally in the area adjacent to U.S. Highway 212. Development of roads and railways has resulted in the natural channel of the creek being altered or moved at numerous locations. Locations where channel modifications are evident include, from upstream to downstream:

1. The 459 Avenue road crossing located at the near the upstream boundary of the study area on the section line between Section 25 and Section 26 (Township 117 North, Range 52 West).
2. The segment the creek channel located south of 3rd Avenue North (along the section line between Section 26 and Section 35) is abandoned as a result of the road construction.
3. The 43rd Street East Bridge located were the creek crosses from Section 26 into Section 27.
4. The Interstate-29 Bridge crossings near the center of Section 27.
5. An abandoned bridge crosses the creek at the north line of Section 34 near 3rd Avenue North.
6. The segment of the original creek channel located east of Interstate-29 in Section 34 is abandoned.

7. A culvert crossing is developed where 31st Street East crosses the creek between Section 33 and Section 34.
8. An abandoned railroad crossing is located in southeast quarter of Section 33.
9. The US 212 (9th Avenue South) bridge crossing at the section line between Section 33 in Township 117 North and Section 4 in Township 116 North.
10. The 20th Avenue South Bridge crossing located between Section 4 and Section 9.

Segments of the Willow Creek channel which appear to be natural are characterized by channel widths on the order of 45 feet at the upstream end of the study reach and increase to 75 feet or more near the confluence with the Big Sioux River. Channel depth varies throughout the reach, but is generally between 7 and 12 feet.

3.3.2 Flood Routing

The analysis was performed using HECRAS computer program distributed by McTrans University of Florida Transportation Research Center. Similar to the HEC-2 computer program developed by the US Army Corps of Engineers, water surface profiles are estimated based on the standard step method. This method computes one-dimensional water surface profiles for steady gradually varied flow by solving the energy equation:

$$Y_2 + Z_2 + \frac{\alpha_2 V_2^2}{2g} = Y_1 + Z_1 + \frac{\alpha_1 V_1^2}{2g} + h_e$$

Where

Y_1, Y_2 equals the depth of water at cross sections

Z_1, Z_2	are the invert elevations of the channel
V_1, V_2	are the average flow velocities
α_1, α_2	are velocity weighting coefficients
g	equals gravitational acceleration
h_e	equals energy loss

The energy equation is solved using an iterative procedure from one channel cross-section to the next, where the subscripts 1 and 2 represent the downstream and upstream cross-sections respectfully. Total conveyance at each cross-section is calculated from Manning's equation:

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Where

n	equals the Manning's roughness coefficient
A	equals the cross-sectional flow area
R	equals the hydraulic radius of the flow area

Manning's roughness coefficients were estimated to be 0.040 within the channel banks and 0.050 for the overbank (floodplain) flow area.

3.3.3 Channel and Floodplain Geometry

Channel and floodplain geometry is described by 106 cross-sections acquired by survey. At a few cross-section locations the survey data was augmented with topographic information taken from USGS 7.5-minute topographic mapping. The survey cross-sections were numbered consecutively from downstream to upstream as shown in Figures 3 and 4.

Four cross-sections were acquired adjacent to each roadway crossing to provide adequate model geometry in the vicinity of bridges and culverts. A cross-section is located immediately upstream and downstream of each structure to represent the effective flow area through the structure. In addition, cross-sections were located upstream and downstream from each structure a sufficient distance to allow full contraction/expansion of the flow such that the entire channel width is effectively conveying flow. The cross section locations and the contraction, expansion coefficients were based on the criterion set forth in Appendix B of the HEC RAS Users Manual.

Survey data was also acquired at each of the bridge crossings to document the dimensions of the deck, roadway profile elevations and the low chord elevation. Construction plans for Interstate-29 were used to describe the two bridges.

3.3.4 Hydrologic Data

Peak discharge data was input for the 5, 10, 50, 100 and 500-year precipitation events based on the revised '97 USGS gage estimates (Station 06479515 Willow Creek near Watertown). The HEC-1 analysis of the watershed was calibrated to match the USGS estimates at the gauging station site. The calibrated HEC-1 results were used to compute the contributing drainage flow throughout the drainage basin. The results of this analysis was used as input to distribute the storm flow for the HEC-RAS water surface elevation model at design points where contributions from sub-basins within the watershed were established in the hydrologic analysis.

Table 4 summarizes the hydrologic data used for the study.

3.3.5 Boundary Conditions

Boundary conditions are input to establish the starting water surface elevation at the end of the stream reach being investigated. For this hydraulic analysis, a single reach encompassed the entire project area. A downstream boundary condition is needed for a subcritical flow regime whereas an upstream boundary condition must be established for a supercritical flow regime. In cases, as with this project, where it was possible for both flow regimes to exist, termed a mixed flow regime, both upstream and downstream boundary conditions must be established.

Table 5

Flood Discharges

Design Point (HEC-1/HECRAS)	Peak Discharge (cubic-feet per second)				
	5-year	10-year	50-year	100-year	500-year
J30 / RS106	1342	2017	3902	4867	7483
J40 / RS57	1453	2147	4108	5111	7816
J50 / RS27	1659	2387	4472	5529	8357
J60 / RS13	1725	2444	4525	5575	8357

The 100-year water surface elevation of the Big Sioux River, at the downstream boundary of this project, is approximately 1712. The City of Watertown is actively searching for flood control alternatives that will reduce Big Sioux River flow rates that enter Lake Kampeska and the Watertown reach of the Big Sioux River. The water level of the Big Sioux River is dependent on a variety of factors that are independent of a storm event that could cause flooding along Willow

Creek. Therefore it is unlikely that the two peak flows will occur at same time. For this reason, the downstream boundary condition was established based on a normal depth calculation for Willow Creek. Normal depth was estimated from Manning's equation based on an energy slope approximated by the channel slope of Willow Creek at this location.

3.3.6 Results

A summary table of the resulting flood elevations for the 5, 10, 50, 100, and 500-year flood flows are included at the end of this report as Exhibit 2. Generally the low flow is confined to the channel. The 100 and 500-year flow have been plotted for review. Potential for flooding occurs during these rainstorm events. The channel area upstream from Highway 212 is undeveloped thus does not destroy personal property. The water spreads out downstream of Highway 212. This area has the greatest potential for flooding due to the flat low ground and the flood influence of the Big Sioux River. Generally flood damage can be minimized in the Willow Creek flood plain by controlling the location of development along the stream banks.

4. FLOOD PLAIN MANAGEMENT APPLICATIONS

The purpose of this Flood Plain Study is to provide a tool to the City of Watertown to use in approving land development proposals, building permits, and storm water run off. This Floodplain Study includes a map to assist the City of Watertown in developing sound flood plain management measures.

4.1 Flood Boundaries

The Federal Emergency Management Agency (FEMA) has adopted the 100-year flood as the national standard for the base flood. The 500-year flood is employed to indicate additional areas of flood risk in the community. The boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps that was generated from field data collected for the cross sections with contour intervals of 2 feet.

In cases where the 100-year and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway map. Figure 3 and 4.

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; due to the limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the

encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. The concept of a floodway is used as a tool to assist the local communities in this aspect of flood plain management. Under concept, the area of the 100-year flood is divided into a floodway and floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantially increasing the base flood elevation. As minimum standards the Federal Insurance Administration limits such increased flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodway for Willow Creek is based on equal conveyance reduction from each side of the flood plain. Equal conveyance reduction means that the encroachment line is adjusted to reduce the overbank flows equally on each side of the stream. When overbank conditions do not exist on one side due to a high steam bank and the opposite side is low, equal conveyance reduction cannot be obtained. At these locations conveyance reduction is from one side only to obtain the target value of one foot above the base flood elevation.

The results of these computations are tabulated at selected cross sections for Willow Creek. As shown on the Flood Boundary and Floodway Map (Figures 3 and 4), the floodway and 100-year flood were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed with out increasing the water-surface elevation of the 100-year flood more that 1.0-foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figures 3 and 4.

5. INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains determined in the Flood Insurance Study by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

6. FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

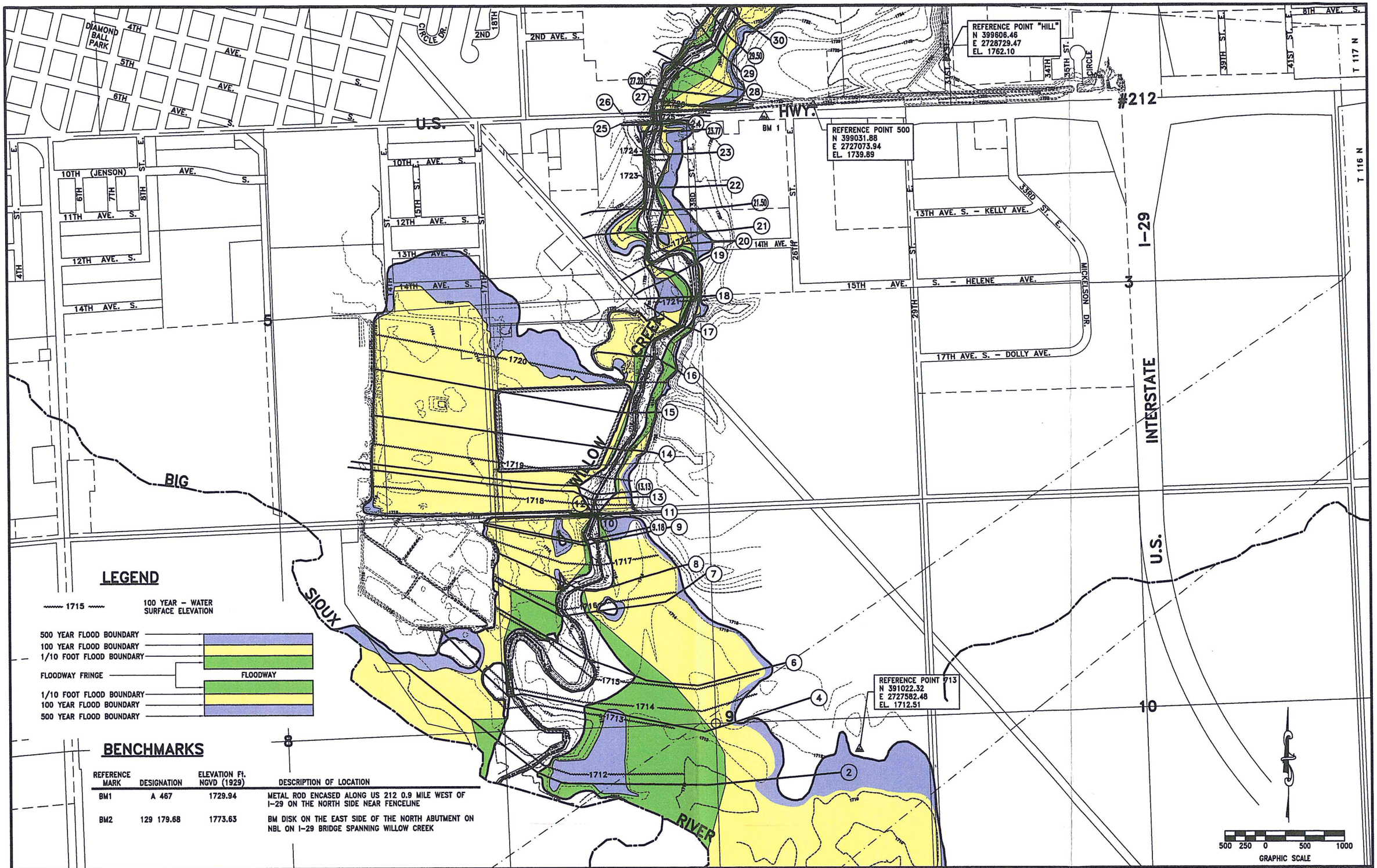
For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the Zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screened, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analysis and floodway computations. (See Figures 3 and 4)

7. OTHER STUDIES

Feasibility Report and Environmental Assessment, Flood Control For Watertown and Vicinity, South Dakota, Omaha District, US Army Corp of Engineers, August 1994.

Flood Insurance Study, City of Watertown, South Dakota, Federal Emergency Management Agency, July 4, 1989



REFERENCE MARK	DESIGNATION	ELEVATION Ft. NGVD (1929)	DESCRIPTION OF LOCATION
BM1	A 467	1729.94	METAL ROD ENCASED ALONG US 212 0.9 MILE WEST OF I-29 ON THE NORTH SIDE NEAR FENCELINE
BM2	129 179.68	1773.63	BM DISK ON THE EAST SIDE OF THE NORTH ABUTMENT ON NBL ON I-29 BRIDGE SPANNING WILLOW CREEK

DRAWN BY: L.B.K.
DESIGNED BY: D.G.O.
CHECKED BY: D.G.O.
REVIEWED DATE : FOR
REVIEWED DATE : FOR BANNER ASSOCIATES, INC.

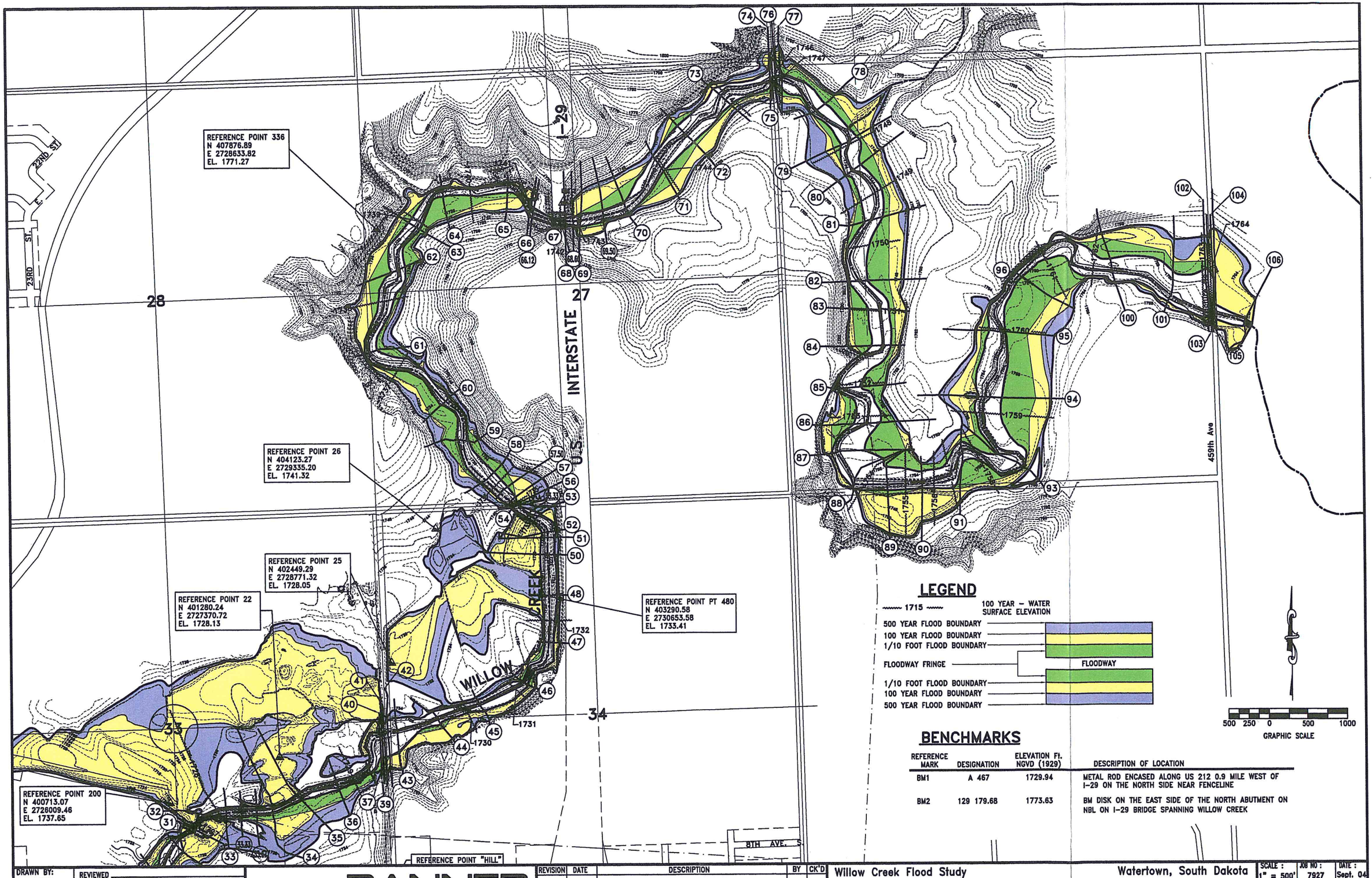
BANNER
BANNER ASSOCIATES, INC. • CONSULTING ENGINEERS & ARCHITECTS
409 22nd Av S • P.O.Box 298 - Brookings, SD 57006 • (605)692-6342

REVISION	DATE	DESCRIPTION	BY	CK'D
1	2/17/00	REVISED TOPO FOR LAGOONS	L.B.K.	D.G.O.
2	1/29/01	BRIDGE TRANSITION AREAS	S.A.N.	D.G.O.
3	8/21/03	TSC/ENDRESE DEVELOPMENT (XSEC'S "23" to "25")	K.R.J.	D.G.O.

Willow Creek Flood Study — Watertown, South Dakota

FLOOD BOUNDARY AND FLOODWAY MAP (LOWER REACH)

SCALE : 1" = 500' | JOB NO : 7927 | DATE : Sept. 04
SHEET NO. :
FIGURE 3A



LEGEND

1715 — 100 YEAR – WATER SURFACE ELEVATION

500 YEAR FLOOD BOUNDARY
100 YEAR FLOOD BOUNDARY
1/10 FOOT FLOOD BOUNDARY
FLOODWAY FRINGE
FLOODWAY
1/10 FOOT FLOOD BOUNDARY
100 YEAR FLOOD BOUNDARY
500 YEAR FLOOD BOUNDARY

500 250 0 500 1000
GRAPHIC SCALE

BENCHMARKS

REFERENCE MARK	DESIGNATION	ELEVATION Ft. NGVD (1929)	DESCRIPTION OF LOCATION
BM1	A 467	1729.94	METAL ROD ENCASED ALONG US 212 0.9 MILE WEST OF I-29 ON THE NORTH SIDE NEAR FENCELINE
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DRAWN BY: L.B.K.
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REVISION	DATE	DESCRIPTION	BY	CK'D

Willow Creek Flood Study — Watertown, South Dakota

FLOOD BOUNDARY AND FLOODWAY MAP (UPPER REACH)

SCALE : 1" = 500' | JOB NO : 7927 | DATE : Sept. 04
SHEET NO. :

FIGURE 4A

9. EVALUATION OF THE PROPOSED FIRST AVENUE BRIDGE

Separate hydraulic analyses were performed to evaluate the feasibility of the bridge proposed as part of an extension of 1st Avenue from 19th Street East to US Highway 212 near its intersection with 29th Street East. The location of the bridge was approximated from information presented in the 1st Avenue Feasibility Study (HDR Engineering, 1996).

Alternative locations were evaluated within the segment of Willow Creek from Cross-section 30 to 32. Alternative locations were evaluated based on a bridge configuration with a span length of approximately 65 feet, a width of 75 feet, a deck with a depth of 2.5 feet and a multi-barrel box culvert. The number of barrels required to convey to 100-year storm event required more than eight 12' x 12' box culvert. The number of barrel sections required does not fit the channel thus was eliminated from further evaluation. The recommended site for a bridge is near stream station 31.5. The old Railroad Bridge is near this location.

State DOT bid letting information was reviewed to determine an approximate cost for the proposed new bridge. Five bridges were let in 1998 that were similar to the proposed bridge in span length. The total project cost including road realignment, earthwork, pavement, guide-rails etc. ranged from approximately $72 per square foot to $92 per square foot. The proposed bridge will be 5 lanes wide with curb and gutter and sidewalk. A road does not exist at this location. It is assumed that a road will be constructed up to the bridge approach slabs as a separate project, therefore the construction cost for the road is not included in this report. Thus for purposes of this report the estimated square foot cost for the bridge only, will be $51 per square foot and the approach slab will be $195 per square yard.

Bridge 75' x 65' = 4875 square feet	@ $51	$ 248,625
Approach Slab 76' x 20' = 1520 sq. ft. each x 2 = 3040 sq. ft. = 340 sq. yards	@ $ 195	$ 66,300
Total Estimated Probable Cost For Bridge only		$ 314,925

The total probable cost for a 65' continuous span bridge will be approximately $315,000. This same bridge could be located south of stream station 31.5, however earth fill will be required to construct the road and bridge approach sections. This earthwork would increase the total construction cost of a bridge at that location.

The following recommendations resulted from the hydraulic analyses completed:

- The bridge should be located within the segment of Willow Creek from Cross-section 31 to 32. Although the location proposed in the Feasibility Study is acceptable, an alternative alignment for the proposed extension, which would eliminate the curves north of Willow Creek and provide straight alignment southeast from 19th Street East, would also intersect the Creek at a viable location to construct a bridge crossing.

- The low chord of the bridge deck should be planned at minimum elevation of 1730 feet, which fits the natural stream banks and has the hydraulic capacity to convey the 500-year discharge.

10. EVALUATION OF A GREENWAY STRIP ALONG WILLOW CREEK

The City of Watertown has an existing policy for protecting the people from flooding which was established through the adoption of a FEMA approved ordinance which regulates the flood plain along the Big Sioux River. This ordinance was established to control/regulate construction below an established elevation. The controlled or regulated elevation should be 1 foot above the 100-year flood plain. The area that falls within that jurisdiction is readily obtained by field surveys or established contour maps. Encroachment on the 100-yr flood plain to the established floodway line can be allowed provided that the surrounding area upstream and downstream of the encroachment is adequately protected to the regulated elevation of 1 foot above the 100 yr. flood elevation.

The City of Watertown must also consider how the flood plain will be managed. There are several ways to manage the flood plain and three ways are listed below for consideration.

1. Privately owned: Each property owner along the creek is responsible for cleaning, clearing and maintaining the channel. This method would be enforced similar to sidewalk replacement ordinances. Property owners are required to maintain the section of the stream within their property. If the channel is not properly maintained the City would assess the property and clean the channel.

   Advantage of this method is the reduced cost incurred by the City.
   Disadvantage is that it can be difficult to get cooperation from all residents.

2. Drainage way easement: The City of Watertown establishes a drainage way easement along the stream. The easement gives the City the authority to clean, clear and grade the channel as necessary to provide an unencumbered low flow stream and floodway.

   Advantage is that the City crews can schedule channel cleaning on a regular basis and is "in control" of the maintenance.

Disadvantage is cost and the potential for property owners to get upset with workers regarding the cleanup activities on their property.

3. City owned floodway: The City of Watertown would purchase the property in the stream floodway and establish a public use area along Willow Creek.

   Advantage is complete control of the property use and control of the channel cleaning and maintenance. Disadvantage is the cost including initial land purchase (approximately 335 acres) and the maintenance cost on an on going basis.

If the City establishes a greenway strip along Willow Creek, the area could be developed for public use without encumbering the floodway. A greenway strip along Willow Creek could be an area owned or controlled by the City of Watertown where there would be no development or structures. The advantage of creating a buffer zone along the stream is to allow the water to flood the area without causing extensive property damage. A typical method of establishing a floodway is shown in Figure 5. Some uses for the area could include the following:

Public/Recreational Use

1. Bicycle/jogging paths
2. City Parks with open sided picnic shelters
3. Softball and soccer field complexes
4. Tennis and handball courts
5. Basketball courts
6. Outdoor Ice Arena
7. Flower gardens
8. Upland game preserves

Commercial/Industrial Use

1. Auto Sales - Car lot - (building constructed out of the flooded area)
2. Parking for Retail Business - Retail store constructed out of the flooded area
3. Employee Parking for Light Industrial or Commercial Manufacturing

The greenway should allow for an unencumbered path for the flood waters to flow through the area. Therefore there are some things that should not be allowed in the floodway as follows:

4. Buildings and or fill that encroaches on the floodway.
5. Occupied buildings within the floodplain below the regulated flood elevation.
6. Restroom facilities in the flood way. (place restroom facilities in the flood plain 1 foot higher than the 100 year flood elevation.)
7. Loose storage of materials.
8. Fences that impede the flood water flows.

Banner reviewed Title 5: Building Revisions. This ordinance seems complete and compatible to floodway and or drainage ordinances for surrounding communities. When the City adopts the Willow Creek Flood Study then 5.0206: General Provisions. (b) BASIS FOR ESTABLISHING THE AREAS OF SPECIAL FLOOD HAZARD should be modified to incorporate the Willow Creek Flood Study into the ordinance. Subparagraphs 1, 2, and 3 of Section 5.0210 B SPECIFIC STANDARDS discusses regulation to the base flood elevation. The floodway is established by allowing encroachment until the base elevation is raised 1 foot, therefore the regulated elevation should be to 1 foot above the base flood elevation. Ordinance No. 99-7 which amends portions of Title 5 makes these revisions.

The City of Watertown must also review their ordinance regarding, development and subsequent storm runoff. The City of Watertown currently has a 3-step process in approving a plat including the Sketch Plan, the Preliminary Plan and the Final Plan. Detailed drainage is addressed under the Final Plan, some of the detailed information required in the Final Drainage Plan should be submitted at the Preliminary Plan stage. The Sketch Plan should indicate where the intended

retention ponds will be located if necessary. Some communities have modified their ordinances to include a separate section requiring submittal of drainage plans and drainage studies for larger developments. These requirements are a separate section of the ordinance and are requirements that must be met at the time a preliminary plat is submitted rather than issues that are resolved at the time of Final design of the development. The storm water management system prepared and submitted by the developer must include a section that addresses impacts on downstream and upstream properties. Development along the Big Sioux River and Willow Creek have completed hydraulic studies that can be made available to the developer. The development of the hydrology and hydraulic data for areas outside the major drainage ways will have to be prepared by the developer. The drainage plan should include some of the following items:

- Map showing the discharge route from point of collection to outlet;
- Existing structures which may limit the flow enroute to the major drainage way;
- Calculations for peak flow within the development (2, 5, 10, 25, 50 and 100 year storm events, predevelopment and post-development)
- Discussions and analysis of drainage problems and solutions; this section must address storm flows and drainage assuming the basin is fully developed.
- Discussions and analysis of downstream and upstream facilities as shown on the route outlet map;
- Location and size of easements for drainage systems; Drainage easements should include prohibition of structures, fences and landscaping other than grass for designated drainage ways;
- Identification of flood plains; and
- Location of open channels, bridges, culverts, storm sewers, and ponding areas.

Chapter 21.50: Subdivision of Land incorporates most of the suggested items above. The City must review their ordinances as a whole and the final ordinance must meet their objective of allowing development in an orderly way, which protects the public and reduces the potential damage due to flooding.

This ordinance was reviewed and the following changes are suggested as a minimum. Final changes may differ than what is suggested below as long as the intent is similar.

1. Section 21.5013: C. 3. Final Drainage Plan: An overall drainage plan showing proposed drainageways and storm sewer system will be required. The plans shall included calculations of the rainfall duration and intensity for the 2, 5, 10, 25, 50, and 100-year events and proposed volume of flow for each in the development area and the surrounding drainage basin. The proposed channel and/or pipe sizes with grades and proposed inlet locations and outlet connections shall be shown.

2. Section 21.5019: B. Design Methodology: ... The ~~excess~~ storm water runoff based on post-developed conditions shall not be discharged from the ~~retention~~ detention structure at a rate greater ~~rate~~ than ~~what a 2 year~~ the corresponding peak storm water flow ~~would be~~ based on predeveloped conditions, or the limiting flow capacity of the downstream structures/drainage facilities whichever is smaller.

3. Section 21.5019: F. Structural Entrances: In areas where drainageways are allowed, all structural entrances shall have ~~an~~ a minimum elevation ~~which exceeds~~ of 1 foot above the water elevation that would be reached during a 100 year rainfall.

4. Section 21.5019: G. Design Standards: ... The ~~excess~~ storm water volume resulting ~~to~~ from the change in runoff coefficient ~~from~~ due to development shall not be released at a greater rate than the corresponding ~~a 2 year~~ peak flow based on predeveloped conditions, or the limiting flow capacity of the downstream structures/drainage facilities whichever is smaller.

5. Section 21.5022: B. Development Review in Flood Zones: Add the following:
   5. Adjoining properties and/or impacted properties is protected from flooding to 1 foot above the 100-year flood event, due to development within the flood prone area.

For flood hazard areas, it would be appropriate to spell out the requirements, in detail, on how to prepare documentation and make a request for a floodway mapping change to FEMA. A statement making it the responsibility of the property owner and not the city to request changes would make the financial obligations of the city clear.

Willow Creek, at the present time, is generally undeveloped. Establishing a policy and an enforceable ordinance prior to development could reduce personal property damage due to flooding along Willow Creek. Banner recommends that the City obtain a drainageway easement along Willow Creek from the Big Sioux River to the City of Watertown's jurisdictional limits as a minimum and suggests that the City consider buying the floodway throughout the City limits.

The City of Watertown has been contemplating implementing an ordinance that would allow no filling or construction within the 100-year flood plain. An ordinance of this nature would mirror the existing ordinances but a duplicate ordinance would have to be established, because it would vary from the existing FEMA floodplain ordinance along the Big Sioux River. It is anticipated that the Willow Creek flood study would be submitted to FEMA for approval and establishment of FEMA mapping in conjunction with a Flood Insurance Report. FEMA will not object to a more stringent ordinance; however, a consistent floodplain ordinance throughout the City would be easier to regulate. An option would be to modify the existing ordinance for the Big Sioux River which regulates the 100-year flood plain. The City would then have a consistent policy to regulate all drainage ways through the City. Advantages and disadvantages of implementing an ordinance that restricts construction in the floodplain on Willow Creek is as follows:

Advantages:

1. No construction within the floodplain would prevent flood damage personal and/or Public property due to the 100-year flood.

2. Maintain a wide area for flood flows to spread into, thereby reducing flood velocities.

3. Gives City control of a wider area along the stream.

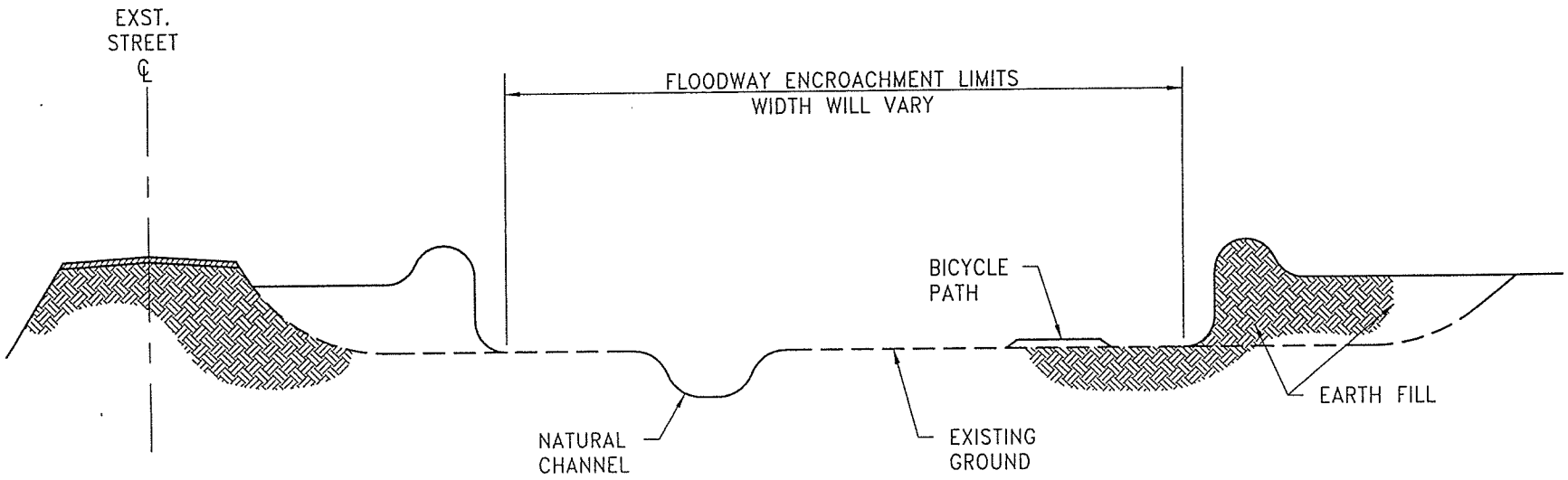
Disadvantages:

1. The Willow Creek floodplain ordinance would differ from the Big Sioux River floodplain ordinance. Big Sioux River control is based on the floodway and 1 foot above the base flood elevation.

2. Remove land that could be used for private development.

3. Acreage of land purchased or easement purchase would increase.

4. Maintenance cost would also increase.



BANNER BANNER ASSOCIATES, INC. Brookings, South Dakota	Willow Creek Drainage Basin Study	March 15, 2001
	TYPICAL FLOODWAY GREENWAY STRIP	FIGURE No. 5

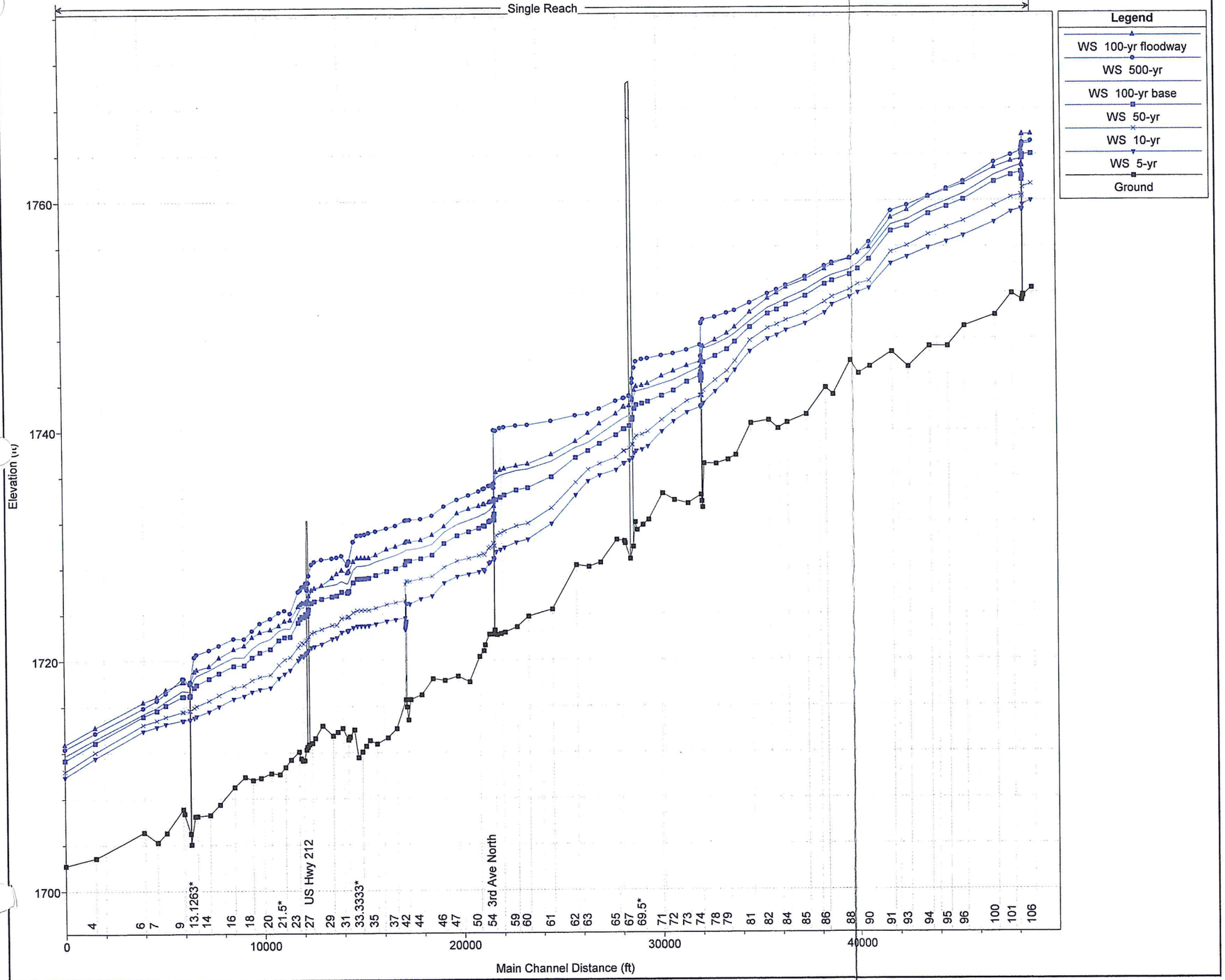
EXHIBIT 1

FLOOD PROFILE

WILLOW CREEK

FEMA FIRM - Watertown, SD Willow Creek - Sept 04 9/23/2004

Single Reach



1 in Horiz. = 5295.675 ft 1 in Vert. = 9.155064 ft

EXHIBIT 2

Cross Section Table

Glossary of Terms

River Sta - Station along Willow Creek Centerline
Storm Event - Reoccurance interval
Q Total - Flow in Willow Creek
Min. Chan. Elev. - Minimum Channel Elevation
W.S. Elev - Water surface elevation
Crit W.S. - Critical Water Surface Elevation
E.G. Elev - Energy Grade Line elevation
E.G. Slope - Energy Grade Line slope
Vel chnl - Velocity in the channel
Flow Area - Cross section area of flow
Top Width - Width of the water
Effective Top Width - Top width of the wetted cross-section not including the inneffective flow
Froude # Chl - Froude # of the channel: if greater than 1, flow is supercritical if less than 1, flow is subcritical
SA Total - Total accumulated Surface Area (acres) from the downstream end

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
106	5-year	1342	1752.37	1759.97	1760.18	0.001395	4.19	469.12	187.06	42.51	0.31	303.72
106	10-year	2017	1752.37	1761.4	1761.56	0.000977	3.96	877.29	387.4	44.79	0.27	449.54
106	50-year	3902	1752.37	1764.02	1764.09	0.000393	3.13	2394.2	684.87	44.79	0.18	796.55
106	100-year	4867	1752.37	1764.93	1764.99	0.000322	3.01	3032.42	720.39	44.79	0.17	896.27
106	500-year	7483	1752.37	1765.11	1765.24	0.000674	4.42	3167.03	727.66	44.79	0.24	1058.21
105	5-year	1342	1751.7	1759.59	1759.72	0.000826	2.88	512.83	176.7	99.85	0.24	302.12
105	10-year	2017	1751.7	1761.11	1761.23	0.000645	2.85	854.68	582.07	115.23	0.22	445.23
105	50-year	3902	1751.7	1763.93	1763.97	0.000198	2.1	3416.84	1153.23	115.23	0.13	788.3
105	100-year	4867	1751.7	1764.86	1764.89	0.000154	1.99	4534.09	1249	115.23	0.12	887.41
105	500-year	7483	1751.7	1764.97	1765.04	0.000337	2.97	4672.55	1260.37	115.23	0.17	1049.27
104	5-year	1342	1751.77	1759.2	1759.6	0.002307	5.08	264.11	47.43	47.43	0.38	302.04
104	10-year	2017	1751.77	1760.42	1761.02	0.002851	6.26	322.03	47.52	47.52	0.42	445.02
104	50-year	3902	1751.77	1763.66	1763.9	0.001231	4.98	1671.61	925.23	47.76	0.28	787.65
104	100-year	4867	1751.77	1764.77	1764.87	0.000639	3.7	2811.22	1109.27	49.77	0.2	886.67
104	500-year	7483	1751.77	1764.73	1764.97	0.00157	5.78	2766.9	1104.87	49.77	0.31	1048.52
103.5		Bridge										
103	5-year	1342	1751.52	1759.13	1759.54	0.002133	4.92	272.59	49.48	49.48	0.37	302.01
103	10-year	2017	1751.52	1760.29	1760.95	0.002684	6.11	330.36	50.08	50.08	0.42	444.99
103	50-year	3902	1751.52	1761.77	1763.2	0.005399	9.59	426.71	205.43	50.85	0.6	787.5
103	100-year	4867	1751.52	1762.13	1764.02	0.007028	11.18	536.08	406.78	51.04	0.68	886.25
103	500-year	7483	1751.52	1763.97	1764.67	0.003365	8.52	1867.24	962.32	51.95	0.48	1047.89
102	5-year	1342	1751.31	1759.26	1759.37	0.00082	2.85	609.01	341.2	93.36	0.24	301.81
102	10-year	2017	1751.31	1760.47	1760.56	0.000556	2.76	1146.39	544.24	93.36	0.2	444.67
102	50-year	3902	1751.31	1762.45	1762.52	0.000369	2.74	2684.21	990.16	93.36	0.17	786.82
102	100-year	4867	1751.31	1763.06	1763.12	0.000344	2.78	3299.13	1037.38	93.36	0.17	885.41
102	500-year	7483	1751.31	1764.26	1764.33	0.00034	3.03	4607.86	1131.35	93.36	0.17	1046.65
101	5-year	1342	1751.9	1758.98	1759.04	0.000488	2	680.44	211.42	173.47	0.18	298.5
101	10-year	2017	1751.9	1760.24	1760.31	0.000421	2.19	995.17	288.21	181	0.17	439.62
101	50-year	3902	1751.9	1762.19	1762.3	0.000468	2.81	1677.13	456	190.69	0.19	777.94

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
101	100-year	4867	1751.9	1762.75	1762.89	0.000532	3.16	1983.71	623.52	190.69	0.21	875.2
101	500-year	7483	1751.9	1763.9	1764.08	0.000627	3.79	2869.46	862.95	190.69	0.23	1034.36
100	5-year	1342	1750.02	1758.09	1758.33	0.001592	4.14	387.01	140.66	60.2	0.33	295.14
100	10-year	2017	1750.02	1759.49	1759.71	0.001337	4.17	621.16	185.31	68.32	0.31	435.14
100	50-year	3902	1750.02	1761.6	1761.77	0.000881	4.13	1610.3	640.08	70.25	0.26	767.76
100	100-year	4867	1750.02	1762.17	1762.34	0.000852	4.26	1977.64	647.29	70.25	0.26	863.43
100	500-year	7483	1750.02	1763.27	1763.47	0.000899	4.77	2702.3	661.3	70.25	0.28	1020.27
96	5-year	1342	1749.04	1756.91	1757.02	0.000494	2.63	522.26	97.85	86.26	0.19	290.83
96	10-year	2017	1749.04	1758.18	1758.34	0.000603	3.2	653.02	107.94	91.46	0.22	429.84
96	50-year	3902	1749.04	1760.04	1760.33	0.000937	4.47	1204.65	703.55	99.07	0.28	742.97
96	100-year	4867	1749.04	1760.55	1760.86	0.001011	4.83	1609.76	855.16	99.43	0.29	835.73
96	500-year	7483	1749.04	1761.62	1761.93	0.001033	5.28	2540.11	886.67	99.43	0.3	991.74
95	5-year	1342	1747.3	1756.39	1756.5	0.000802	3.11	586.42	174.58	51.07	0.23	288.32
95	10-year	2017	1747.3	1757.63	1757.75	0.00083	3.38	877.77	340.97	58.5	0.24	425.82
95	50-year	3902	1747.3	1759.44	1759.58	0.000802	3.96	1829.14	721.01	58.5	0.25	730.81
95	100-year	4867	1747.3	1759.93	1760.07	0.000837	4.22	2205.83	831.25	58.5	0.26	821.4
95	500-year	7483	1747.3	1760.99	1761.14	0.000849	4.6	3191.6	991.05	58.5	0.27	975.81
94	5-year	1342	1747.3	1755.87	1755.95	0.000469	2.26	594.31	123.97	123.97	0.18	285.28
94	10-year	2017	1747.3	1757.01	1757.12	0.000585	2.71	745.45	183.3	139.24	0.21	420.57
94	50-year	3902	1747.3	1758.81	1758.94	0.000633	3.19	1831.6	918.83	158.32	0.22	714.68
94	100-year	4867	1747.3	1759.27	1759.41	0.000659	3.37	2240.4	1038.41	160.86	0.23	803.04
94	500-year	7483	1747.3	1760.34	1760.48	0.000658	3.71	3255	1386.47	160.86	0.23	952.52
93	5-year	1342	1745.5	1755.07	1755.27	0.000885	3.68	400.51	183.46	54.09	0.25	281.64
93	10-year	2017	1745.5	1756.02	1756.29	0.001069	4.38	647.18	331.78	58.54	0.29	414.55
93	50-year	3902	1745.5	1757.73	1758.04	0.001203	5.24	1518.23	864	65.77	0.33	694.08
93	100-year	4867	1745.5	1758.31	1758.55	0.001049	5.06	2021.53	896.84	65.77	0.31	780.7
93	500-year	7483	1745.5	1759.53	1759.71	0.000841	4.88	3166.93	968.41	65.77	0.28	925.42
91	5-year	1342	1746.82	1754.49	1754.6	0.000703	3.22	724.02	383.45	43.89	0.23	276.26
91	10-year	2017	1746.82	1755.5	1755.6	0.000602	3.31	1187.49	552.99	43.89	0.22	406.14

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
91	50-year	3902	1746.82	1757.32	1757.4	0.000453	3.34	2299.97	738.47	43.89	0.2	678.83
91	100-year	4867	1746.82	1757.86	1757.94	0.000475	3.56	2665.75	838.09	43.89	0.2	764.19
91	500-year	7483	1746.82	1759.06	1759.16	0.000506	3.98	3569.35	973.31	43.89	0.21	906.94
90	5-year	1342	1745.54	1752.34	1752.99	0.005489	6.44	208.3	55.1	55.1	0.58	272.4
90	10-year	2017	1745.54	1752.97	1754.03	0.007997	8.25	245.93	66.35	59.29	0.72	400.87
90	50-year	3902	1745.54	1754.86	1756.16	0.007934	9.61	521.73	260.65	70.89	0.74	670.67
90	100-year	4867	1745.54	1755.42	1756.71	0.007508	9.91	682.63	298.35	72.14	0.73	755.01
90	500-year	7483	1745.54	1756.33	1757.88	0.008199	11.44	969.45	332.62	72.14	0.79	896.51
89	5-year	1342	1744.92	1751.98	1752.06	0.000587	2.4	755.85	386.95	107.28	0.2	269.92
89	10-year	2017	1744.92	1752.71	1752.8	0.000696	2.72	1090.3	526.93	118.36	0.22	397.61
89	50-year	3902	1744.92	1754.04	1754.13	0.000766	3.05	1942.01	696.4	140.2	0.24	665.54
89	100-year	4867	1744.92	1754.5	1754.6	0.000805	3.15	2273.85	1207.72	152.03	0.24	747.1
89	500-year	7483	1744.92	1755.41	1755.53	0.000829	3.55	3201.11	1249.45	152.03	0.25	888.23
88	5-year	1342	1746.06	1751.59	1751.71	0.00104	2.88	569.47	304.58	111.8	0.26	266.59
88	10-year	2017	1746.06	1752.23	1752.39	0.001279	3.39	815.29	460.26	120.2	0.29	392.88
88	50-year	3902	1746.06	1753.54	1753.7	0.001317	3.82	1622.73	786.59	137.08	0.3	658.48
88	100-year	4867	1746.06	1753.98	1754.15	0.001358	4.05	2017.36	956.6	140.46	0.31	736.72
88	500-year	7483	1746.06	1754.97	1755.12	0.001151	4.05	2968.38	968.7	148.05	0.29	877.58
87	5-year	1342	1743.1	1750.93	1751.03	0.000691	2.97	808.86	585.17	59.02	0.22	261.5
87	10-year	2017	1743.1	1751.59	1751.69	0.00068	3.17	1226.07	685.37	59.02	0.22	386.59
87	50-year	3902	1743.1	1753.01	1753.1	0.000619	3.47	2407.58	1015.07	59.02	0.22	649.06
87	100-year	4867	1743.1	1753.5	1753.58	0.00058	3.5	2904.83	1031.39	59.02	0.22	726.42
87	500-year	7483	1743.1	1754.57	1754.65	0.000536	3.66	4030.32	1067.4	59.02	0.21	866.96
86	5-year	1342	1743.7	1750.21	1750.52	0.002692	4.99	463.77	559.06	46.78	0.41	255.05
86	10-year	2017	1743.7	1751.15	1751.28	0.001319	3.96	1039.51	670.58	46.78	0.3	378.9
86	50-year	3902	1743.7	1752.71	1752.79	0.000756	3.55	2221.13	849.96	46.78	0.24	638.43
86	100-year	4867	1743.7	1753.2	1753.28	0.000744	3.69	2654.29	916.76	46.78	0.24	715.3
86	500-year	7483	1743.7	1754.28	1754.37	0.000682	3.86	3675.25	963.99	46.78	0.23	855.36
85	5-year	1342	1741.36	1749.29	1749.42	0.000606	2.92	476.87	119.39	77.28	0.21	250.14
85	10-year	2017	1741.36	1750.17	1750.38	0.000819	3.73	602.75	176.59	77.28	0.25	372.92

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
85	50-year	3902	1741.36	1751.67	1752.02	0.00118	5.11	1217.4	606.73	77.28	0.31	628.61
85	100-year	4867	1741.36	1752.17	1752.52	0.001229	5.42	1522.53	617.36	77.28	0.32	704.98
85	500-year	7483	1741.36	1753.34	1753.69	0.001223	5.88	2261.1	642.35	77.28	0.33	844.59
84	5-year	1342	1740.66	1748.71	1748.81	0.000716	3.07	718.22	387.68	32.72	0.22	245.29
84	10-year	2017	1740.66	1749.58	1749.67	0.000687	3.29	1079.39	450.13	32.72	0.22	366.98
84	50-year	3902	1740.66	1750.92	1751.04	0.00089	4.23	1844.54	614.16	32.72	0.26	617.39
84	100-year	4867	1740.66	1751.42	1751.54	0.000896	4.41	2148.93	623.34	32.72	0.27	693.59
84	500-year	7483	1740.66	1752.61	1752.74	0.000875	4.76	2904.43	645.56	32.72	0.27	832.77
83	5-year	1342	1740.15	1748.27	1748.41	0.001066	3.82	640.88	307.31	31.16	0.27	241.69
83	10-year	2017	1740.15	1749.18	1749.3	0.000949	3.85	978.01	381.14	32.3	0.26	362.69
83	50-year	3902	1740.15	1750.48	1750.61	0.000994	4.31	1716.4	698.33	33.36	0.27	610.57
83	100-year	4867	1740.15	1750.98	1751.11	0.000979	4.46	2064.85	704.02	33.36	0.27	686.69
83	500-year	7483	1740.15	1752.21	1752.35	0.000881	4.63	2940.13	718.1	33.36	0.26	825.68
82	5-year	1342	1740.87	1747.96	1748.06	0.000562	3.03	704.07	317.41	38.4	0.21	238.6
82	10-year	2017	1740.87	1748.88	1748.98	0.000559	3.29	1180.58	602.86	38.4	0.21	357.86
82	50-year	3902	1740.87	1750.14	1750.26	0.000651	3.93	1971.22	647.27	38.4	0.23	604.01
82	100-year	4867	1740.87	1750.63	1750.75	0.000689	4.19	2289.59	664.31	38.4	0.24	680.02
82	500-year	7483	1740.87	1751.87	1752.01	0.000696	4.57	3142.57	707.96	38.4	0.25	818.74
81	5-year	1342	1740.61	1746.88	1747.17	0.002401	5.32	427.23	223.21	26.15	0.4	233.64
81	10-year	2017	1740.61	1747.81	1748.1	0.002392	5.88	704.7	388.67	26.15	0.41	348.86
81	50-year	3902	1740.61	1748.97	1749.28	0.002625	6.88	1268.66	577.62	26.15	0.44	592.91
81	100-year	4867	1740.61	1749.49	1749.78	0.002408	6.89	1584.8	650.91	26.15	0.43	668.12
81	500-year	7483	1740.61	1751.08	1751.25	0.001299	5.7	2772.55	793.95	26.15	0.32	805.16
80	5-year	1342	1737.81	1745.23	1745.56	0.002066	5.31	386.12	206.11	28.29	0.37	230.35
80	10-year	2017	1737.81	1746.01	1746.4	0.00237	6.14	620.11	404.12	28.29	0.41	342.82
80	50-year	3902	1737.81	1747.71	1747.92	0.001461	5.57	1459.93	526.54	28.29	0.33	584.53
80	100-year	4867	1737.81	1748.4	1748.59	0.001236	5.39	1834.59	548.32	28.29	0.31	659.01
80	500-year	7483	1737.81	1750.42	1750.56	0.000799	4.92	3062.73	719.75	28.29	0.26	793.69
79	5-year	1342	1737.41	1744.33	1744.66	0.002585	5.51	411.86	242.14	29.96	0.41	228.39
79	10-year	2017	1737.41	1745.13	1745.45	0.0024	5.81	635.88	312.97	29.96	0.41	339.7

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
79	50-year	3902	1737.41	1747.05	1747.3	0.001777	5.97	1407.46	597.91	29.96	0.37	579.63
79	100-year	4867	1737.41	1747.96	1748.13	0.001169	5.2	1970.95	641.48	29.96	0.3	653.83
79	500-year	7483	1737.41	1750.2	1750.3	0.000562	4.17	3530.79	772.38	29.96	0.22	787.21
78	5-year	1342	1737.06	1743.36	1743.51	0.001394	3.97	584.88	272.96	33.89	0.31	224.96
78	10-year	2017	1737.06	1744.34	1744.47	0.001111	3.99	871.67	306.26	33.89	0.29	335.57
78	50-year	3902	1737.06	1746.47	1746.6	0.00079	4.12	1573.97	352.99	33.89	0.25	573.32
78	100-year	4867	1737.06	1747.47	1747.59	0.000699	4.19	1941.91	389	33.89	0.24	646.99
78	500-year	7483	1737.06	1749.85	1749.98	0.000529	4.25	2983.27	484.79	33.89	0.22	778.86
77	5-year	1342	1737.1	1742.35	1742.56	0.001678	4.09	430.9	172.49	59.16	0.34	221.83
77	10-year	2017	1737.1	1743.47	1743.69	0.001421	4.37	657.61	264.3	59.16	0.33	331.57
77	50-year	3902	1737.1	1745.93	1746.1	0.000833	4.27	1678.27	553.28	59.16	0.27	566.97
77	100-year	4867	1737.1	1747.09	1747.21	0.00057	3.86	2375.59	648.36	59.16	0.22	639.74
77	500-year	7483	1737.1	1749.64	1749.72	0.000307	3.34	4274.42	834.35	59.16	0.17	769.68
76	5-year	1342	1733.27	1742.14	1742.42	0.001505	4.23	317.42	56.77	56.77	0.32	221.6
76	10-year	2017	1733.27	1743.06	1743.52	0.002133	5.46	369.27	56.88	56.88	0.38	331.25
76	50-year	3902	1733.27	1744.84	1745.88	0.003729	8.2	509.78	148.67	57.11	0.5	566.28
76	100-year	4867	1733.27	1746.03	1747.02	0.003349	8.31	762.9	277.72	57.26	0.48	638.84
76	500-year	7483	1733.27	1749.29	1749.64	0.001196	5.97	2149.48	562.81	57.35	0.3	768.31
75.5		Bridge										
75	5-year	1342	1733.8	1742.12	1742.35	0.001087	3.87	346.86	55.62	55.62	0.27	221.56
75	10-year	2017	1733.8	1743.01	1743.41	0.001649	5.08	397.25	56.89	56.89	0.34	331.21
75	50-year	3902	1733.8	1744.36	1745.41	0.003609	8.22	480.77	94.1	57.09	0.5	566.25
75	100-year	4867	1733.8	1744.81	1746.25	0.004733	9.67	533.18	140.03	57.16	0.58	638.77
75	500-year	7483	1733.8	1746.43	1748.24	0.005531	11.35	894.73	306.28	57.41	0.62	768.04
74	5-year	1342	1734.37	1742.02	1742.31	0.001646	4.32	314.76	113.22	61.49	0.34	221.5
74	10-year	2017	1734.37	1742.99	1743.34	0.001798	4.97	524.34	247.42	63.52	0.36	331.1
74	50-year	3902	1734.37	1744.75	1745.09	0.001574	5.53	1177.56	483.85	63.85	0.35	566.05
74	100-year	4867	1734.37	1745.47	1745.78	0.001394	5.53	1556.56	557.13	63.85	0.34	638.53
74	500-year	7483	1734.37	1747.42	1747.62	0.000834	4.92	2689.56	605.94	63.85	0.27	767.73

Willow Creek Flood Study
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River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
73	5-year	1342	1733.62	1741.55	1741.63	0.00059	2.24	620.41	242.12	150.36	0.2	218.87
73	10-year	2017	1733.62	1742.54	1742.64	0.000589	2.58	869.78	263.34	151.45	0.2	327.28
73	50-year	3902	1733.62	1744.22	1744.38	0.000688	3.39	1405.35	376.36	151.54	0.23	559.7
73	100-year	4867	1733.62	1744.94	1745.12	0.000695	3.65	1690.74	415.64	151.54	0.24	631.36
73	500-year	7483	1733.62	1746.99	1747.17	0.00056	3.86	2606.18	476.13	151.54	0.22	759.77
72	5-year	1342	1733.9	1740.77	1741.02	0.001455	4.21	407.39	169.56	51.63	0.32	215.68
72	10-year	2017	1733.9	1741.71	1742	0.00156	4.85	615.21	281.05	51.63	0.34	323.07
72	50-year	3902	1733.9	1743.46	1743.74	0.001354	5.32	1391.02	571.8	51.63	0.33	552.4
72	100-year	4867	1733.9	1744.37	1744.56	0.000967	4.83	1948.4	638.48	51.63	0.28	623.25
72	500-year	7483	1733.9	1746.7	1746.81	0.000468	3.92	3496.93	690.82	51.63	0.21	750.79
71	5-year	1342	1734.5	1739.91	1740.06	0.001731	3.12	429.51	147.1	147.1	0.32	213.65
71	10-year	2017	1734.5	1740.9	1741.08	0.001497	3.44	620.57	273.41	154.41	0.31	319.67
71	50-year	3902	1734.5	1743.02	1743.15	0.000731	3.16	1684.74	540.75	161.27	0.23	545.8
71	100-year	4867	1734.5	1744.05	1744.15	0.000516	2.97	2258.21	572.48	161.27	0.2	616.08
71	500-year	7483	1734.5	1746.52	1746.6	0.000292	2.75	3764.62	648.46	161.27	0.16	742.88
70	5-year	1342	1732.21	1738.61	1738.8	0.001854	3.47	386.97	120.04	120.04	0.34	211.49
70	10-year	2017	1732.21	1739.88	1740.08	0.001361	3.56	632.51	290.83	130.24	0.31	315.16
70	50-year	3902	1732.21	1742.5	1742.65	0.000676	3.46	1502.36	397.43	130.24	0.23	538.34
70	100-year	4867	1732.21	1743.65	1743.79	0.000527	3.39	2014.99	470.95	130.24	0.21	607.79
70	500-year	7483	1732.21	1746.27	1746.38	0.000328	3.23	3326.49	529.22	130.24	0.17	733.55
69	5-year	1342	1731.31	1738.19	1738.25	0.000371	2.05	656.79	141.66	134	0.16	209.78
69	10-year	2017	1731.31	1739.51	1739.59	0.000388	2.39	867.26	177.45	139.84	0.17	312.61
69	50-year	3902	1731.31	1742.2	1742.34	0.000403	3.02	1384.53	482.57	149.11	0.19	532.68
69	100-year	4867	1731.31	1743.38	1743.53	0.000385	3.22	1640.39	516.72	149.11	0.19	601.5
69	500-year	7483	1731.31	1746	1746.19	0.000369	3.72	2211.1	575.81	149.11	0.19	726.32
68.6	5-year	1342	1732	1738.01	1738.18	0.00125	3.31	405.18	100.06	100	0.29	209.51
68.6	10-year	2017	1732	1739.3	1739.52	0.001124	3.78	534.08	106.94	100	0.29	312.31
68.6	50-year	3902	1732	1741.88	1742.26	0.001133	4.93	791.79	120.68	100	0.31	532.02
68.6	100-year	4867	1732	1742.99	1743.44	0.001137	5.39	903.05	126.62	100	0.32	600.8

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
68.6	500-year	7483	1732	1745.43	1746.09	0.001212	6.53	1146.75	149.13	100	0.34	725.53
68		1342	1729.85	1737.57	1737.98	0.002796	5.11	262.61	60.48	60.48	0.43	209.33
68		2017	1729.85	1738.76	1739.31	0.003114	5.96	338.46	66.89	66.89	0.47	312.11
68	5-year	3902	1729.85	1741.1	1742.01	0.003754	7.68	508.37	78.63	78.63	0.53	531.79
68	10-year	4867	1729.85	1742.15	1743.19	0.003806	8.2	593.83	83.94	83.94	0.54	600.56
68	50-year	7483	1729.85	1744.47	1745.82	0.003965	9.32	802.93	96.25	96.25	0.57	725.24
	100-year											
67.5	500-year	Bridge										
67	5-year	1342	1728.8	1737.33	1737.62	0.001539	4.33	309.89	57.18	57.18	0.33	209.12
67	10-year	2017	1728.8	1738.4	1738.85	0.002093	5.39	374.27	62.53	62.53	0.39	311.88
67	50-year	3902	1728.8	1740.37	1741.29	0.003463	7.69	507.26	72.35	72.35	0.51	531.54
67	100-year	4867	1728.8	1741.27	1742.39	0.003863	8.47	574.32	76.82	76.82	0.55	600.28
67	500-year	7483	1728.8	1743	1744.7	0.005097	10.48	714.12	85.4	85.4	0.64	724.93
66	5-year	1342	1730.34	1737.11	1737.24	0.000785	2.89	463.84	98.21	98.21	0.23	208.59
66	10-year	2017	1730.34	1738.17	1738.36	0.000957	3.54	569.84	103.07	103.07	0.27	311.33
66	50-year	3902	1730.34	1740.1	1740.49	0.001429	5.02	777.6	111.99	111.99	0.34	530.92
66	100-year	4867	1730.34	1741.02	1741.49	0.001536	5.51	882.75	116.24	116.24	0.35	599.63
66	500-year	7483	1730.34	1742.78	1743.5	0.00192	6.84	1095.59	128.34	122.8	0.4	724.23
65	5-year	1342	1730.46	1736.53	1736.78	0.001862	4.46	413.05	169.96	49.3	0.36	207.32
65	10-year	2017	1730.46	1737.61	1737.87	0.00164	4.8	619.72	214.03	49.3	0.35	309.8
65	50-year	3902	1730.46	1739.58	1739.88	0.0015	5.58	1120.19	294.6	49.3	0.35	528.93
65	100-year	4867	1730.46	1740.6	1740.88	0.001263	5.55	1441.94	336.36	49.3	0.33	597.41
65	500-year	7483	1730.46	1742.54	1742.82	0.001028	5.72	2146.8	378.04	49.3	0.31	721.73
64	5-year	1342	1728.47	1736.07	1736.12	0.000386	2.24	747.62	158.82	45.11	0.17	204.23
64	10-year	2017	1728.47	1737.07	1737.15	0.00048	2.79	910.27	166.39	45.11	0.19	306.22
64	50-year	3902	1728.47	1738.84	1739	0.000741	4.05	1293.4	320.83	45.11	0.25	523.15
64	100-year	4867	1728.47	1739.61	1739.86	0.001193	5.45	1579.19	405.47	45.11	0.32	590.44
64	500-year	7483	1728.47	1741.86	1742.06	0.000777	5.1	2564.26	467.26	45.11	0.27	713.79
63	5-year	1342	1728.11	1735.57	1735.75	0.001107	3.71	501.46	241.75	56.07	0.28	201.47

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
63	10-year	2017	1728.11	1736.56	1736.74	0.001059	3.94	746.88	254.31	58.6	0.28	303.32
63	50-year	3902	1728.11	1738.2	1738.44	0.001195	4.79	1213.41	355.7	60.9	0.31	518.53
63	100-year	4867	1728.11	1738.91	1739.16	0.001171	5.03	1483.43	394.57	60.9	0.31	584.99
63	500-year	7483	1728.11	1741.44	1741.63	0.000692	4.61	2537.8	440.01	60.9	0.25	707.61
62	5-year	1342	1728.26	1734.34	1734.72	0.002525	5.17	327	162.13	49.41	0.42	198.67
62	10-year	2017	1728.26	1735.45	1735.81	0.002119	5.43	556.71	301.89	49.41	0.39	299.5
62	50-year	3902	1728.26	1737.61	1737.77	0.000947	4.47	1807.64	720.22	49.41	0.28	511.26
62	100-year	4867	1728.26	1738.48	1738.6	0.000657	3.99	2446.5	743.49	49.41	0.24	577.31
62	500-year	7483	1728.26	1741.3	1741.35	0.000248	2.94	4643.88	818.48	49.41	0.15	699.14
61	5-year	1342	1724.4	1731.86	1732.19	0.001727	4.69	320.97	101.51	49.1	0.35	195.18
61	10-year	2017	1724.4	1733.23	1733.6	0.001597	5.21	488.15	142.91	49.1	0.35	293.71
61	50-year	3902	1724.4	1735.94	1736.39	0.001425	6.13	990.06	281.34	49.1	0.35	498.37
61	100-year	4867	1724.4	1737.28	1737.62	0.001034	5.69	1493.37	398.88	49.1	0.3	562.63
61	500-year	7483	1724.4	1740.82	1740.98	0.000422	4.37	3093.36	505.56	49.1	0.2	682.14
60	5-year	1342	1723.79	1730.48	1730.65	0.000939	3.32	407.2	86.23	78.47	0.26	192.65
60	10-year	2017	1723.79	1731.89	1732.12	0.000943	3.86	541.73	109.13	80.32	0.27	290.34
60	50-year	3902	1723.79	1734.99	1735.22	0.000656	4.19	1297.26	316.69	80.32	0.24	490.49
60	100-year	4867	1723.79	1736.62	1736.8	0.000461	3.9	1846.23	357.74	80.32	0.21	552.69
60	500-year	7483	1723.79	1740.48	1740.6	0.000243	3.45	3442.38	471.27	80.32	0.16	669.33
59	5-year	1342	1722.87	1730.23	1730.31	0.000357	2.32	671.08	160.98	81.17	0.16	191.05
59	10-year	2017	1722.87	1731.67	1731.77	0.000355	2.66	929.11	197.55	81.17	0.17	288.37
59	50-year	3902	1722.87	1734.79	1734.92	0.000346	3.3	1783.79	396.36	81.17	0.18	486.16
59	100-year	4867	1722.87	1736.48	1736.59	0.000249	3.09	2513.66	466.62	81.17	0.15	547.7
59	500-year	7483	1722.87	1740.42	1740.49	0.000134	2.73	4671.79	625.23	81.17	0.12	662.73
58	5-year	1342	1722.4	1729.78	1729.96	0.001034	3.47	423.9	108.23	71.28	0.27	189.23
58	10-year	2017	1722.4	1731.21	1731.42	0.001033	3.83	596.04	132.82	79.74	0.28	286.16
58	50-year	3902	1722.4	1734.36	1734.6	0.000906	4.27	1163.69	257.38	98.39	0.27	481.82
58	100-year	4867	1722.4	1736.18	1736.36	0.000593	3.89	1733.36	375.52	102.43	0.23	542.13
58	500-year	7483	1722.4	1740.29	1740.38	0.000228	3.09	3672.53	560.7	102.43	0.15	654.86

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
57	5-year	1453	1722.21	1729.43	1729.58	0.000845	3.14	462.7	90.66	90.66	0.24	188.3
57	10-year	2147	1722.21	1730.84	1731.04	0.000866	3.61	598.67	105.51	96.22	0.26	285.03
57	50-year	4108	1722.21	1733.95	1734.24	0.000853	4.38	977.75	259.59	109.23	0.27	479.26
57	100-year	5111	1722.21	1735.83	1736.11	0.000705	4.32	1233.36	404.2	119.14	0.25	538.46
57	500-year	7816	1722.21	1739.97	1740.25	0.000461	4.35	2000.05	652.9	125.35	0.21	649
56		1453	1722.6	1728.72	1729.37	0.004702	6.46	225.04	51.31	51.31	0.54	188.14
56		2147	1722.6	1729.96	1730.8	0.004907	7.37	291.23	55.45	55.45	0.57	284.85
56	5-year	4108	1722.6	1732.72	1733.98	0.005057	8.98	457.25	76.35	64.68	0.6	478.9
56	10-year	5111	1722.6	1734.72	1735.88	0.003528	8.64	591.38	335.82	67.68	0.52	537.71
56	50-year	7816	1722.6	1740.03	1740.17	0.000394	3.96	3481.93	659.77	67.68	0.19	647.78
	100-year											
55	500-year	Bridge										
54	5-year	1453	1722.25	1728.84	1729.15	0.001893	4.42	328.71	66.47	66.47	0.35	188.1
54	10-year	2147	1722.25	1730.13	1730.55	0.002	5.18	414.49	66.71	66.71	0.37	284.8
54	50-year	4108	1722.25	1732.45	1733.26	0.00275	7.21	569.57	67.13	67.13	0.44	478.9
54	100-year	5111	1722.25	1733.43	1734.42	0.00342	7.99	639.77	77.01	77.01	0.49	537.68
54	500-year	7816	1722.25	1735.33	1736.75	0.004194	9.64	885.2	233.38	85.22	0.56	647.61
53	5-year	1453	1722.23	1728.42	1728.67	0.001426	4.01	367.19	81.54	71.52	0.31	187.69
53	10-year	2147	1722.23	1729.72	1730.05	0.001481	4.62	483.02	96.04	75.03	0.33	284.35
53	50-year	4108	1722.23	1732.03	1732.59	0.001808	6.1	736.88	132.05	80.11	0.38	478.31
53	100-year	5111	1722.23	1732.98	1733.66	0.001923	6.78	879.31	199.02	80.11	0.4	536.9
53	500-year	7816	1722.23	1735.14	1735.84	0.001668	7.3	1525.67	359.44	80.11	0.39	645.52
52	5-year	1453	1721.3	1727.73	1728.16	0.004065	5.28	275	301.01	80.91	0.51	186.77
52	10-year	2147	1721.3	1729.14	1729.57	0.003436	5.27	407.09	371.79	106.23	0.47	283.22
52	50-year	4108	1721.3	1731.64	1732.1	0.002446	5.56	787	550.47	132.6	0.42	476.63
52	100-year	5111	1721.3	1732.7	1733.16	0.002065	5.6	984.85	620.06	139.41	0.4	534.87
52	500-year	7816	1721.3	1734.92	1735.43	0.001557	5.97	1478.09	752.92	139.41	0.36	642.71
51	5-year	1453	1720.8	1727.85	1727.97	0.000775	2.82	514.9	348.43	113.08	0.23	186.25
51	10-year	2147	1720.8	1729.24	1729.4	0.000775	3.15	682.52	404.41	127.23	0.24	282.6
51	50-year	4108	1720.8	1731.67	1731.93	0.000935	4.02	1021.37	534.36	151.34	0.27	475.37

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
51	100-year	5111	1720.8	1732.7	1732.99	0.000977	4.32	1182.18	596.31	162.39	0.28	533.46
51	500-year	7816	1720.8	1734.87	1735.26	0.000996	5.02	1583.56	732.22	172.97	0.3	640.63
50	5-year	1453	1720.3	1727.67	1727.8	0.000824	2.84	510.94	384.76	115.26	0.24	184.43
50	10-year	2147	1720.3	1729.07	1729.22	0.00081	3.14	683.2	463.61	131.04	0.24	280.45
50	50-year	4108	1720.3	1731.47	1731.72	0.000968	3.99	1030.22	678.38	158.11	0.28	472.37
50	100-year	5111	1720.3	1732.49	1732.77	0.000997	4.27	1197.29	763.58	169.61	0.28	530.09
50	500-year	7816	1720.3	1734.67	1735.04	0.000974	4.93	1616.98	875.33	177.6	0.29	635.76
48	5-year	1453	1718.1	1727.48	1727.54	0.000304	2.04	711.46	1236.18	124.82	0.15	174.94
48	10-year	2147	1718.1	1728.85	1728.94	0.000364	2.4	894.12	1287.56	140.94	0.17	270.2
48	50-year	4108	1718.1	1731.16	1731.33	0.000549	3.28	1251.46	1372.15	168.06	0.21	460.36
48	100-year	5111	1718.1	1732.16	1732.36	0.000603	3.59	1424.9	1406	179.76	0.22	517.38
48	500-year	7816	1718.1	1734.33	1734.61	0.000661	4.25	1856.06	1482.81	192.12	0.24	621.96
47	5-year	1453	1718.6	1727.28	1727.35	0.000332	2.22	678.64	133.71	107.48	0.16	165.75
47	10-year	2147	1718.6	1728.62	1728.73	0.000356	2.62	878.76	163.73	107.48	0.17	260.46
47	50-year	4108	1718.6	1730.82	1731.02	0.000498	3.7	1296.72	223.43	107.48	0.21	449.64
47	100-year	5111	1718.6	1731.8	1732.03	0.000517	4.02	1520.19	231.74	107.48	0.22	506.38
47	500-year	7816	1718.6	1733.95	1734.25	0.000564	4.75	2034.45	247.52	107.48	0.24	610.33
46	5-year	1453	1718.24	1726.72	1726.97	0.001081	4.31	442.52	144.21	41.78	0.29	163.75
46	10-year	2147	1718.24	1728.08	1728.35	0.000999	4.66	663.72	177.91	41.78	0.28	258.01
46	50-year	4108	1718.24	1730.15	1730.52	0.001201	5.92	1080.19	226.74	41.78	0.32	446.46
46	100-year	5111	1718.24	1731.12	1731.52	0.001204	6.29	1319.64	265.5	41.78	0.33	502.89
46	500-year	7816	1718.24	1733.38	1733.76	0.001028	6.56	1989.98	315.33	41.78	0.31	606.4
45	5-year	1453	1718.39	1725.6	1726.01	0.002474	5.83	357.84	129.72	29.94	0.41	161.8
45	10-year	2147	1718.39	1727.29	1727.59	0.001543	5.41	597.26	156.29	29.94	0.34	255.64
45	50-year	4108	1718.39	1729.15	1729.61	0.001903	6.92	925.82	196.41	29.94	0.39	443.45
45	100-year	5111	1718.39	1730.08	1730.59	0.001972	7.49	1120.33	232.74	29.94	0.4	499.35
45	500-year	7816	1718.39	1732.58	1733.01	0.001474	7.45	1871.42	335.86	29.94	0.36	601.77
44	5-year	1453	1716.99	1725.34	1725.42	0.000436	2.61	740.23	161.56	47.09	0.18	159.91
44	10-year	2147	1716.99	1727.08	1727.16	0.000355	2.71	1057.79	225.34	47.61	0.16	253.16

Willow Creek Flood Study
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(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
44	50-year	4108	1716.99	1728.84	1728.99	0.000545	3.82	1503.39	262.61	47.61	0.21	440.47
44	100-year	5111	1716.99	1729.78	1729.95	0.000556	4.09	1751.98	424.79	47.61	0.22	495.08
44	500-year	7816	1716.99	1732.29	1732.49	0.000502	4.45	2433.79	438.59	47.61	0.21	596.74
43	5-year	1453	1716.57	1724.89	1725.07	0.000946	3.75	524.67	219.9	49.49	0.26	157.56
43	10-year	2147	1716.57	1726.85	1726.94	0.000438	3.06	1269.2	578.73	49.49	0.19	248.23
43	50-year	4108	1716.57	1728.64	1728.72	0.000391	3.29	2369.31	627.92	49.49	0.18	435.02
43	100-year	5111	1716.57	1729.62	1729.7	0.000319	3.17	2993.42	640.58	49.49	0.17	488.55
43	500-year	7816	1716.57	1732.22	1732.28	0.000214	2.99	4739.76	737.33	49.49	0.14	589.55
42	5-year	1453	1714.8	1724.95	1724.99	0.000158	1.53	949.27	153.48	153.02	0.11	157.03
42	10-year	2147	1714.8	1726.86	1726.9	0.000125	1.61	1626.45	475.58	153.89	0.1	246.62
42	50-year	4108	1714.8	1728.62	1728.68	0.000178	2.2	2524.45	553.43	154	0.12	433.23
42	100-year	5111	1714.8	1729.6	1729.66	0.000173	2.31	3083.12	586.33	154	0.12	486.7
42	500-year	7816	1714.8	1732.19	1732.25	0.000141	2.4	4698.31	665.62	154	0.12	587.45
41		1453	1715.93	1724.94	1724.98	0.000122	1.64	1409.92	457.58	78.12	0.1	156.61
41		2147	1715.93	1726.87	1726.89	0.000078	1.51	2355.99	526.2	78.12	0.08	245.94
41	5-year	4108	1715.93	1728.63	1728.67	0.000117	2.07	3338.74	589.08	78.12	0.11	432.46
41	10-year	5111	1715.93	1729.61	1729.65	0.000118	2.19	3931.02	623.92	78.12	0.11	485.88
41	50-year	7816	1715.93	1732.2	1732.24	0.000104	2.32	5826.69	867.41	78.12	0.1	586.43
	100-year											
40	500-year	Culvert										
39	5-year	1453	1716.57	1723.68	1723.85	0.000891	3.37	435.17	87.77	79.09	0.25	156.25
39	10-year	2147	1716.57	1725.2	1725.41	0.000801	3.74	672.54	259.19	79.91	0.25	245.42
39	50-year	4108	1716.57	1728.3	1728.42	0.000393	3.36	1985.8	486.75	79.91	0.19	431.74
39	100-year	5111	1716.57	1729.5	1729.6	0.000317	3.25	2585.21	518.81	79.91	0.17	485.12
39	500-year	7816	1716.57	1732.15	1732.24	0.000231	3.2	4097.77	634.05	79.91	0.15	585.43
37	5-year	1453	1714.05	1723.54	1723.62	0.000271	2.28	638.4	83.34	83.34	0.14	155.32
37	10-year	2147	1714.05	1725.03	1725.15	0.000343	2.8	768.23	96.33	86.66	0.17	243.58
37	50-year	4108	1714.05	1727.98	1728.21	0.000481	3.88	1153.26	164.73	92	0.2	428.46
37	100-year	5111	1714.05	1729.13	1729.4	0.000528	4.27	1358.93	194.29	94.07	0.22	481.53
37	500-year	7816	1714.05	1731.71	1732.06	0.000587	4.97	1944.83	381.26	98.74	0.23	580.27

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
36	5-year	1453	1713.26	1723.4	1723.49	0.0003	2.36	614.71	83.13	83.13	0.15	154.46
36	10-year	2147	1713.26	1724.85	1724.99	0.000387	2.9	739.46	96.94	88.59	0.18	242.59
36	50-year	4108	1713.26	1727.74	1727.98	0.000539	3.97	1151.32	307.34	96.91	0.22	426.06
36	100-year	5111	1713.26	1728.89	1729.15	0.000551	4.24	1434.83	361.59	98.97	0.22	478.71
36	500-year	7816	1713.26	1731.49	1731.79	0.000558	4.75	2319.79	710.12	103.59	0.23	574.78
35	5-year	1453	1712.73	1723.16	1723.28	0.000455	2.84	511.42	90.97	68.83	0.18	153.37
35	10-year	2147	1712.73	1724.55	1724.73	0.000558	3.42	693.05	383.75	72.16	0.21	239.67
35	50-year	4108	1712.73	1727.4	1727.66	0.000635	4.36	1248.35	859.22	73.36	0.23	419.1
35	100-year	5111	1712.73	1728.58	1728.84	0.000597	4.52	1614.93	1064.51	73.36	0.23	470.2
35	500-year	7816	1712.73	1731.23	1731.48	0.000527	4.83	2711.49	1444.27	73.36	0.22	562.07
34	5-year	1453	1713.03	1723.02	1723.13	0.000383	2.66	545.98	184.69	73.1	0.17	152.27
34	10-year	2147	1713.03	1724.37	1724.54	0.000494	3.31	670.16	264.25	75.26	0.2	237.03
34	50-year	4108	1713.03	1727.16	1727.44	0.000613	4.37	1169.46	650.36	77.4	0.23	412.97
34	100-year	5111	1713.03	1728.31	1728.62	0.000637	4.75	1503.78	972.48	77.4	0.24	461.88
34	500-year	7816	1713.03	1731.08	1731.3	0.000434	4.49	3119.39	1731.76	77.4	0.2	548.96
33	5-year	1453	1711.55	1722.98	1723.01	0.000077	1.34	1082.05	124.76	124.76	0.08	150.73
33	10-year	2147	1711.55	1724.32	1724.37	0.000108	1.71	1252.04	128.48	128.48	0.1	235.28
33	50-year	4108	1711.55	1727.08	1727.18	0.000185	2.54	1616.84	136.1	136.1	0.13	409.49
33	100-year	5111	1711.55	1728.21	1728.34	0.000218	2.88	1771.79	139.22	139.22	0.14	456.73
33	500-year	7816	1711.55	1730.85	1731.06	0.00028	3.63	2181.05	171.47	142.98	0.17	537.39
32	5-year	1453	1713.97	1722.86	1722.97	0.00053	2.64	550.28	94.07	94.07	0.19	150.25
32	10-year	2147	1713.97	1724.16	1724.32	0.000613	3.19	672.41	94.3	94.3	0.21	234.78
32	50-year	4108	1713.97	1726.79	1727.1	0.000841	4.46	920.71	94.75	94.75	0.25	408.98
32	100-year	5111	1713.97	1727.85	1728.23	0.000946	5.01	1021.13	94.93	94.93	0.27	456.22
32	500-year	7816	1713.97	1730.32	1730.92	0.001179	6.22	1256.96	172.64	96.59	0.3	536.6
31.7	5-year	1453	1713.37	1722.63	1722.82	0.000758	3.54	410.04	53.14	53.14	0.22	149.87
31.7	10-year	2147	1713.37	1723.81	1724.13	0.001082	4.54	473.02	53.88	53.88	0.27	234.41
31.7	50-year	4108	1713.37	1726.04	1726.78	0.002021	6.91	594.84	55.28	55.28	0.37	408.6
31.7	100-year	5111	1713.37	1726.87	1727.85	0.002521	7.98	640.85	55.8	55.8	0.41	455.83

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
31.7	500-year	7816	1713.37	1728.65	1730.37	0.003882	10.54	741.22	56.92	56.92	0.51	536.05
31.5	5-year	1453	1713.27	1722.61	1722.8	0.000736	3.51	414.19	53.19	53.19	0.22	149.83
31.5	10-year	2147	1713.27	1723.77	1724.09	0.001057	4.5	476.69	53.92	53.92	0.27	234.37
31.5	50-year	4108	1713.27	1725.98	1726.71	0.002001	6.88	596.9	55.31	55.31	0.37	408.56
31.5	100-year	5111	1713.27	1726.78	1727.77	0.00251	7.96	641.88	55.82	55.82	0.41	455.79
31.5	500-year	7816	1713.27	1728.51	1730.24	0.003917	10.58	738.91	56.9	56.9	0.52	536.01
31	5-year	1453	1713.1	1722.58	1722.76	0.000698	3.45	421.58	53.28	53.28	0.22	149.77
31	10-year	2147	1713.1	1723.73	1724.03	0.001014	4.44	483.4	54	54	0.26	234.31
31	50-year	4108	1713.1	1725.88	1726.61	0.00196	6.83	601.23	55.36	55.36	0.37	408.49
31	100-year	5111	1713.1	1726.67	1727.64	0.002478	7.93	644.75	55.85	55.85	0.41	455.73
31	500-year	7816	1713.1	1728.3	1730.05	0.00395	10.61	736.76	56.87	56.87	0.52	535.94
30	5-year	1453	1714.1	1722.45	1722.55	0.000591	3.07	693.07	212.87	44.83	0.2	148.86
30	10-year	2147	1714.1	1723.65	1723.76	0.000563	3.33	970.51	243.3	44.83	0.21	233.28
30	50-year	4108	1714.1	1725.96	1726.13	0.000676	4.31	1615.98	383.37	44.83	0.23	406.99
30	100-year	5111	1714.1	1726.88	1727.06	0.000681	4.57	2039.04	489.3	44.83	0.24	453.85
30	500-year	7816	1714.1	1729.1	1729.25	0.000498	4.4	3215.63	570.18	44.83	0.21	533.79
29	5-year	1453	1713.44	1721.89	1722.01	0.000664	3.26	669.19	226.06	46.6	0.22	147.02
29	10-year	2147	1713.44	1723.06	1723.18	0.000622	3.42	940.3	237.7	48.21	0.22	230.79
29	50-year	4108	1713.44	1725.56	1725.69	0.000547	3.79	1725.7	449.06	49.82	0.21	402.27
29	100-year	5111	1713.44	1726.56	1726.69	0.000492	3.84	2219.14	518.23	49.82	0.2	448.29
29	500-year	7816	1713.44	1728.89	1729	0.000373	3.8	3526.38	604.42	49.82	0.18	527.29
28	5-year	1453	1714.31	1721.43	1721.59	0.00101	3.47	584.87	264.39	64.96	0.27	144.2
28	10-year	2147	1714.31	1722.71	1722.83	0.000747	3.36	959.28	348.95	68.1	0.24	227.42
28	50-year	4108	1714.31	1725.36	1725.44	0.000391	3.07	2346.71	753.79	68.1	0.18	395.46
28	100-year	5111	1714.31	1726.41	1726.48	0.000303	2.91	2990.98	819.78	68.1	0.16	440.73
28	500-year	7816	1714.31	1728.78	1728.85	0.00021	2.79	4483.26	968.44	68.1	0.14	518.41
27	5-year	1659	1712.8	1721.13	1721.25	0.000491	2.93	697.55	162.62	68.55	0.2	141.87
27	10-year	2387	1712.8	1722.37	1722.52	0.000524	3.38	916.81	259.17	68.55	0.21	224.08
27	50-year	4472	1712.8	1725.01	1725.21	0.000524	4.07	1435.66	517.22	68.55	0.22	388.16

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
27	100-year	5529	1712.8	1726.04	1726.26	0.00054	4.39	1642.04	588.94	68.55	0.22	432.94
27	500-year	8357	1712.8	1728.36	1728.66	0.000576	5.11	2116.42	606.08	68.55	0.24	508.79
26		1659	1712.7	1720.91	1721.14	0.001064	3.8	436.61	75.72	75.72	0.28	141.47
26		2387	1712.7	1722.07	1722.39	0.001287	4.53	527.3	80.83	80.83	0.31	223.5
26	5-year	4472	1712.7	1724.46	1725.04	0.001789	6.1	733.05	91.37	91.37	0.38	387.13
26	10-year	5529	1712.7	1725.37	1726.08	0.002018	6.76	817.51	95.36	95.36	0.41	431.77
26	50-year	8357	1712.7	1727.38	1728.43	0.002508	8.2	1018.54	104.24	104.24	0.46	507.57
	100-year											
25.5	500-year	Bridge										
25	5-year	1659	1712.48	1720.69	1720.92	0.00103	3.81	435.79	73.32	73.32	0.28	141.31
25	10-year	2387	1712.48	1721.77	1722.1	0.001316	4.61	517.48	78.19	78.19	0.32	223.33
25	50-year	4472	1712.48	1723.93	1724.57	0.002019	6.42	696.67	87.95	87.95	0.4	386.94
25	100-year	5529	1712.48	1724.69	1725.5	0.002383	7.23	764.98	91.39	91.39	0.44	431.58
25	500-year	8357	1712.48	1726.26	1727.56	0.003336	9.14	913.95	98.49	98.49	0.53	507.36
24	5-year	1659	1712.25	1720.57	1720.85	0.001184	4.35	439.82	125.59	56.41	0.3	141.2
24	10-year	2387	1712.25	1721.67	1722.03	0.00129	5.04	610.86	205.83	56.41	0.32	223.18
24	50-year	4472	1712.25	1724.05	1724.41	0.001088	5.56	1164.83	533.11	56.41	0.31	386.59
24	100-year	5529	1712.25	1724.91	1725.29	0.001083	5.87	1365.46	559.55	56.41	0.32	431.21
24	500-year	8357	1712.25	1726.74	1727.2	0.001132	6.66	1793.67	617.38	56.41	0.33	506.96
23.7736	5-year	1659	1711.32	1720.37	1720.69	0.001758	4.66	394.67	114.69	61.37	0.35	140.9
23.7736	10-year	2387	1711.32	1721.47	1721.87	0.001781	5.3	547.03	163.05	61.37	0.37	222.72
23.7736	50-year	4472	1711.32	1723.77	1724.25	0.001663	6.27	996	227.77	61.37	0.37	385.65
23.7736	100-year	5529	1711.32	1724.6	1725.13	0.001695	6.72	1198.76	261.25	61.37	0.38	430.2
23.7736	500-year	8357	1711.32	1726.45	1727.04	0.001652	7.46	1751.83	336.03	61.37	0.39	505.78
23.54	5-year	1659	1711.29	1720.44	1720.56	0.00048	3.28	691.3	133.88	40.6	0.2	140.67
23.54	10-year	2387	1711.29	1721.54	1721.72	0.0006	3.98	852.55	155.55	40.6	0.23	222.42
23.54	50-year	4472	1711.29	1723.8	1724.1	0.000822	5.38	1256.65	204.07	40.6	0.28	385.24
23.54	100-year	5529	1711.29	1724.63	1724.98	0.000903	5.9	1428.59	214.46	40.6	0.29	429.75
23.54	500-year	8357	1711.29	1726.4	1726.91	0.001162	7.31	2026.72	478.53	40.6	0.34	505

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
23.27	5-year	1659	1711.48	1720.28	1720.48	0.001418	4.24	508.22	124.51	39.64	0.32	140.39
23.27	10-year	2387	1711.48	1721.39	1721.63	0.001486	4.64	650.22	133.58	43.32	0.33	222.1
23.27	50-year	4472	1711.48	1723.62	1723.98	0.001835	5.97	1040.5	202.52	47.86	0.38	384.8
23.27	100-year	5529	1711.48	1724.46	1724.85	0.001831	6.24	1213.54	211.05	49.56	0.38	429.28
23.27	500-year	8357	1711.48	1726.11	1726.73	0.002767	8.31	1722.33	424.59	52.92	0.48	504.02
23	5-year	1659	1712.07	1720.05	1720.32	0.001883	4.61	442.68	121.16	53.18	0.36	140.12
23	10-year	2387	1712.07	1721.15	1721.46	0.001865	5.06	580.69	131.06	56.03	0.37	221.82
23	50-year	4472	1712.07	1723.28	1723.78	0.00233	6.58	970.78	243.89	61.59	0.43	384.31
23	100-year	5529	1712.07	1724.13	1724.65	0.002317	6.89	1200.02	299.76	63.79	0.43	428.72
23	500-year	8357	1712.07	1725.97	1726.47	0.002079	7.17	1867.03	425.3	68.57	0.42	503.09
22	5-year	1659	1711.37	1719.19	1719.51	0.002058	5.62	429.11	114.63	23.2	0.38	139.01
22	10-year	2387	1711.37	1720.26	1720.65	0.002098	6.25	557.07	123.36	23.2	0.39	220.62
22	50-year	4472	1711.37	1722.05	1722.71	0.00285	8.33	800.24	154.24	23.2	0.47	382.43
22	100-year	5529	1711.37	1722.75	1723.52	0.003126	9.13	913.21	169.79	23.2	0.5	426.5
22	500-year	8357	1711.37	1724.09	1725.24	0.004096	11.32	1223.44	316	23.2	0.58	499.57
21	5-year	1659	1710.1	1718.48	1718.74	0.001049	4.32	500.08	152.23	45.59	0.28	136.22
21	10-year	2387	1710.1	1719.62	1719.94	0.00116	5	806.13	428.75	45.59	0.3	216.7
21	50-year	4472	1710.1	1721.76	1721.96	0.000773	4.74	1822	532.58	45.59	0.26	377.66
21	100-year	5529	1710.1	1722.56	1722.75	0.000703	4.74	2274.31	847.9	45.59	0.25	420.45
21	500-year	8357	1710.1	1724.15	1724.33	0.000636	4.92	3278.91	1231.69	45.59	0.24	489.18
20	5-year	1659	1710.2	1717.65	1718.09	0.002318	5.77	382.83	126.72	39.07	0.41	134.96
20	10-year	2387	1710.2	1718.75	1719.26	0.002413	6.41	549.06	185.68	40.45	0.43	213.92
20	50-year	4472	1710.2	1720.99	1721.46	0.001949	6.93	1163.07	469.74	40.45	0.4	373.25
20	100-year	5529	1710.2	1721.87	1722.3	0.001766	7.01	1633.39	571.39	40.45	0.39	414.34
20	500-year	8357	1710.2	1723.64	1723.96	0.001322	6.75	2804.59	838.14	40.45	0.35	480.4
19	5-year	1659	1709.79	1717.5	1717.59	0.000363	2.37	721	163.75	111.2	0.17	133.19
19	10-year	2387	1709.79	1718.57	1718.69	0.000424	2.84	927.49	223.35	111.2	0.19	211.43
19	50-year	4472	1709.79	1720.7	1720.89	0.000527	3.76	1532.85	352.32	111.2	0.22	368.24
19	100-year	5529	1709.79	1721.53	1721.75	0.000556	4.08	1849.79	419.82	111.2	0.22	408.31
19	500-year	8357	1709.79	1723.23	1723.49	0.000588	4.65	2786.8	602.83	111.2	0.24	471.64

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
18	5-year	1659	1709.6	1717.29	1717.4	0.0006	2.77	599.7	110.73	110.73	0.21	131.96
18	10-year	2387	1709.6	1718.3	1718.47	0.000739	3.34	716.42	125.58	116.27	0.24	209.89
18	50-year	4472	1709.6	1720.27	1720.6	0.00102	4.63	1029.05	190.94	119.73	0.29	365.86
18	100-year	5529	1709.6	1721.04	1721.43	0.001124	5.13	1184.47	216.31	120.8	0.31	405.53
18	500-year	8357	1709.6	1722.57	1723.13	0.001333	6.24	1762.51	521.54	120.8	0.35	466.79
17	5-year	1659	1709.87	1716.92	1717.11	0.000873	3.54	496.9	118.41	75.7	0.25	130.91
17	10-year	2387	1709.87	1717.83	1718.11	0.001093	4.32	615.38	143.79	76.23	0.29	208.64
17	50-year	4472	1709.87	1719.6	1720.09	0.001537	5.95	901.79	187.57	76.23	0.36	364.12
17	100-year	5529	1709.87	1720.29	1720.87	0.001687	6.57	1088.65	442.06	76.23	0.38	402.57
17	500-year	8357	1709.87	1721.89	1722.53	0.001687	7.29	1677.77	507.95	76.23	0.39	462.2
16	5-year	1659	1709.01	1716.68	1716.73	0.000489	2.2	999.68	583.96	110.47	0.18	126.63
16	10-year	2387	1709.01	1717.64	1717.7	0.00043	2.27	1429.09	830.29	116.32	0.18	202.7
16	50-year	4472	1709.01	1719.53	1719.6	0.000387	2.6	2346.31	968.77	120.95	0.17	357.08
16	100-year	5529	1709.01	1720.26	1720.34	0.000392	2.8	2748.88	1050.72	120.95	0.18	393.48
16	500-year	8357	1709.01	1721.9	1722	0.000371	3.1	3739.5	1095.14	120.95	0.18	452.43
15		1659	1707.5	1716.02	1716.19	0.001148	3.48	570.25	1761.35	87.58	0.28	106.9
15		2387	1707.5	1716.99	1717.19	0.001162	3.92	798.89	1853.35	88.42	0.29	180.15
15	5-year	4472	1707.5	1718.91	1719.14	0.001038	4.47	1379.53	3210.08	89.02	0.29	321.96
15	10-year	5529	1707.5	1719.63	1719.88	0.001023	4.72	1665.71	3408.42	89.02	0.29	356
15	50-year	8357	1707.5	1721.3	1721.57	0.000941	5.11	2384.32	3469.97	89.02	0.28	414.08
	100-year											
14	500-year	1659	1706.6	1715.58	1715.75	0.000688	3.59	633.71	235.72	52.64	0.23	95.81
14		2387	1706.6	1716.51	1716.72	0.000776	4.12	880.26	1610.3	52.64	0.25	160.92
14	5-year	4472	1706.6	1718.43	1718.68	0.000848	4.94	1576.06	2853.51	52.64	0.27	288.34
14	10-year	5529	1706.6	1719.17	1719.43	0.000845	5.16	1904.92	2973.47	52.64	0.27	320.62
14	50-year	8357	1706.6	1720.91	1721.15	0.000744	5.34	2722.79	3115.86	52.64	0.26	377.55
	100-year											
13	500-year	1725	1706.47	1715.04	1715.2	0.001005	3.17	589.88	1108.66	116.23	0.26	82.84
13		2444	1706.47	1715.9	1716.1	0.001049	3.64	760.75	1733.32	116.23	0.28	133.06
13	5-year	4525	1706.47	1717.68	1718	0.001243	4.79	1211.21	2620.26	116.23	0.32	237.37
13	10-year	5575	1706.47	1718.45	1718.77	0.001166	4.96	1496.7	3136.12	116.23	0.31	267.04

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
13	50-year	8357	1706.47	1720.29	1720.61	0.000962	5.18	2184.23	3265.48	116.23	0.29	322.13
	100-year											
12	500-year	1725	1704.04	1714.9	1715.05	0.000522	3.13	550.97	60.63	60.63	0.18	79.9
12		2444	1704.04	1715.64	1715.9	0.000827	4.1	595.92	60.74	60.74	0.23	128.53
12	5-year	4525	1704.04	1716.95	1717.65	0.001949	6.7	675.47	60.93	60.93	0.35	230.62
12	10-year	5575	1704.04	1717.39	1718.37	0.002637	7.94	702.21	61	61	0.41	258.99
12	50-year	8357	1704.04	1718.14	1720.08	0.004917	11.17	747.98	61.11	61.11	0.56	313.79
	100-year											
11	500-year	Bridge										
10	5-year	1725	1704.97	1714.88	1715.03	0.000528	3.15	547.72	63.42	63.42	0.19	79.85
10	10-year	2444	1704.97	1715.61	1715.87	0.000829	4.11	594.12	63.6	63.6	0.24	128.48
10	50-year	4525	1704.97	1716.88	1717.58	0.001936	6.7	675.15	63.9	63.9	0.36	230.57
10	100-year	5575	1704.97	1717.3	1718.28	0.00262	7.95	701.62	64	64	0.42	258.95
10	500-year	8357	1704.97	1717.94	1719.9	0.004976	11.25	742.57	64.15	64.15	0.58	313.74
9	5-year	1725	1707.1	1714.8	1714.85	0.000279	1.77	974.42	216.61	198.25	0.14	78.75
9	10-year	2444	1707.1	1715.53	1715.6	0.000369	2.17	1151.68	609.01	208.63	0.17	127.04
9	50-year	4525	1707.1	1716.87	1717.01	0.000568	3.08	1639.29	1272.64	213.52	0.21	225.17
9	100-year	5575	1707.1	1717.37	1717.55	0.000645	3.45	1852.19	1499.74	213.52	0.23	252.28
9	500-year	8357	1707.1	1718.44	1718.7	0.000844	4.34	2370.52	2018.52	213.52	0.27	304.07
8	5-year	1725	1705.06	1714.5	1714.56	0.000423	2.1	822.77	199.72	177.76	0.17	74.87
8	10-year	2444	1705.06	1715.11	1715.21	0.000589	2.61	949.15	619.62	186.24	0.21	117.91
8	50-year	4525	1705.06	1716.11	1716.35	0.001156	3.95	1215.97	1414.68	200.03	0.29	206.38
8	100-year	5575	1705.06	1716.45	1716.76	0.001451	4.55	1345.12	1812.91	204.15	0.33	228.99
8	500-year	8357	1705.06	1717.16	1717.65	0.002095	5.82	1783.06	2184.1	208.46	0.4	274.72
7		1725	1704.23	1714.23	1714.35	0.000524	2.9	810.14	519.72	77.88	0.2	71.5
7		2444	1704.23	1714.79	1714.94	0.000661	3.42	1166.29	1159.52	78.31	0.23	110.14
7		4525	1704.23	1715.63	1715.85	0.001088	4.68	1926.14	1686.23	78.95	0.29	193.08
7		5575	1704.23	1715.9	1716.15	0.00129	5.14	2216.95	1865.76	80.81	0.32	213.36
7		8357	1704.23	1716.51	1716.78	0.001679	5.7	2940.59	2181.54	91.79	0.36	256.31
6		1725	1705.1	1713.87	1713.96	0.000596	2.56	1036.32	1760.26	120.13	0.2	55.55

Willow Creek Flood Study
5-yr, 10-yr, 50-yr, 100-yr, and 500-yr Flood Analysis
(USING HECRAS 2.2)

River Station	Return Period	Total Flow (cfs)	Min. Chan. Elevation (ft)	Wat. Sur. Elevation (ft)	E. G. Elevation (ft)	E. G. Slope (ft/ft)	Channel Velocity (ft/sec)	Flow Area (sq. ft)	Top Width (ft)	Effective Top Width (ft)	Froude # Channel	SA Total (acres)
6		2444	1705.1	1714.41	1714.5	0.000605	2.76	1671.98	2303.01	120.13	0.21	86.01
6		4525	1705.1	1715.13	1715.23	0.000743	3.32	3058.6	3213.04	120.13	0.24	159.03
6		5575	1705.1	1715.34	1715.45	0.000824	3.58	3519.17	3313.43	120.13	0.25	177.38
6		8357	1705.1	1715.85	1715.97	0.000904	3.95	4678.66	3487.68	120.13	0.26	216.93
4		1725	1702.85	1711.52	1711.71	0.001835	3.64	574.49	395	122.42	0.34	18.2
4		2444	1702.85	1712.01	1712.24	0.002048	4.15	860.87	1011.08	124.69	0.37	30.13
4		4525	1702.85	1712.84	1713.03	0.001854	4.4	2168.65	2012.54	128.52	0.36	72.28
4		5575	1702.85	1713.16	1713.31	0.001632	4.28	2828.43	2209.75	129.96	0.34	85.83
4		8357	1702.85	1713.69	1713.84	0.001627	4.52	4105.37	2710.57	132.43	0.34	114.47
2		1725	1702.2	1709.87	1709.97	0.000801	2.83	1025.34	904.19	107.59	0.23	
2		2444	1702.2	1710.36	1710.46	0.000801	3.02	1525	1179.44	108.48	0.24	
2		4525	1702.2	1711.33	1711.42	0.000801	3.38	2939.96	3386.61	109.09	0.25	
2		5575	1702.2	1711.73	1711.82	0.0008	3.53	3959.01	4204.45	109.09	0.25	
2		8357	1702.2	1712.31	1712.39	0.0008	3.75	6015.61	5866.35	109.09	0.25	

EXHIBIT 3

Encroachment Table

Glossary of Terms

River Sta - Station along Willow Creek Centerline
W.S. Elev - Water surface elevation
Prof Delta WS - Profile Delta Water Surface Elevation (difference in Water Elevation)
Top Width - Width of the water
Effective Top Width - Top width of the wetted cross-section not including the inneffective flow
Enc Sta L - Encroachment Station Left
Ch Sta L - Channel Station Left
Ch Sta R - Channel Station Right
Enc Sta R - Encroachment Station Right
Vel Total - Velocity of the Stream
SA Total - Total Surface Area (acres)
Min. Chan. Elev. - Minimum Channel Elevation

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
106	1764.93		720.39	720.39		413.29	458.08		1.6	896.27	1752.37
106	1765.72	0.8	98	98	387	413.29	458.08	485	5.65	281.89	1752.37
105	1764.86		1249	1249		162.62	277.85		1.07	887.41	1751.7
105	1765.7	0.84	189	189	146	162.62	277.85	335	3.16	280.55	1751.7
104	1764.77		1109.27	1109.27		200.75	250.52		1.73	886.67	1751.77
104	1765.68	0.91	500.26	500.26	164.74	200.75	250.52	665	2.59	280.33	1751.77
103.5 BR U	1764.78		1072.51	1072.51		200.75	250.52		2.02	886.66	1751.77
103.5 BR U	1762.98	-1.8	308.38	308.38	199.24	200.75	250.52	770	7.18	280.33	1751.77
103.5 BR D	1762.02		278.96	278.96		199.24	251.31		10.27	886.26	1751.52
103.5 BR D	1762.46	0.44	245.31	245.31	199.24	199.24	251.31	770	8.66	280.17	1751.52
103	1762.13		406.78	406.78		199.24	251.31		9.08	886.25	1751.52
103	1763.1	0.97	415.78	415.78	199.24	199.24	251.31	770	5.75	280.16	1751.52
102	1763.06		1037.38	1037.38		185.39	278.75		1.48	885.41	1751.31
102	1763.57	0.52	600	600	180	185.39	278.75	780	1.73	279.59	1751.31
101	1762.75		623.52	623.52		169.24	359.93		2.45	875.2	1751.9
101	1763.37	0.61	394.63	394.63	169.24	169.24	359.93	563.87	2.28	273.52	1751.9
100	1762.17		647.29	647.29		513.22	583.47		2.46	863.43	1750.02
100	1762.83	0.66	300	300	400	513.22	583.47	700	3.05	267.01	1750.02
96	1760.55		855.16	855.16		926.89	1026.32		3.02	835.73	1749.04

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
96	1761.43	0.88	275	275	775	926.89	1026.32	1050	3.79	256.48	1749.04
95	1759.93		831.25	831.25		1273.9	1332.4		2.21	821.4	1747.3
95	1760.89	0.96	204	204	1272	1273.9	1332.4	1476	3.26	252.22	1747.3
94	1759.27		1038.41	891.6		903.37	1064.23		2.17	803.04	1747.3
94	1760.28	1	294.23	294.23	770	903.37	1064.23	1064.23	3.19	247.2	1747.3
93	1758.31		896.84	896.84		314.18	379.95		2.41	780.7	1745.5
93	1759.11	0.81	370.82	370.82	314.18	314.18	379.95	685	3.73	239.43	1745.5
91	1757.86		838.09	702.37		717.18	761.07		1.83	764.19	1746.82
91	1758.46	0.61	288	288	550	717.18	761.07	838	2.98	233.18	1746.82
90	1755.42		298.35	298.35		509.66	581.8		7.13	755.01	1745.54
90	1755.88	0.46	214	214	466	509.66	581.8	680	7.13	228.82	1745.54
89	1754.5		1207.72	1010.33		600	752.03		2.14	747.1	1744.92
89	1755.49	1	300	300	600	600	752.03	900	3.2	225.87	1744.92
88	1753.98		956.6	956.6		12.36	171.28		2.41	736.72	1746.06
88	1754.92	0.94	551.4	551.4	12.36	12.36	171.28	575	3.21	221.75	1746.06
87	1753.5		1031.39	1031.39		250.47	309.49		1.68	726.42	1743.1
87	1754.44	0.94	425	425	200	250.47	309.49	625	2.28	216.06	1743.1
86	1753.2		916.76	916.76		619.76	666.54		1.83	715.3	1743.7
86	1754	0.8	330	330	495	619.76	666.54	825	3.13	211.86	1743.7

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
85	1752.17		617.36	617.36		58.81	136.09		3.2	704.98	1741.36
85	1753.11	0.94	300	300	55	58.81	136.09	355	3.43	207.26	1741.36
84	1751.42		623.34	623.34		706.36	739.08		2.26	693.59	1740.66
84	1752.42	1	250	250	575	706.36	739.08	825	3.15	202.09	1740.66
83	1750.98		704.02	704.02		399.6	432.96		2.36	686.69	1740.15
83	1751.91	0.93	260	260	265	399.6	432.96	525	3.55	199.44	1740.15
82	1750.63		664.31	664.31		388.83	427.23		2.13	680.02	1740.87
82	1751.45	0.82	230	230	275	388.83	427.23	505	3.48	197.01	1740.87
81	1749.49		650.91	650.91		414.8	440.95		3.07	668.12	1740.61
81	1750.25	0.77	230	230	340	414.8	440.95	570	4.15	192.78	1740.61
80	1748.4		548.32	548.32		444.31	472.6		2.65	659.01	1737.81
80	1748.95	0.55	230	230	350	444.31	472.6	580	4.11	189.26	1737.81
79	1747.96		641.48	641.48		814.17	844.13		2.47	653.83	1737.41
79	1748.41	0.46	225	225	725	814.17	844.13	950	3.8	187.27	1737.41
78	1747.47		389	389		467.28	501.17		2.51	646.99	1737.06
78	1747.84	0.37	215	215	410	467.28	501.17	625	3.33	184.34	1737.06
77	1747.09		648.36	648.36		573.29	632.45		2.05	639.74	1737.1
77	1747.31	0.22	210	210	460	573.29	632.45	670	3.4	181.4	1737.1
76	1746.03		277.72	277.72		532.94	590.29		6.38	638.84	1733.27
76	1746.28	0.25	213.8	213.8	532.94	532.94	590.29	775	7.01	180.98	1733.27

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
75.5 BR U	1745.05		113.64	113.64		532.94	590.29		10.11	638.84	1733.27
75.5 BR U	1746.04	1	221.99	221.99		532.94	590.29		7.5	180.98	1733.27
75.5 BR D	1744.59		60.77	60.77		545.5	602.95		10.36	638.77	1733.8
75.5 BR D	1745.22	0.63	125.35	125.35		545.5	602.95		9.21	180.84	1733.8
75	1744.81		140.03	140.03		545.5	602.95		9.13	638.77	1733.8
75	1745.54	0.73	197.02	197.02	545.5	545.5	602.95	833	7.43	180.84	1733.8
74	1745.47		557.13	557.13		325.41	389.26		3.13	638.53	1734.37
74	1746	0.52	320	320	275	325.41	389.26	595	3.58	180.67	1734.37
73	1744.94		415.64	415.64		364.7	516.24		2.88	631.36	1733.62
73	1745.62	0.68	300	300	275	364.7	516.24	575	2.8	176.02	1733.62
72	1744.37		638.48	638.48		520.89	572.52		2.5	623.25	1733.9
72	1745.13	0.76	290	290	405	520.89	572.52	695	3.03	171.47	1733.9
71	1744.05		572.48	572.48		434.4	595.67		2.16	616.08	1734.5
71	1744.7	0.65	235	235	390	434.4	595.67	625	3.42	168.23	1734.5
70	1743.65		470.95	470.95		193.79	324.03		2.42	607.79	1732.21
70	1744.05	0.4	136	136	191	193.79	324.03	327	4.34	165.25	1732.21
69	1743.38		516.72	218		496.78	645.89		2.97	601.5	1731.31
69	1743.79	0.41	154	154	494	496.78	645.89	648	3.28	163.34	1731.31
68.6	1742.99		126.62	100		30	130		5.39	600.8	1732

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
68.6	1743.47	0.48	100	100	30	30	130	130	5.12	163.07	1732
68	1742.15		83.94	83.94		452.57	665.09		8.2	600.56	1729.85
68	1742.78	0.63	87.31	87.31	452.57	452.57	665.09	665.09	7.51	162.85	1729.85
67.5 BR U	1741.91		77.72	77.72		452.57	665.09		8.83	600.55	1729.85
67.5 BR U	1742.61	0.7	81.36	81.36		452.57	665.09		8.02	162.84	1729.85
67.5 BR D	1741.26		71.74	71.74		507.63	608.92		8.68	600.29	1728.8
67.5 BR D	1742.11	0.86	76	76		507.63	608.92		7.8	162.57	1728.8
67	1741.27		76.82	76.82		507.63	608.92		8.47	600.28	1728.8
67	1742.13	0.86	81.1	81.1	507.63	507.63	608.92	608.92	7.58	162.56	1728.8
66	1741.02		116.24	116.24		227.61	352.24		5.51	599.63	1730.34
66	1741.99	0.97	120.73	120.73	227.61	227.61	352.24	352.24	4.88	161.88	1730.34
65	1740.6		336.36	336.36		435.25	484.55		3.38	597.41	1730.46
65	1741.41	0.81	124.55	124.55	370	435.25	484.55	494.55	4.98	160.75	1730.46
64	1739.61		405.47	405.47		515.84	560.95		3.08	590.44	1728.47
64	1740.56	0.95	120	120	450	515.84	560.95	570	4.31	158.45	1728.47
63	1738.91		394.57	394.57		431.97	492.87		3.28	584.99	1728.11
63	1739.75	0.85	165	165	410	431.97	492.87	575	4.65	156.5	1728.11
62	1738.48		743.49	743.49		333.59	383		1.99	577.31	1728.26
62	1739.03	0.55	195	195	260	333.59	383	455	3.94	154.03	1728.26

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
61	1737.28		398.88	398.88		522.18	571.28		3.26	562.63	1724.4
61	1737.88	0.59	170	170	430	522.18	571.28	600	3.87	149.25	1724.4
60	1736.62		357.74	357.74		164.49	244.81		2.64	552.69	1723.79
60	1737.07	0.45	140	140	135	164.49	244.81	275	3.91	145.12	1723.79
59	1736.48		466.62	466.62		468.3	549.47		1.94	547.7	1722.87
59	1736.89	0.41	140	140	440	468.3	549.47	580	3.11	143.31	1722.87
58	1736.18		375.52	375.52		427.76	530.19		2.81	542.13	1722.4
58	1736.66	0.48	203	203	328	427.76	530.19	531	3.05	141.03	1722.4
57	1735.83		404.2	141.35		616.21	741.56		4.14	538.46	1722.21
57	1736.35	0.53	144.14	144.14	594	616.21	741.56	741.56	3.91	139.36	1722.21
56	1734.72		335.82	67.68		621.49	689.17		8.64	537.71	1722.6
56	1735.42	0.7	67.68	67.68	621.49	621.49	689.17	689.17	8	139.12	1722.6
55 BR U	1732.91					621.49	689.17		12.77	537.69	1722.6
55 BR U	1733.39	0.49			612.31	621.49	689.17	697.53	12.77	139.12	1722.6
55 BR D	1733.16		42.83	42.83		612.31	697.53		9.67	537.68	1722.25
55 BR D	1733.76	0.6	79.94	79.94	612.31	612.31	697.53	697.53	9.04	139.1	1722.25
54	1733.43		77.01	77.01		612.31	697.53		7.99	537.68	1722.25
54	1733.99	0.57	82.61	82.61	612.31	612.31	697.53	697.53	7.46	139.09	1722.25
53	1732.98		199.02	199.02		352.84	432.95		5.81	536.9	1722.23
53	1733.71	0.73	140	140	305	352.84	432.95	445	5.28	138.43	1722.23

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
52	1732.7		620.06	197.08		118.13	257.54		5.19	534.87	1721.3
52	1733.54	0.84	187.54	187.54	70	118.13	257.54	257.54	4.48	137.58	1721.3
51	1732.7		596.31	162.39		90.35	263.32		4.32	533.46	1720.8
51	1733.53	0.83	170.55	170.55	90.35	90.35	263.32	263.32	3.87	136.89	1720.8
50	1732.49		763.58	169.61		90.62	268.22		4.27	530.09	1720.3
50	1733.38	0.89	177.6	177.6	90.62	90.62	268.22	268.22	3.78	136.03	1720.3
48	1732.16		1406	179.76		85.8	277.92		3.59	517.38	1718.1
48	1733.15	0.99	190.45	190.45	85.8	85.8	277.92	277.92	3.18	133.87	1718.1
47	1731.8		231.74	231.74		139.4	246.88		3.36	506.38	1718.6
47	1732.76	0.96	109	109	138	139.4	246.88	247	4.11	131.85	1718.6
46	1731.12		265.5	265.5		131.04	172.82		3.87	502.89	1718.24
46	1731.63	0.51	82	82	110	131.04	172.82	192	6.39	130.43	1718.24
45	1730.08		232.74	232.74		234.98	264.92		4.56	499.35	1718.39
45	1730.89	0.81	155	155	155	234.98	264.92	310	4.7	128.76	1718.39
44	1729.78		424.79	267.02		298.77	346.38		2.92	495.08	1716.99
44	1730.45	0.67	190	190	235	298.77	346.38	425	3.6	126.52	1716.99
43	1729.62		640.58	640.58		462.51	512		1.71	488.55	1716.57
43	1730.31	0.69	425	425	225	462.51	512	650	2.01	122.76	1716.57
42	1729.6		586.33	586.33		574.81	728.81		1.66	486.7	1714.8

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
42	1730.3	0.7	450	450	350	574.81	728.81	800	1.73	121.46	1714.8
41	1729.61		623.92	623.92		679.18	757.3		1.3	485.88	1715.93
41	1730.31	0.7	410	410	440	679.18	757.3	850	1.46	120.88	1715.93
40	Culvert										
39	1729.5		518.81	518.81		657.48	737.39		1.98	485.12	1716.57
39	1730.21	0.72	370	370	425	657.48	737.39	795	2.11	120.36	1716.57
37	1729.13		194.29	194.29		389.34	490.43		3.76	481.53	1714.05
37	1729.88	0.75	109.76	109.76	375	389.34	490.43	490.43	4	117.9	1714.05
36	1728.89		361.59	254		1349.37	1454.72		3.56	478.71	1713.26
36	1729.65	0.76	116.7	116.7	1333	1349.37	1454.72	1454.72	4.03	116.74	1713.26
35	1728.58		1064.51	335.38		1545.73	1619.09		3.16	470.2	1712.73
35	1729.17	0.58	89.09	89.09	1530	1545.73	1619.09	1619.09	4.92	115.46	1712.73
34	1728.31		972.48	396.47		1342.77	1420.17		3.4	461.88	1713.03
34	1728.9	0.59	78.17	78.17	1342	1342.77	1420.17	1420.17	5.12	114.78	1713.03
33	1728.21		139.22	139.22		144.45	293.5		2.88	456.73	1711.55
33	1728.89	0.68	140.3	140.3	144.45	144.45	293.5	293.5	2.74	113.33	1711.55
32	1727.85		94.93	94.93		261.79	368.75		5.01	456.22	1713.97
32	1728.58	0.73	95.06	95.06	261.79	261.79	368.75	368.75	4.69	112.8	1713.97
31.7	1726.87		55.8	55.8		164.47	230.7		7.98	455.83	1713.37

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
31.7	1727.76	0.89	56.36	56.36	164.47	164.47	230.7	230.7	7.4	112.42	1713.37
31.5	1726.78		55.82	55.82		164.47	230.7		7.96	455.79	1713.27
31.5	1727.7	0.91	56.39	56.39	164.47	164.47	230.7	230.7	7.38	112.38	1713.27
31	1726.67		55.85	55.85		164.47	230.7		7.93	455.73	1713.1
31	1727.6	0.94	56.44	56.44	164.47	164.47	230.7	230.7	7.33	112.31	1713.1
30	1726.88		489.3	489.3		609.6	654.43		2.51	453.85	1714.1
30	1727.81	0.93	210	210	490	609.6	654.43	700	2.96	111.41	1714.1
29	1726.56		518.23	518.23		444.82	494.64		2.3	448.29	1713.44
29	1727.18	0.62	135	135	410	444.82	494.64	545	4.64	109.36	1713.44
28	1726.41		819.78	619.49		865.28	933.38		1.71	440.73	1714.31
28	1726.52	0.12	122	122	828	865.28	933.38	950	5.05	107.86	1714.31
27	1726.04		588.94	201.96		935.33	1003.88		3.37	432.94	1712.8
27	1726.11	0.07	120	120	890	935.33	1003.88	1010	4.55	106.44	1712.8
26	1725.37		95.36	95.36		549.92	674.99		6.76	431.77	1712.7
26	1725.62	0.25	96.47	96.47	549.92	549.92	674.99	674.99	6.57	106.07	1712.7
25.5 BR U	1724.95		85.54	85.54		549.92	674.99		7.93	431.73	1712.7
25.5 BR U	1725.25	0.29	86.83	86.83		549.92	674.99		7.66	106.02	1712.7
25.5 BR D	1724.62		83.08	83.08		550.79	674.85		8.1	431.62	1712.48
25.5 BR D	1724.95	0.33	84.58	84.58		550.79	674.85		7.78	105.91	1712.48

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
25	1724.69		91.39	91.39		550.79	674.85		7.23	431.58	1712.48
25	1725.02	0.33	92.87	92.87	550.79	550.79	674.85	674.85	6.95	105.87	1712.48
24	1724.91		559.55	234		358.87	415.28		4.05	431.21	1712.25
24	1725.09	0.18	145	145	340	358.87	415.28	485	5.07	105.74	1712.25
23.7736	1724.6		261.25	261.25		476.21	537.58		4.61	430.2	1711.32
23.7736	1724.96	0.36	211.68	211.68	400	476.21	537.58	615	4.69	105.3	1711.32
23.54	1724.63		214.46	214.46		435.1	475.7		3.87	429.75	1711.29
23.54	1725	0.38	180.59	180.59	400	435.1	475.7	586	3.83	104.92	1711.29
23.27	1724.46		211.05	211.05		518.5	582.5		4.56	429.28	1711.48
23.27	1724.85	0.39	168.86	168.86	400	518.5	582.5	582.5	4.58	104.54	1711.48
23	1724.13		299.76	299.76		857.42	935.34		4.61	428.72	1712.07
23	1724.69	0.57	292.68	292.68	630	857.42	935.34	935.34	4.05	104.04	1712.07
22	1722.75		169.79	169.79		907.49	930.69		6.05	426.5	1711.37
22	1723.51	0.75	110	110	885	907.49	930.69	995	6.2	102.13	1711.37
21	1722.56		847.9	591.77		1035.21	1080.8		2.43	420.45	1710.1
21	1723.01	0.45	220	220	980	1035.21	1080.8	1200	4.05	99.61	1710.1
20	1721.87		571.39	571.39		1095.65	1136.1		3.38	414.34	1710.2
20	1722.66	0.79	288	288	850	1095.65	1136.1	1138	3.46	97.41	1710.2
19	1721.53		419.82	419.82		222.12	333.32		2.99	408.31	1709.79
19	1722.43	0.9	280	280	220	222.12	333.32	500	2.8	93.96	1709.79

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
18	1721.04		216.31	216.31		207.33	328.13		4.67	405.53	1709.6
18	1722.01	0.97	122	122	207	207.33	328.13	329	4.76	92.19	1709.6
17	1720.29		442.06	364.36		217.85	294.08		5.08	402.57	1709.87
17	1721.27	0.99	100	100	200	217.85	294.08	300	6.06	91.18	1709.87
16	1720.26		1050.72	586.27		379.23	500.18		2.01	393.48	1709.01
16	1720.96	0.7	220	220	330	379.23	500.18	550	3.69	89.23	1709.01
15	1719.63		3408.42	421.94		267.98	357		3.32	356	1707.5
15	1720.24	0.6	218	218	182	267.98	357	400	3.95	85.54	1707.5
14	1719.17		2973.47	457.86		422.72	475.36		2.9	320.62	1706.6
14	1719.49	0.31	145	145	380	422.72	475.36	525	4.84	83.49	1706.6
13	1718.45		3136.12	373		629.67	745.9		3.72	267.04	1706.47
13	1719.02	0.57	373	373	497	629.67	745.9	870	3.26	77.87	1706.47
12	1717.39		61	61		816	877.48		7.94	258.99	1704.04
12	1718.07	0.69	61.1	61.1	816	816	877.48	877.48	7.49	76.85	1704.04
11 BR U	1717.38		61	61		816	877.48		7.94	258.99	1704.04
11 BR U	1718.07	0.69	61.1	61.1		816	877.48		7.49	76.85	1704.04
11 BR D	1717.3		64	64		811.53	876.38		7.94	258.95	1704.97
11 BR D	1718.01	0.71	64.17	64.17		811.53	876.38		7.46	76.8	1704.97
10	1717.3		64	64		811.53	876.38		7.95	258.95	1704.97

Willow Creek Flood Study
1.0' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
10	1718	0.71	64.17	64.17	811.53	811.53	876.38	876.38	7.46	76.8	1704.97
9	1717.37		1499.74	427.34		680.46	893.98		3.01	252.28	1707.1
9	1718.1	0.73	214	214	680	680.46	893.98	894	3.34	75.62	1707.1
8	1716.45		1812.91	440.73		1390.63	1601.78		4.14	228.99	1705.06
8	1717.45	1	210.86	210.86	1390	1390.63	1601.78	1601.78	3.97	71.55	1705.06
7	1715.9		1865.76	1110.57		1715.9	1821.02		2.51	213.36	1704.23
7	1716.81	0.92	288.08	288.08	1525	1715.9	1821.02	1821.02	4.11	69.22	1704.23
6	1715.34		3313.43	2232.16		2318.66	2438.79		1.58	177.38	1705.1
6	1716.34	1	1140	1140	1760	2318.66	2438.79	2900	1.92	59.14	1705.1
4	1713.16		2209.75	2200.19		2785.48	2919.23		1.97	85.83	1702.85
4	1714.15	1	970	970	1950	2785.48	2919.23	2920	2.85	22.23	1702.85
2	1711.73		4204.45	2935.56		3686.98	3796.07		1.41		1702.2
2	1712.68	0.96	632	632	3620	3686.98	3796.07	4252	2.46		1702.2

EXHIBIT 3A

Encroachment Table
0.1-ft Rise in Water Surface

Glossary of Terms

River Sta - Station along Willow Creek Centerline
W.S. Elev - Water surface elevation
Prof Delta WS - Profile Delta Water Surface Elevation (difference in Water Elevation)
Top Width - Width of the water
Effective Top Width - Top width of the wetted cross-section not including the inneffective flow
Enc Sta L - Encroachment Station Left
Ch Sta L - Channel Station Left
Ch Sta R - Channel Station Right
Enc Sta R - Encroachment Station Right
Vel Total - Velocity of the Stream
SA Total - Total Surface Area (acres)
Min. Chan. Elev. - Minimum Channel Elevation

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
106	1764.93		720.39	720.39		413.29	458.08		1.6	896.27	1752.37
106	1765.03	0.1	98	98	387	413.29	458.08	485	6.13	538.42	1752.37
105	1764.86		1249	1249		162.62	277.85		1.07	887.41	1751.7
105	1764.95	0.09	189	189	146	162.62	277.85	335	3.48	537.08	1751.7
104	1764.77		1109.27	1109.27		200.75	250.52		1.73	886.67	1751.77
104	1764.82	0.06	535.26	535.26	164.74	200.75	250.52	700	3.11	536.86	1751.77
103.5 BR U	1764.78		1072.51	1072.51		200.75	250.52		2.02	886.66	1751.77
103.5 BR U	1764.43	-0.35	620.44	620.44	199.24	200.75	250.52	904.76	3.09	536.86	1751.77
103.5 BR D	1762.02		278.96	278.96		199.24	251.31		10.27	886.26	1751.52
103.5 BR D	1761.96	-0.06	245.39	245.39	199.24	199.24	251.31	904.76	10.63	536.59	1751.52
103	1762.13		406.78	406.78		199.24	251.31		9.08	886.25	1751.52
103	1762.18	0.05	414.62	414.62	199.24	199.24	251.31	904.76	8.73	536.59	1751.52
102	1763.06		1037.38	1037.38		185.39	278.75		1.48	885.41	1751.31
102	1763.07	0.02	785	785	95	185.39	278.75	880	1.59	535.9	1751.31
101	1762.75		623.52	623.52		169.24	359.93		2.45	875.2	1751.9
101	1762.79	0.03	505.76	505.76	169.24	169.24	359.93	675	2.47	527.99	1751.9
100	1762.17		647.29	647.29		513.22	583.47		2.46	863.43	1750.02
100	1762.2	0.03	575	575	400	513.22	583.47	975	2.55	517.95	1750.02
96	1760.55		855.16	855.16		926.89	1026.32		3.02	835.73	1749.04

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
96	1760.56	0	575	575	475	926.89	1026.32	1050	3.34	496.73	1749.04
95	1759.93		831.25	831.25		1273.9	1332.4		2.21	821.4	1747.3
95	1759.98	0.06	575	575	1000	1273.9	1332.4	1575	2.32	486.86	1747.3
94	1759.27		1038.41	891.6		903.37	1064.23		2.17	803.04	1747.3
94	1759.37	0.1	714.23	714.23	350	903.37	1064.23	1064.23	2.27	474.14	1747.3
93	1758.31		896.84	896.84		314.18	379.95		2.41	780.7	1745.5
93	1758.36	0.06	735.82	735.82	314.18	314.18	379.95	1050	2.66	457.36	1745.5
91	1757.86		838.09	702.37		717.18	761.07		1.83	764.19	1746.82
91	1757.88	0.03	640	640	250	717.18	761.07	890	1.94	444.27	1746.82
90	1755.42		298.35	298.35		509.66	581.8		7.13	755.01	1745.54
90	1755.51	0.09	297	297	466	509.66	581.8	763	6.86	436.62	1745.54
89	1754.5		1207.72	1010.33		600	752.03		2.14	747.1	1744.92
89	1754.59	0.1	685	685	515	600	752.03	1200	2.54	431.34	1744.92
88	1753.98		956.6	956.6		12.36	171.28		2.41	736.72	1746.06
88	1754.04	0.06	926.87	926.87	12.36	12.36	171.28	957.2	2.46	423.64	1746.06
87	1753.5		1031.39	1031.39		250.47	309.49		1.68	726.42	1743.1
87	1753.52	0.02	930	930	200	250.47	309.49	1130	1.81	413.99	1743.1
86	1753.2		916.76	916.76		619.76	666.54		1.83	715.3	1743.7
86	1753.21	0.02	795	795	225	619.76	666.54	1020	1.91	404.18	1743.7

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
85	1752.17		617.36	617.36		58.81	136.09		3.2	704.98	1741.36
85	1752.22	0.05	595	595	55	58.81	136.09	650	3.17	394.78	1741.36
84	1751.42		623.34	623.34		706.36	739.08		2.26	693.59	1740.66
84	1751.52	0.1	510	510	375	706.36	739.08	885	2.36	384.62	1740.66
83	1750.98		704.02	704.02		399.6	432.96		2.36	686.69	1740.15
83	1751.08	0.1	535	535	65	399.6	432.96	600	2.6	379.2	1740.15
82	1750.63		664.31	664.31		388.83	427.23		2.13	680.02	1740.87
82	1750.66	0.03	500	500	275	388.83	427.23	775	2.52	374.13	1740.87
81	1749.49		650.91	650.91		414.8	440.95		3.07	668.12	1740.61
81	1749.54	0.05	470	470	190	414.8	440.95	660	3.25	365.32	1740.61
80	1748.4		548.32	548.32		444.31	472.6		2.65	659.01	1737.81
80	1748.44	0.03	425	425	350	444.31	472.6	775	2.99	358.52	1737.81
79	1747.96		641.48	641.48		814.17	844.13		2.47	653.83	1737.41
79	1747.96	0	375	375	625	814.17	844.13	1000	3.02	355.03	1737.41
78	1747.47		389	389		467.28	501.17		2.51	646.99	1737.06
78	1747.51	0.05	355	355	410	467.28	501.17	765	2.5	350.18	1737.06
77	1747.09		648.36	648.36		573.29	632.45		2.05	639.74	1737.1
77	1747.1	0.01	375	375	375	573.29	632.45	750	2.54	345.09	1737.1
76	1746.03		277.72	277.72		532.94	590.29		6.38	638.84	1733.27
76	1746.11	0.08	280.89	280.89	532.94	532.94	590.29	857	6.19	344.45	1733.27

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
75.5 BR U	1745.05		113.64	113.64		532.94	590.29		10.11	638.84	1733.27
75.5 BR U	1745.12	0.07	121.62	121.62		532.94	590.29		9.93	344.45	1733.27
75.5 BR D	1744.59		60.77	60.77		545.5	602.95		10.36	638.77	1733.8
75.5 BR D	1744.66	0.06	67.14	67.14		545.5	602.95		10.28	344.37	1733.8
75	1744.81		140.03	140.03		545.5	602.95		9.13	638.77	1733.8
75	1744.89	0.08	144.26	144.26	545.5	545.5	602.95	833	8.94	344.37	1733.8
74	1745.47		557.13	557.13		325.41	389.26		3.13	638.53	1734.37
74	1745.54	0.07	460	460	190	325.41	389.26	650	3.21	344.17	1734.37
73	1744.94		415.64	415.64		364.7	516.24		2.88	631.36	1733.62
73	1745.03	0.09	325	325	250	364.7	516.24	575	2.97	338.34	1733.62
72	1744.37		638.48	638.48		520.89	572.52		2.5	623.25	1733.9
72	1744.47	0.1	430	430	350	520.89	572.52	780	2.79	332.53	1733.9
71	1744.05		572.48	572.48		434.4	595.67		2.16	616.08	1734.5
71	1744.09	0.03	425	425	200	434.4	595.67	625	2.59	327.4	1734.5
70	1743.65		470.95	470.95		193.79	324.03		2.42	607.79	1732.21
70	1743.7	0.05	351	351	170	193.79	324.03	521	2.56	321.23	1732.21
69	1743.38		516.72	218		496.78	645.89		2.97	601.5	1731.31
69	1743.41	0.03	218	218	459	496.78	645.89	677	2.95	317.36	1731.31
68.6	1742.99		126.62	100		30	130		5.39	600.8	1732

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
68.6	1743.02	0.03	100	100	30	30	130	130	5.37	317.01	1732
68	1742.15		83.94	83.94		452.57	665.09		8.2	600.56	1729.85
68	1742.17	0.02	84.07	84.07	452.57	452.57	665.09	665.09	8.17	316.8	1729.85
67.5 BR U	1741.91		77.72	77.72		452.57	665.09		8.83	600.55	1729.85
67.5 BR U	1741.94	0.03	77.86	77.86		452.57	665.09		8.79	316.79	1729.85
67.5 BR D	1741.26		71.74	71.74		507.63	608.92		8.68	600.29	1728.8
67.5 BR D	1741.29	0.04	71.91	71.91		507.63	608.92		8.64	316.53	1728.8
67	1741.27		76.82	76.82		507.63	608.92		8.47	600.28	1728.8
67	1741.31	0.04	77	77	507.63	507.63	608.92	608.92	8.43	316.53	1728.8
66	1741.02		116.24	116.24		227.61	352.24		5.51	599.63	1730.34
66	1741.06	0.04	116.43	116.43	227.61	227.61	352.24	352.24	5.48	315.88	1730.34
65	1740.6		336.36	336.36		435.25	484.55		3.38	597.41	1730.46
65	1740.6	0	194.55	194.55	300	435.25	484.55	494.55	4.09	314.4	1730.46
64	1739.61		405.47	405.47		515.84	560.95		3.08	590.44	1728.47
64	1739.66	0.06	385	385	185	515.84	560.95	570	3.06	308.95	1728.47
63	1738.91		394.57	394.57		431.97	492.87		3.28	584.99	1728.11
63	1738.92	0.01	345	345	320	431.97	492.87	665	3.54	303.99	1728.11
62	1738.48		743.49	743.49		333.59	383		1.99	577.31	1728.26
62	1738.48	0	690	690	60	333.59	383	750	2.06	297.01	1728.26

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
61	1737.28		398.88	398.88		522.18	571.28		3.26	562.63	1724.4
61	1737.29	0	390	390	215	522.18	571.28	605	3.26	283.12	1724.4
60	1736.62		357.74	357.74		164.49	244.81		2.64	552.69	1723.79
60	1736.63	0.01	350	350	115	164.49	244.81	465	2.63	273.4	1723.79
59	1736.48		466.62	466.62		468.3	549.47		1.94	547.7	1722.87
59	1736.5	0.01	455	455	330	468.3	549.47	785	1.93	268.53	1722.87
58	1736.18		375.52	375.52		427.76	530.19		2.81	542.13	1722.4
58	1736.2	0.02	360	360	190	427.76	530.19	550	2.8	263.13	1722.4
57	1735.83		404.2	141.35		616.21	741.56		4.14	538.46	1722.21
57	1735.84	0.02	141.45	141.45	594	616.21	741.56	741.56	4.14	260.7	1722.21
56	1734.72		335.82	67.68		621.49	689.17		8.64	537.71	1722.6
56	1734.75	0.03	67.68	67.68	621.49	621.49	689.17	689.17	8.62	260.46	1722.6
55 BR U	1732.91					621.49	689.17		12.77	537.69	1722.6
55 BR U	1732.92	0.02			612.31	621.49	689.17	697.53	12.77	260.46	1722.6
55 BR D	1733.16		42.83	42.83		612.31	697.53		9.67	537.68	1722.25
55 BR D	1733.18	0.02	43.93	43.93	612.31	612.31	697.53	697.53	9.66	260.45	1722.25
54	1733.43		77.01	77.01		612.31	697.53		7.99	537.68	1722.25
54	1733.44	0.02	77.19	77.19	612.31	612.31	697.53	697.53	7.97	260.44	1722.25
53	1732.98		199.02	199.02		352.84	432.95		5.81	536.9	1722.23
53	1733.05	0.06	145	145	305	352.84	432.95	450	5.81	259.78	1722.23

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
52	1732.7		620.06	197.08		118.13	257.54		5.19	534.87	1721.3
52	1732.76	0.06	189	189	70	118.13	257.54	259	5.14	258.92	1721.3
51	1732.7		596.31	162.39		90.35	263.32		4.32	533.46	1720.8
51	1732.75	0.05	162.97	162.97	90.35	90.35	263.32	263.32	4.29	258.23	1720.8
50	1732.49		763.58	169.61		90.62	268.22		4.27	530.09	1720.3
50	1732.55	0.06	170.28	170.28	90.62	90.62	268.22	268.22	4.23	257.41	1720.3
48	1732.16		1406	179.76		85.8	277.92		3.59	517.38	1718.1
48	1732.23	0.07	180.54	180.54	85.8	85.8	277.92	277.92	3.56	255.35	1718.1
47	1731.8		231.74	231.74		139.4	246.88		3.36	506.38	1718.6
47	1731.81	0.01	136	136	129	139.4	246.88	265	3.95	253.22	1718.6
46	1731.12		265.5	265.5		131.04	172.82		3.87	502.89	1718.24
46	1731.15	0.03	181	181	69	131.04	172.82	250	4.24	250.95	1718.24
45	1730.08		232.74	232.74		234.98	264.92		4.56	499.35	1718.39
45	1730.13	0.05	174	174	145	234.98	264.92	319	4.98	248.44	1718.39
44	1729.78		424.79	267.02		298.77	346.38		2.92	495.08	1716.99
44	1729.86	0.08	262	262	173	298.77	346.38	435	2.89	245.61	1716.99
43	1729.62		640.58	640.58		462.51	512		1.71	488.55	1716.57
43	1729.64	0.02	450	450	200	462.51	512	650	2.17	241.26	1716.57
42	1729.6		586.33	586.33		574.81	728.81		1.66	486.7	1714.8

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
42	1729.62	0.02	450	450	350	574.81	728.81	800	1.93	239.92	1714.8
41	1729.61		623.92	623.92		679.18	757.3		1.3	485.88	1715.93
41	1729.64	0.03	485	485	365	679.18	757.3	850	1.41	239.29	1715.93
40	Culvert										
39	1729.5		518.81	518.81		657.48	737.39		1.98	485.12	1716.57
39	1729.52	0.02	515	515	280	657.48	737.39	795	1.97	238.62	1716.57
37	1729.13		194.29	194.29		389.34	490.43		3.76	481.53	1714.05
37	1729.16	0.03	192.46	192.46	291	389.34	490.43	490.43	3.75	235.06	1714.05
36	1728.89		361.59	254		1349.37	1454.72		3.56	478.71	1713.26
36	1728.92	0.03	248.39	248.39	1200	1349.37	1454.72	1454.72	3.55	232.8	1713.26
35	1728.58		1064.51	335.38		1545.73	1619.09		3.16	470.2	1712.73
35	1728.63	0.05	292	292	1350	1545.73	1619.09	1642	3.19	229.67	1712.73
34	1728.31		972.48	396.47		1342.77	1420.17		3.4	461.88	1713.03
34	1728.37	0.07	186	186	1250	1342.77	1420.17	1436	3.76	227.58	1713.03
33	1728.21		139.22	139.22		144.45	293.5		2.88	456.73	1711.55
33	1728.27	0.06	139.39	139.39	144.45	144.45	293.5	293.5	2.87	225.38	1711.55
32	1727.85		94.93	94.93		261.79	368.75		5.01	456.22	1713.97
32	1727.91	0.07	94.94	94.94	261.79	261.79	368.75	368.75	4.97	224.86	1713.97
31.7	1726.87		55.8	55.8		164.47	230.7		7.98	455.83	1713.37

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
31.7	1726.95	0.08	55.86	55.86	164.47	164.47	230.7	230.7	7.92	224.48	1713.37
31.5	1726.78		55.82	55.82		164.47	230.7		7.96	455.79	1713.27
31.5	1726.87	0.08	55.87	55.87	164.47	164.47	230.7	230.7	7.9	224.43	1713.27
31	1726.67		55.85	55.85		164.47	230.7		7.93	455.73	1713.1
31	1726.75	0.09	55.9	55.9	164.47	164.47	230.7	230.7	7.87	224.37	1713.1
30	1726.88		489.3	489.3		609.6	654.43		2.51	453.85	1714.1
30	1726.96	0.08	270	270	480	609.6	654.43	750	3.08	223.28	1714.1
29	1726.56		518.23	518.23		444.82	494.64		2.3	448.29	1713.44
29	1726.55	0	340	340	300	444.82	494.64	640	2.9	220.17	1713.44
28	1726.41		819.78	619.49		865.28	933.38		1.71	440.73	1714.31
28	1726.4	-0.01	478	478	500	865.28	933.38	978	1.94	215.52	1714.31
27	1726.04		588.94	201.96		935.33	1003.88		3.37	432.94	1712.8
27	1726.03	-0.01	201	201	816	935.33	1003.88	1017	3.37	211.33	1712.8
26	1725.37		95.36	95.36		549.92	674.99		6.76	431.77	1712.7
26	1725.36	-0.01	95.33	95.33	549.92	549.92	674.99	674.99	6.77	210.82	1712.7
25.5 BR U	1724.95		85.54	85.54		549.92	674.99		7.93	431.73	1712.7
25.5 BR U	1724.95	-0.01	85.51	85.51		549.92	674.99		7.94	210.78	1712.7
25.5 BR D	1724.62		83.08	83.08		550.79	674.85		8.1	431.62	1712.48
25.5 BR D	1724.61	-0.01	83.04	83.04		550.79	674.85		8.11	210.67	1712.48

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
25	1724.69		91.39	91.39		550.79	674.85		7.23	431.58	1712.48
25	1724.68	-0.01	91.36	91.36	550.79	550.79	674.85	674.85	7.23	210.62	1712.48
24	1724.91		559.55	234		358.87	415.28		4.05	431.21	1712.25
24	1724.84	-0.06	195	195	310	358.87	415.28	505	4.5	210.46	1712.25
23.7736	1724.6		261.25	261.25		476.21	537.58		4.61	430.2	1711.32
23.7736	1724.61	0.01	223.77	223.77	411	476.21	537.58	635	4.76	209.95	1711.32
23.54	1724.63		214.46	214.46		435.1	475.7		3.87	429.75	1711.29
23.54	1724.64	0.01	214.61	214.61	354	435.1	475.7	586	3.86	209.53	1711.29
23.27	1724.46		211.05	211.05		518.5	582.5		4.56	429.28	1711.48
23.27	1724.47	0.01	211.19	211.19	335	518.5	582.5	582.5	4.55	209.07	1711.48
23	1724.13		299.76	299.76		857.42	935.34		4.61	428.72	1712.07
23	1724.15	0.02	299.26	299.26	622	857.42	935.34	935.34	4.58	208.51	1712.07
22	1722.75		169.79	169.79		907.49	930.69		6.05	426.5	1711.37
22	1722.85	0.09	162	162	855	907.49	930.69	1017	5.96	206.32	1711.37
21	1722.56		847.9	591.77		1035.21	1080.8		2.43	420.45	1710.1
21	1722.56	0	420	420	980	1035.21	1080.8	1400	2.83	202.46	1710.1
20	1721.87		571.39	571.39		1095.65	1136.1		3.38	414.34	1710.2
20	1721.92	0.05	450	450	700	1095.65	1136.1	1150	3.54	198.66	1710.2
19	1721.53		419.82	419.82		222.12	333.32		2.99	408.31	1709.79
19	1721.6	0.07	391	391	209	222.12	333.32	600	2.95	193.56	1709.79

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
18	1721.04		216.31	216.31		207.33	328.13		4.67	405.53	1709.6
18	1721.12	0.08	216	216	207	207.33	328.13	423	4.6	190.91	1709.6
17	1720.29		442.06	364.36		217.85	294.08		5.08	402.57	1709.87
17	1720.39	0.1	170	170	130	217.85	294.08	300	5.35	189.13	1709.87
16	1720.26		1050.72	586.27		379.23	500.18		2.01	393.48	1709.01
16	1720.31	0.05	554	554	126	379.23	500.18	680	2.15	184.77	1709.01
15	1719.63		3408.42	421.94		267.98	357		3.32	356	1707.5
15	1719.67	0.04	349	349	70	267.98	357	419	3.37	177.22	1707.5
14	1719.17		2973.47	457.86		422.72	475.36		2.9	320.62	1706.6
14	1719.22	0.05	457.23	457.23	320	422.72	475.36	779	2.87	172.69	1706.6
13	1718.45		3136.12	373		629.67	745.9		3.72	267.04	1706.47
13	1718.53	0.08	373	373	497	629.67	745.9	870	3.65	164.39	1706.47
12	1717.39		61	61		816	877.48		7.94	258.99	1704.04
12	1717.49	0.1	61.01	61.01	816	816	877.48	877.48	7.87	163.36	1704.04
11 BR U	1717.38		61	61		816	877.48		7.94	258.99	1704.04
11 BR U	1717.48	0.1	61.01	61.01		816	877.48		7.87	163.36	1704.04
11 BR D	1717.3		64	64		811.53	876.38		7.94	258.95	1704.97
11 BR D	1717.4	0.1	64.03	64.03		811.53	876.38		7.87	163.32	1704.97
10	1717.3		64	64		811.53	876.38		7.95	258.95	1704.97

Willow Creek Flood Study
0.1' Encroachment Table

River Sta	Wat.Sur. Elev (ft)	Delta Wat. Sur. (ft)	Top Width (ft)	Effective Top Width (ft)	Enc Sta Left (ft)	Ch Sta Left (ft)	Ch Sta Right (ft)	Enc Sta Right (ft)	Velocity Total (ft/s)	SA Total (acres)	Min. Chan Elevation (ft)
10	1717.4	0.1	64.03	64.03	811.53	811.53	876.38	876.38	7.87	163.31	1704.97
9	1717.37		1499.74	427.34		680.46	893.98		3.01	252.28	1707.1
9	1717.45	0.08	320	320	630	680.46	893.98	950	3.21	162.05	1707.1
8	1716.45		1812.91	440.73		1390.63	1601.78		4.14	228.99	1705.06
8	1716.51	0.06	205.13	205.13	1390	1390.63	1601.78	1601.78	4.61	157.33	1705.06
7	1715.9		1865.76	1110.57		1715.9	1821.02		2.51	213.36	1704.23
7	1716	0.1	998.65	998.65	1475	1715.9	1821.02	2525	2.5	151.84	1704.23
6	1715.34		3313.43	2232.16		2318.66	2438.79		1.58	177.38	1705.1
6	1715.44	0.1	2006.96	2006.96	1285	2318.66	2438.79	3465	1.65	130.89	1705.1
4	1713.16		2209.75	2200.19		2785.48	2919.23		1.97	85.83	1702.85
4	1713.25	0.1	2012.5	2012.5	345	2785.48	2919.23	2925	2.05	63.38	1702.85
2	1711.73		4204.45	2935.56		3686.98	3796.07		1.41		1702.2
2	1711.82	0.1	2668.49	2668.49	1305	3686.98	3796.07	4676	1.48		1702.2

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
106	4867	1752.37	1752.37	1752.37	1752.37	1764.93	1764.93	1764.93	1764.93				720.39	720.39	720.39	720.39	720.39	720.39	720.39	720.39
			1752.37	1752.37	1752.37		1765.03	1765.16	1765.72	0.1	0.24	0.8		98	98	98		98	98	98
105	4867	1751.7	1751.7	1751.7	1751.7	1764.86	1764.86	1764.86	1764.86				1249	1249	1249	1249	1249	1249	1249	1249
			1751.7	1751.7	1751.7		1764.95	1765.11	1765.7	0.09	0.24	0.84		189	189	189		189	189	189
104	4867	1751.77	1751.77	1751.77	1751.77	1764.77	1764.77	1764.77	1764.77				1109.27	1109.27	1109.27	1109.27	1109.27	1109.27	1109.27	1109.27
			1751.77	1751.77	1751.77		1764.82	1764.99	1765.68	0.06	0.23	0.91		535.26	520.26	500.26		535.26	520.26	500.26
103.5U	Bridge		1751.77	1751.77	1751.77		1764.78	1764.78	1764.78					1072.51	1072.51	1072.51		1072.51	1072.51	1072.51
			1751.77	1751.77	1751.77		1764.43	1764.67	1762.98	-0.35	-0.12	-1.8		620.44	624.6	308.38		620.44	624.6	308.38
103.5D	Bridge		1751.52	1751.52	1751.52		1762.02	1762.02	1762.02					278.96	278.96	278.96		278.96	278.96	278.96
			1751.52	1751.52	1751.52		1761.96	1762.12	1762.46	-0.06	0.1	0.44		245.39	312.94	245.31		245.39	312.94	245.31
103	4867	1751.52	1751.52	1751.52	1751.52	1762.13	1762.13	1762.13	1762.13				406.78	406.78	406.78	406.78	406.78	406.78	406.78	406.78
			1751.52	1751.52	1751.52		1762.18	1762.59	1763.1	0.05	0.45	0.97		414.62	449.64	415.78		414.62	449.64	415.78
102	4867	1751.31	1751.31	1751.31	1751.31	1763.06	1763.06	1763.06	1763.06				1037.38	1037.38	1037.38	1037.38	1037.38	1037.38	1037.38	1037.38
			1751.31	1751.31	1751.31		1763.07	1763.24	1763.57	0.02	0.18	0.52		785	730	600		785	730	600
101	4867	1751.9	1751.9	1751.9	1751.9	1762.75	1762.75	1762.75	1762.75				623.52	623.52	623.52	623.52	623.52	623.52	623.52	623.52
			1751.9	1751.9	1751.9		1762.79	1762.98	1763.37	0.03	0.23	0.61		505.76	415.76	394.63		505.76	415.76	394.63
100	4867	1750.02	1750.02	1750.02	1750.02	1762.17	1762.17	1762.17	1762.17				647.29	647.29	647.29	647.29	647.29	647.29	647.29	647.29
			1750.02	1750.02	1750.02		1762.2	1762.42	1762.83	0.03	0.25	0.66		575	425	300		575	425	300
96	4867	1749.04	1749.04	1749.04	1749.04	1760.55	1760.55	1760.55	1760.55				855.16	855.16	855.16	855.16	855.16	855.16	855.16	855.16
			1749.04	1749.04	1749.04		1760.56	1760.91	1761.43	0	0.35	0.88		575	430	275		575	430	275
95	4867	1747.3	1747.3	1747.3	1747.3	1759.93	1759.93	1759.93	1759.93				831.25	831.25	831.25	831.25	831.25	831.25	831.25	831.25
			1747.3	1747.3	1747.3		1759.98	1760.31	1760.89	0.06	0.38	0.96		575	276	204		575	276	204
94	4867	1747.3	1747.3	1747.3	1747.3	1759.27	1759.27	1759.27	1759.27				1038.41	1038.41	1038.41	1038.41	891.6	891.6	891.6	891.6
			1747.3	1747.3	1747.3		1759.37	1759.77	1760.28	0.1	0.5	1		714.23	589.23	294.23		714.23	589.23	294.23
93	4867	1745.5	1745.5	1745.5	1745.5	1758.31	1758.31	1758.31	1758.31				896.84	896.84	896.84	896.84	896.84	896.84	896.84	896.84
			1745.5	1745.5	1745.5		1758.36	1758.69	1759.11	0.06	0.38	0.81		735.82	590.82	370.82		735.82	590.82	370.82
91	4867	1746.82	1746.82	1746.82	1746.82	1757.86	1757.86	1757.86	1757.86				838.09	838.09	838.09	838.09	702.37	702.37	702.37	702.37
			1746.82	1746.82	1746.82		1757.88	1758.08	1758.46	0.03	0.22	0.61		640	515	288		640	515	288

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
106	3032.42	3032.42	3032.42	3032.42	1.6	1.6	1.6	1.6	4852	4868	4870	4871	3.01	3.01	3.01	3.01	897.84	897.84	897.84	897.84
		794.06	807.59	862.06		6.13	6.03	5.65						7.56	7.44	7		539.4	400.08	282.3
105	4534.09	4534.09	4534.09	4534.09	1.07	1.07	1.07	1.07	4851	4864	4863	4862	1.99	1.99	1.99	1.99	888.98	888.98	888.98	888.98
		1397.57	1426.04	1538.52		3.48	3.41	3.16						4	3.92	3.65		538.06	398.74	280.96
104	2811.22	2811.22	2811.22	2811.22	1.73	1.73	1.73	1.73	4863	4862	4871	4861	3.7	3.7	3.7	3.7	888.24	888.24	888.24	888.24
		1563.23	1602.25	1876.86		3.11	3.04	2.59						5.51	5.34	4.49		537.83	398.52	280.75
103.5U						2.02	2.02	2.02										888.24	888.24	888.24
						3.09	2.92	7.18										537.83	398.52	280.75
103.5D						10.27	10.27	10.27										887.83	887.83	887.83
						10.63	9.66	8.66										537.57	398.23	280.58
103	536.08	536.08	536.08	536.08	9.08	9.08	9.08	9.08	4868	4869	4869	4869	11.18	11.18	11.18	11.18	887.82	887.82	887.82	887.82
		557.74	724.53	846.8		8.73	6.72	5.75						11.03	9.85	8.79		537.57	398.23	280.58
102	3299.13	3299.13	3299.13	3299.13	1.48	1.48	1.48	1.48	4883	4872	4879	4877	2.78	2.78	2.78	2.78	886.99	886.99	886.99	886.99
		3063.99	3088.26	2819.11		1.59	1.58	1.73						2.73	2.63	2.76		536.88	397.55	280
101	1983.71	1983.71	1983.71	1983.71	2.45	2.45	2.45	2.45	4860	4865	4871	4869	3.16	3.16	3.16	3.16	876.77	876.77	876.77	876.77
		1969.62	2004.43	2135.38		2.47	2.43	2.28						3.1	2.95	2.75		528.97	390.55	273.93
100	1977.64	1977.64	1977.64	1977.64	2.46	2.46	2.46	2.46	4865	4858	4864	4864	4.26	4.26	4.26	4.26	865	865	865	865
		1905.17	1762.3	1594.78		2.55	2.76	3.05						4.28	4.28	4.33		518.93	382.7	267.43
96	1609.76	1609.76	1609.76	1609.76	3.02	3.02	3.02	3.02	4861	4863	4862	4870	4.83	4.83	4.83	4.83	837.3	837.3	837.3	837.3
		1456.01	1409.14	1284.96		3.34	3.45	3.79						4.88	4.74	4.66		497.7	366.97	256.9
95	2205.83	2205.83	2205.83	2205.83	2.21	2.21	2.21	2.21	4875	4858	4869	4866	4.22	4.22	4.22	4.22	822.97	822.97	822.97	822.97
		2094.18	1607.06	1492.74		2.32	3.03	3.26						3.98	4.19	4.2		487.84	360.83	252.63
94	2240.4	2240.4	2240.4	2240.4	2.17	2.17	2.17	2.17	4862	4862	4866	4865	3.37	3.37	3.37	3.37	804.61	804.61	804.61	804.61
		2141.84	2125.07	1525.13		2.27	2.29	3.19						3.34	3.2	3.63		475.12	352.23	247.61
93	2021.53	2021.53	2021.53	2021.53	2.41	2.41	2.41	2.41	4872	4874	4860	4864	5.06	5.06	5.06	5.06	782.28	782.28	782.28	782.28
		1832.25	1552.81	1304.12		2.66	3.13	3.73						5.25	5.72	5.9		458.34	338.54	239.85
91	2665.75	2665.75	2665.75	2665.75	1.83	1.83	1.83	1.83	4878	4878	4862	4866	3.56	3.56	3.56	3.56	765.77	765.77	765.77	765.77
		2514.3	2077.96	1633.01		1.94	2.34	2.98						3.71	4.36	4.69		445.25	328.03	233.59

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
90	4867	1745.54	1745.54 1745.54	1745.54 1745.54	1745.54 1745.54	1755.42	1755.42 1755.51	1755.42 1755.67	1755.42 1755.88	0.09	0.25	0.46	298.35	298.35 297	298.35 284	298.35 214	298.35	298.35 297	298.35 284	298.35 214
89	4867	1744.92	1744.92 1744.92	1744.92 1744.92	1744.92 1744.92	1754.5	1754.5 1754.59	1754.5 1755	1754.5 1755.49	0.1	0.5	1	1207.72	1207.72 685	1207.72 350	1207.72 300	1010.33	1010.33 685	1010.33 350	1010.33 300
88	4867	1746.06	1746.06 1746.06	1746.06 1746.06	1746.06 1746.06	1753.98	1753.98 1754.04	1753.98 1754.43	1753.98 1754.92	0.06	0.45	0.94	956.6	956.6 926.87	956.6 762.62	956.6 551.4	956.6	956.6 926.87	956.6 762.62	956.6 551.4
87	4867	1743.1	1743.1 1743.1	1743.1 1743.1	1743.1 1743.1	1753.5	1753.5 1753.52	1753.5 1753.96	1753.5 1754.44	0.02	0.46	0.94	1031.39	1031.39 930	1031.39 525	1031.39 425	1031.39	1031.39 930	1031.39 525	1031.39 425
86	4867	1743.7	1743.7 1743.7	1743.7 1743.7	1743.7 1743.7	1753.2	1753.2 1753.21	1753.2 1753.57	1753.2 1754	0.02	0.37	0.8	916.76	916.76 795	916.76 425	916.76 330	916.76	916.76 795	916.76 425	916.76 330
85	4867	1741.36	1741.36 1741.36	1741.36 1741.36	1741.36 1741.36	1752.17	1752.17 1752.22	1752.17 1752.56	1752.17 1753.11	0.05	0.39	0.94	617.36	617.36 595	617.36 445	617.36 300	617.36	617.36 595	617.36 445	617.36 300
84	4867	1740.66	1740.66 1740.66	1740.66 1740.66	1740.66 1740.66	1751.42	1751.42 1751.52	1751.42 1751.91	1751.42 1752.42	0.1	0.5	1	623.34	623.34 510	623.34 350	623.34 250	623.34	623.34 510	623.34 350	623.34 250
83	4867	1740.15	1740.15 1740.15	1740.15 1740.15	1740.15 1740.15	1750.98	1750.98 1751.08	1750.98 1751.43	1750.98 1751.91	0.1	0.45	0.93	704.02	704.02 535	704.02 360	704.02 260	704.02	704.02 535	704.02 360	704.02 260
82	4867	1740.87	1740.87 1740.87	1740.87 1740.87	1740.87 1740.87	1750.63	1750.63 1750.66	1750.63 1750.97	1750.63 1751.45	0.03	0.34	0.82	664.31	664.31 500	664.31 350	664.31 230	664.31	664.31 500	664.31 350	664.31 230
81	4867	1740.61	1740.61 1740.61	1740.61 1740.61	1740.61 1740.61	1749.49	1749.49 1749.54	1749.49 1749.82	1749.49 1750.25	0.05	0.33	0.77	650.91	650.91 470	650.91 325	650.91 230	650.91	650.91 470	650.91 325	650.91 230
80	4867	1737.81	1737.81 1737.81	1737.81 1737.81	1737.81 1737.81	1748.4	1748.4 1748.44	1748.4 1748.71	1748.4 1748.95	0.03	0.31	0.55	548.32	548.32 425	548.32 325	548.32 230	548.32	548.32 425	548.32 325	548.32 230
79	4867	1737.41	1737.41 1737.41	1737.41 1737.41	1737.41 1737.41	1747.96	1747.96 1747.96	1747.96 1748.16	1747.96 1748.41	0	0.2	0.46	641.48	641.48 375	641.48 250	641.48 225	641.48	641.48 375	641.48 250	641.48 225
78	4867	1737.06	1737.06 1737.06	1737.06 1737.06	1737.06 1737.06	1747.47	1747.47 1747.51	1747.47 1747.64	1747.47 1747.84	0.05	0.17	0.37	389	389 355	389 250	389 215	389	389 355	389 250	389 215
77	4867	1737.1	1737.1 1737.1	1737.1 1737.1	1737.1 1737.1	1747.09	1747.09 1747.1	1747.09 1747.25	1747.09 1747.31	0.01	0.16	0.22	648.37	648.37 375	648.37 350	648.37 210	648.37	648.37 375	648.37 350	648.37 210
76	4867	1733.27	1733.27 1733.27	1733.27 1733.27	1733.27 1733.27	1746.03	1746.03 1746.11	1746.03 1746.41	1746.03 1746.28	0.08	0.38	0.25	277.75	277.75 280.89	277.75 299.95	277.75 213.8	277.75	277.75 280.89	277.75 299.95	277.75 213.8

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
90	682.63	682.63	682.63	682.63	7.13	7.13	7.13	7.13	4867	4866	4867	4867	9.91	9.91	9.91	9.91	756.58	756.58	756.58	756.58
		709.34	751.14	682.63		6.86	6.48	7.13						9.6	9.08	9.24		437.6	321.44	229.23
89	2273.85	2273.85	2273.85	2273.85	2.14	2.14	2.14	2.14	4866	4870	4863	4867	3.15	3.15	3.15	3.15	748.67	748.67	748.67	748.67
		1917.3	1473.76	1520.85		2.54	3.3	3.2						3.64	4.09	3.8		432.31	317.89	226.29
88	2017.36	2017.36	2017.36	2017.36	2.41	2.41	2.41	2.41	4862	4876	4871	4867	4.05	4.05	4.05	4.05	738.29	738.29	738.29	738.29
		1981.96	1758.4	1516.13		2.46	2.77	3.21						4.09	4.31	4.47		424.62	312.55	222.17
87	2904.83	2904.83	2904.83	2904.83	1.68	1.68	1.68	1.68	4880	4865	4855	4876	3.5	3.5	3.5	3.5	727.99	727.99	727.99	727.99
		2687.73	2334.35	2138.68		1.81	2.08	2.28						3.68	3.49	3.63		414.97	305.47	216.48
86	2654.29	2654.29	2654.29	2654.29	1.83	1.83	1.83	1.83	4857	4868	4861	4873	3.69	3.69	3.69	3.69	716.87	716.87	716.87	716.87
		2548.56	1800.23	1557.01		1.91	2.7	3.13						3.63	4.44	4.9		405.16	300.14	212.27
85	1522.53	1522.53	1522.53	1522.53	3.2	3.2	3.2	3.2	4872	4863	4863	4865	5.42	5.42	5.42	5.42	706.55	706.55	706.55	706.55
		1533.95	1469.32	1418.37		3.17	3.31	3.43						5.36	5.2	4.89		395.76	294.03	207.68
84	2148.93	2148.93	2148.93	2148.93	2.26	2.26	2.26	2.26	4857	4865	4862	4868	4.41	4.41	4.41	4.41	695.16	695.16	695.16	695.16
		2061.36	1827.74	1545.26		2.36	2.66	3.15						4.25	4.19	4.63		385.6	286.66	202.51
83	2064.85	2064.85	2064.85	2064.85	2.36	2.36	2.36	2.36	4873	4863	4870	4863	4.46	4.46	4.46	4.46	688.26	688.26	688.26	688.26
		1870.51	1531.38	1369.92		2.6	3.18	3.55						4.57	4.94	5.14		380.18	282.97	199.85
82	2289.59	2289.59	2289.59	2289.59	2.13	2.13	2.13	2.13	4877	4869	4865	4874	4.19	4.19	4.19	4.19	681.59	681.59	681.59	681.59
		1932.04	1621.53	1400.56		2.52	3	3.48						4.59	4.99	5.2		375.11	279.48	197.43
81	1584.8	1584.8	1584.8	1584.8	3.07	3.07	3.07	3.07	4865	4863	4860	4862	6.89	6.89	6.89	6.89	669.69	669.69	669.69	669.69
		1496.19	1335.27	1171.67		3.25	3.64	4.15						6.4	6.34	6.58		366.3	273.32	193.2
80	1834.59	1834.59	1834.59	1834.59	2.65	2.65	2.65	2.65	4862	4864	4867	4870	5.39	5.39	5.39	5.39	660.58	660.58	660.58	660.58
		1626.85	1448.51	1184.99		2.99	3.36	4.11						5.63	5.88	6.64		359.5	268.36	189.67
79	1970.95	1970.95	1970.95	1970.95	2.47	2.47	2.47	2.47	4868	4869	4861	4871	5.2	5.2	5.2	5.2	655.4	655.4	655.4	655.4
		1612.38	1331.75	1281.82		3.02	3.65	3.8						5.31	5.76	5.85		356.01	265.86	187.69
78	1941.91	1941.91	1941.91	1941.91	2.51	2.51	2.51	2.51	4874	4859	4874	4864	4.19	4.19	4.19	4.19	648.56	648.56	648.56	648.56
		1943.59	1603.27	1460.71		2.5	3.04	3.33						4.02	4.46	4.77		351.16	262.53	184.76
77	2375.67	2375.67	2375.67	2375.67	2.05	2.05	2.05	2.05	4870	4864	4866	4867	3.86	3.86	3.86	3.86	641.31	641.31	641.31	641.31
		1915.06	1915.66	1431.48		2.54	2.54	3.4						4.04	3.94	4.66		346.07	258.36	181.81
76	762.97	762.97	762.97	762.97	6.38	6.38	6.38	6.38	4868	4863	4870	4864	8.31	8.31	8.31	8.31	640.41	640.41	640.41	640.41
		785.67	868.06	693.88		6.19	5.61	7.01						8.16	7.68	8.39		345.43	257.72	181.4

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
75.5U	Bridge		1733.27	1733.27	1733.27		1745.05	1745.05	1745.05					113.65	113.65	113.65		113.65	113.65	113.65
			1733.27	1733.27	1733.27		1745.12	1745.52	1746.04	0.07	0.48	1		121.62	165.42	221.99		121.62	165.42	221.99
75.5D	Bridge		1733.8	1733.8	1733.8		1744.59	1744.59	1744.59					60.78	60.78	60.78		60.78	60.78	60.78
			1733.8	1733.8	1733.8		1744.66	1744.95	1745.22	0.06	0.36	0.63		67.14	97.6	125.35		67.14	97.6	125.35
75	4867	1733.8	1733.8	1733.8	1733.8	1744.81	1744.81	1744.81	1744.81				140.04	140.04	140.04	140.04	140.04	140.04	140.04	140.04
			1733.8	1733.8	1733.8		1744.89	1745.24	1745.54	0.08	0.43	0.73		144.26	173.21	197.02		144.26	173.21	197.02
74	4867	1734.37	1734.37	1734.37	1734.37	1745.47	1745.47	1745.47	1745.47				557.14	557.14	557.14	557.14	557.14	557.14	557.14	557.14
			1734.37	1734.37	1734.37		1745.54	1745.76	1746	0.07	0.29	0.52		460	330	320		460	330	320
73	4867	1733.62	1733.62	1733.62	1733.62	1744.94	1744.94	1744.94	1744.94				415.64	415.64	415.64	415.64	415.64	415.64	415.64	415.64
			1733.62	1733.62	1733.62		1745.03	1745.35	1745.62	0.09	0.41	0.68		325	325	300		325	325	300
72	4867	1733.9	1733.9	1733.9	1733.9	1744.37	1744.37	1744.37	1744.37				638.48	638.48	638.48	638.48	638.48	638.48	638.48	638.48
			1733.9	1733.9	1733.9		1744.47	1744.87	1745.13	0.1	0.5	0.76		430	370	290		430	370	290
71	4867	1734.5	1734.5	1734.5	1734.5	1744.05	1744.05	1744.05	1744.05				572.48	572.48	572.48	572.48	572.48	572.48	572.48	572.48
			1734.5	1734.5	1734.5		1744.09	1744.44	1744.7	0.03	0.39	0.65		425	275	235		425	275	235
70	4867	1732.21	1732.21	1732.21	1732.21	1743.65	1743.65	1743.65	1743.65				470.95	470.95	470.95	470.95	470.95	470.95	470.95	470.95
			1732.21	1732.21	1732.21		1743.7	1743.88	1744.05	0.05	0.24	0.4		351	200	136		351	200	136
69.5*	4867	1731.76	1731.76	1731.76	1731.76	1743.52	1743.52	1743.52	1743.52				465.3	465.3	465.3	465.3	465.3	465.3	465.3	465.3
			1731.76	1731.76	1731.76		1743.53	1743.67	1743.89	0.01	0.15	0.37		300	139.67	139.67		300	139.67	139.67
69	4867	1731.31	1731.31	1731.31	1731.31	1743.38	1743.38	1743.38	1743.38				516.72	516.72	516.72	516.72	218	218	218	218
			1731.31	1731.31	1731.31		1743.41	1743.59	1743.79	0.03	0.21	0.41		218	200	154		218	200	154
68.6	4867	1732	1732	1732	1732	1742.99	1742.99	1742.99	1742.99				126.62	126.62	126.62	126.62	100	100	100	100
			1732	1732	1732		1743.02	1743.23	1743.47	0.03	0.24	0.48		100	100	100		100	100	100
68	4867	1729.85	1729.85	1729.85	1729.85	1742.15	1742.15	1742.15	1742.15				83.94	83.94	83.94	83.94	83.94	83.94	83.94	83.94
			1729.85	1729.85	1729.85		1742.17	1742.46	1742.78	0.02	0.31	0.63		84.07	85.59	87.31		84.07	85.59	87.31
67.5U	Bridge		1729.85	1729.85	1729.85		1741.91	1741.91	1741.91					77.72	77.72	77.72		77.72	77.72	77.72
			1729.85	1729.85	1729.85		1741.94	1742.26	1742.61	0.03	0.34	0.7		77.86	79.5	81.36		77.86	79.5	81.36
67.5D	Bridge		1728.8	1728.8	1728.8		1741.26	1741.26	1741.26					71.74	71.74	71.74		71.74	71.74	71.74
			1728.8	1728.8	1728.8		1741.29	1741.69	1742.11	0.03	0.43	0.86		71.91	73.89	76		71.91	73.89	76
67	4867	1728.8	1728.8	1728.8	1728.8	1741.27	1741.27	1741.27	1741.27				76.82	76.82	76.82	76.82	76.82	76.82	76.82	76.82
			1728.8	1728.8	1728.8		1741.31	1741.71	1742.13	0.04	0.44	0.86		77	78.99	81.1		77	78.99	81.1

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
75.5U						10.11	10.11	10.11										640.41	640.41	640.41
						9.93	8.88	7.5										345.43	257.72	181.4
75.5D						10.36	10.36	10.36										640.34	640.34	640.34
						10.28	9.77	9.21										345.35	257.62	181.26
75	533.19	533.19	533.19	533.19	9.13	9.13	9.13	9.13	4868	4865	4865	4866	9.67	9.67	9.67	9.67	640.34	640.34	640.34	640.34
		544.18	600.67	654.85		8.94	8.1	7.43						9.56	9.07	8.67		345.35	257.62	181.26
74	1556.63	1556.63	1556.63	1556.63	3.13	3.13	3.13	3.13	4872	4864	4862	4861	5.53	5.53	5.53	5.53	640.1	640.1	640.1	640.1
		1515.22	1317.75	1357.92		3.21	3.69	3.58						5.42	5.71	5.5		345.15	257.45	181.09
73	1690.79	1690.79	1690.79	1690.79	2.88	2.88	2.88	2.88	4869	4871	4861	4875	3.65	3.65	3.65	3.65	632.93	632.93	632.93	632.93
		1639.96	1742.43	1741		2.97	2.79	2.8						3.58	3.38	3.32		339.32	252.55	176.44
72	1948.48	1948.48	1948.48	1948.48	2.5	2.5	2.5	2.5	4871	4862	4865	4861	4.83	4.83	4.83	4.83	624.82	624.82	624.82	624.82
		1742.63	1756.36	1604.34		2.79	2.77	3.03						4.8	4.52	4.62		333.51	247.19	171.88
71	2258.28	2258.28	2258.28	2258.28	2.16	2.16	2.16	2.16	4878	4861	4872	4873	2.97	2.97	2.97	2.97	617.65	617.65	617.65	617.65
		1876.68	1517.63	1424.85		2.59	3.21	3.42						3.31	3.65	3.73		328.38	243.27	168.65
70	2015.11	2015.11	2015.11	2015.11	2.42	2.42	2.42	2.42	4877	4873	4864	4863	3.39	3.39	3.39	3.39	609.36	609.36	609.36	609.36
		1903.5	1347.26	1120.51		2.56	3.61	4.34						3.31	4.04	4.42		322.2	239.46	165.66
69.5*	2080.15	2080.15	2080.15	2080.15	2.34	2.34	2.34	2.34	4868	4863	4870	4863	3.18	3.18	3.18	3.18	606.31	606.31	606.31	606.31
		1736.82	1232.85	1263.09		2.8	3.95	3.85						3.41	3.95	3.85		320.06	238.33	164.74
69	1640.45	1640.45	1640.45	1640.45	2.97	2.97	2.97	2.97	4872	4860	4864	4874	3.22	3.22	3.22	3.22	603.07	603.07	603.07	603.07
		1647.45	1610.75	1485.97		2.95	3.02	3.28						3.22	3.23	3.31		318.33	237.19	163.76
68.6	903.07	903.07	903.07	903.07	5.39	5.39	5.39	5.39	4868	4868	4866	4869	5.39	5.39	5.39	5.39	602.37	602.37	602.37	602.37
		906.44	926.85	951.02		5.37	5.25	5.12						5.37	5.25	5.12		317.99	236.86	163.48
68	593.85	593.85	593.85	593.85	8.2	8.2	8.2	8.2	4870	4868	4869	4868	8.2	8.2	8.2	8.2	602.13	602.13	602.13	602.13
		595.88	620.2	648.2		8.17	7.85	7.51						8.17	7.85	7.51		317.78	236.65	163.27
67.5U						8.83	8.83	8.83										602.12	602.12	602.12
						8.79	8.41	8.02										317.77	236.64	163.26
67.5D						8.68	8.68	8.68										601.86	601.86	601.86
						8.64	8.22	7.8										317.51	236.38	162.99
67	574.34	574.34	574.34	574.34	8.47	8.47	8.47	8.47	4865	4864	4866	4868	8.47	8.47	8.47	8.47	601.85	601.85	601.85	601.85
		577.04	608.26	642.23		8.43	8	7.58						8.43	8	7.58		317.5	236.37	162.98

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
66.1198*	4867	1730.16	1730.16	1730.16	1730.16	1741.04	1741.04	1741.04	1741.04				111.88	111.88	111.88	111.88	111.88	111.88	111.88	111.88
			1730.16	1730.16	1730.16		1741.08	1741.54	1742.01	0.04	0.5	0.97		112.07	114.2	116.37		112.07	114.2	116.37
66	4867	1730.34	1730.34	1730.34	1730.34	1741.02	1741.02	1741.02	1741.02				116.24	116.24	116.24	116.24	116.24	116.24	116.24	116.24
			1730.34	1730.34	1730.34		1741.06	1741.52	1741.99	0.04	0.5	0.97		116.43	118.56	120.74		116.43	118.56	120.74
65	4867	1730.46	1730.46	1730.46	1730.46	1740.6	1740.6	1740.6	1740.6				336.36	336.36	336.36	336.36	336.36	336.36	336.36	336.36
			1730.46	1730.46	1730.46		1740.6	1741.06	1741.41	0	0.47	0.81		194.55	159.55	124.55		194.55	159.55	124.55
64	4867	1728.47	1728.47	1728.47	1728.47	1739.61	1739.61	1739.61	1739.61				405.48	405.48	405.48	405.48	405.48	405.48	405.48	405.48
			1728.47	1728.47	1728.47		1739.66	1740.1	1740.56	0.06	0.49	0.95		385	120	120		385	120	120
63	4867	1728.11	1728.11	1728.11	1728.11	1738.91	1738.91	1738.91	1738.91				394.58	394.58	394.58	394.58	394.58	394.58	394.58	394.58
			1728.11	1728.11	1728.11		1738.92	1739.41	1739.76	0.01	0.5	0.85		345	270	165		345	270	165
62	4867	1728.26	1728.26	1728.26	1728.26	1738.48	1738.48	1738.48	1738.48				743.5	743.5	743.5	743.5	743.5	743.5	743.5	743.5
			1728.26	1728.26	1728.26		1738.48	1738.71	1739.04	0	0.23	0.55		690	250	195		690	250	195
61	4867	1724.4	1724.4	1724.4	1724.4	1737.28	1737.28	1737.28	1737.28				398.89	398.89	398.89	398.89	398.89	398.89	398.89	398.89
			1724.4	1724.4	1724.4		1737.29	1737.47	1737.88	0	0.19	0.59		390	250	170		390	250	170
60	4867	1723.79	1723.79	1723.79	1723.79	1736.62	1736.62	1736.62	1736.62				357.75	357.75	357.75	357.75	357.75	357.75	357.75	357.75
			1723.79	1723.79	1723.79		1736.63	1736.79	1737.07	0.01	0.17	0.45		350	250	140		350	250	140
59	4867	1722.87	1722.87	1722.87	1722.87	1736.48	1736.48	1736.48	1736.48				466.64	466.64	466.64	466.64	466.64	466.64	466.64	466.64
			1722.87	1722.87	1722.87		1736.5	1736.67	1736.89	0.01	0.19	0.41		455	250	140		455	250	140
58	4867	1722.4	1722.4	1722.4	1722.4	1736.18	1736.18	1736.18	1736.18				375.55	375.55	375.55	375.55	375.55	375.55	375.55	375.55
			1722.4	1722.4	1722.4		1736.2	1736.42	1736.66	0.02	0.24	0.49		360	325	203		360	325	203
57.5*	4867	1722.3	1722.3	1722.3	1722.3	1736.07	1736.07	1736.07	1736.07				382.71	382.71	382.71	382.71	287.05	287.05	287.05	287.05
			1722.3	1722.3	1722.3		1736.08	1736.3	1736.54	0.02	0.23	0.47		261	236	177		261	236	177
57	5111	1722.21	1722.21	1722.21	1722.21	1735.83	1735.83	1735.83	1735.83				404.22	404.22	404.22	404.22	141.35	141.35	141.35	141.35
			1722.21	1722.21	1722.21		1735.85	1736.08	1736.36	0.02	0.25	0.53		141.45	142.67	144.16		141.45	142.67	144.16
56	5111	1722.6	1722.6	1722.6	1722.6	1734.73	1734.73	1734.73	1734.73				335.86	335.86	335.86	335.86	67.68	67.68	67.68	67.68
			1722.6	1722.6	1722.6		1734.75	1735.06	1735.43	0.03	0.34	0.7		67.68	67.68	67.68		67.68	67.68	67.68
55U	Bridge		1722.6	1722.6	1722.6		1732.91	1732.91	1732.91											
			1722.6	1722.6	1722.6		1732.92	1733.14	1733.4	0.02	0.23	0.49								
55D	Bridge		1722.25	1722.25	1722.25		1733.16	1733.16	1733.16					42.86	42.86	42.86		42.86	42.86	42.86
			1722.25	1722.25	1722.25		1733.18	1733.43	1733.76	0.02	0.27	0.6		43.94	59.49	80.22		43.94	59.49	80.22

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
66.1198*	840.63	840.63	840.63	840.63	5.79	5.79	5.79	5.79	4867	4868	4870	4868	5.79	5.79	5.79	5.79	601.3	601.3	601.3	601.3
		845.21	896.86	950.77		5.76	5.43	5.12						5.76	5.43	5.12		316.95	235.8	162.4
66	882.78	882.78	882.78	882.78	5.51	5.51	5.51	5.51	4864	4864	4869	4872	5.51	5.51	5.51	5.51	601.2	601.2	601.2	601.2
		887.6	941.84	998.26		5.48	5.17	4.88						5.48	5.17	4.88		316.85	235.71	162.3
65	1441.99	1441.99	1441.99	1441.99	3.38	3.38	3.38	3.38	4874	4872	4870	4862	5.55	5.55	5.55	5.55	598.98	598.98	598.98	598.98
		1191.27	1124.63	978.31		4.09	4.33	4.97						5.66	5.72	6.26		315.37	234.4	161.17
64	1579.29	1579.29	1579.29	1579.29	3.08	3.08	3.08	3.08	4864	4873	4866	4868	5.45	5.45	5.45	5.45	592.01	592.01	592.01	592.01
		1592.44	1074.17	1129.52		3.06	4.53	4.31						5.31	5.46	5.2		309.93	231.77	158.86
63	1483.57	1483.57	1483.57	1483.57	3.28	3.28	3.28	3.28	4866	4867	4864	4865	5.03	5.03	5.03	5.03	586.56	586.56	586.56	586.56
		1374.96	1266.76	1046.34		3.54	3.84	4.65						5.2	5.46	5.94		304.97	229.1	156.92
62	2446.68	2446.68	2446.68	2446.68	1.99	1.99	1.99	1.99	4869	4867	4872	4864	3.99	3.99	3.99	3.99	578.89	578.89	578.89	578.89
		2362.39	1364.62	1234.45		2.06	3.57	3.94						4.05	5.33	5.55		297.99	225.57	154.44
61	1493.52	1493.52	1493.52	1493.52	3.26	3.26	3.26	3.26	4869	4867	4863	4872	5.69	5.69	5.69	5.69	564.2	564.2	564.2	564.2
		1493.03	1373.59	1258.84		3.26	3.54	3.87						5.66	5.43	5.32		284.1	219.07	149.66
60	1846.36	1846.36	1846.36	1846.36	2.64	2.64	2.64	2.64	4874	4863	4869	4868	3.9	3.9	3.9	3.9	554.26	554.26	554.26	554.26
		1849.08	1633.73	1245.13		2.63	2.98	3.91						3.87	4.02	4.54		274.38	212.47	145.54
59	2513.83	2513.83	2513.83	2513.83	1.94	1.94	1.94	1.94	4877	4861	4876	4867	3.09	3.09	3.09	3.09	549.27	549.27	549.27	549.27
		2518.46	2129.13	1565.03		1.93	2.29	3.11						3.06	3.05	3.67		269.5	209.36	143.73
58	1733.5	1733.5	1733.5	1733.5	2.81	2.81	2.81	2.81	4871	4871	4866	4864	3.89	3.89	3.89	3.89	543.7	543.7	543.7	543.7
		1739.7	1788.9	1594.6		2.8	2.72	3.05						3.85	3.65	3.63		264.11	205.58	141.44
57.5*	1670.22	1670.22	1670.22	1670.22	2.91	2.91	2.91	2.91	4860	4866	4870	4870	3.69	3.69	3.69	3.69	541.9	541.9	541.9	541.9
		1622.14	1612.5	1466.88		3	3.02	3.32						3.72	3.65	3.73		262.63	204.24	140.54
57	1233.41	1233.41	1233.41	1233.41	4.14	4.14	4.14	4.14	5106	5117	5113	5105	4.32	4.32	4.32	4.32	540.03	540.03	540.03	540.03
		1235.95	1268.83	1308.99		4.14	4.03	3.9						4.34	4.22	4.1		261.68	203.34	139.78
56	591.43	591.43	591.43	591.43	8.64	8.64	8.64	8.64	5110	5113	5111	5110	8.64	8.64	8.64	8.64	539.28	539.28	539.28	539.28
		593.13	614.25	638.79		8.62	8.32	8						8.62	8.32	8		261.44	203.1	139.54
55U						12.77	12.77	12.77										539.26	539.26	539.26
						12.77	12.77	12.77										261.44	203.1	139.54
55D						9.67	9.67	9.67										539.25	539.25	539.25
						9.66	9.42	9.04										261.43	203.09	139.52

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
54	5111	1722.25	1722.25	1722.25	1722.25	1733.43	1733.43	1733.43	1733.43				77.01	77.01	77.01	77.01	77.01	77.01	77.01	77.01
			1722.25	1722.25	1722.25		1733.44	1733.69	1733.99	0.02	0.26	0.57		77.2	79.72	82.62		77.2	79.72	82.62
53.3292*	5111	1722.24	1722.24	1722.24	1722.24	1733.09	1733.09	1733.09	1733.09				137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24
			1722.24	1722.24	1722.24		1733.12	1733.41	1733.76	0.03	0.32	0.67		120	120	120		120	120	120
53	5111	1722.23	1722.23	1722.23	1722.23	1732.98	1732.98	1732.98	1732.98				199.12	199.12	199.12	199.12	199.12	199.12	199.12	199.12
			1722.23	1722.23	1722.23		1733.05	1733.35	1733.72	0.06	0.37	0.73		145	140	140		145	140	140
52	5111	1721.3	1721.3	1721.3	1721.3	1732.7	1732.7	1732.7	1732.7				620.1	620.1	620.1	620.1	197.09	197.09	197.09	197.09
			1721.3	1721.3	1721.3		1732.76	1733.13	1733.55	0.06	0.42	0.85		189	187.54	187.54		189	187.54	187.54
51	5111	1720.8	1720.8	1720.8	1720.8	1732.7	1732.7	1732.7	1732.7				596.34	596.34	596.34	596.34	162.4	162.4	162.4	162.4
			1720.8	1720.8	1720.8		1732.75	1733.11	1733.53	0.05	0.41	0.83		162.98	166.86	170.57		162.98	166.86	170.57
50	5111	1720.3	1720.3	1720.3	1720.3	1732.49	1732.49	1732.49	1732.49				763.63	763.63	763.63	763.63	169.62	169.62	169.62	169.62
			1720.3	1720.3	1720.3		1732.55	1732.94	1733.39	0.06	0.45	0.9		170.28	174.67	177.6		170.28	174.67	177.6
48	5111	1718.1	1718.1	1718.1	1718.1	1732.16	1732.16	1732.16	1732.16				1406.02	1406.02	1406.02	1406.02	179.77	179.77	179.77	179.77
			1718.1	1718.1	1718.1		1732.23	1732.66	1733.15	0.07	0.5	0.99		180.54	185.63	190.49		180.54	185.63	190.49
47	5111	1718.6	1718.6	1718.6	1718.6	1731.8	1731.8	1731.8	1731.8				231.75	231.75	231.75	231.75	231.75	231.75	231.75	231.75
			1718.6	1718.6	1718.6		1731.81	1732.29	1732.76	0.01	0.49	0.96		136	136	109		136	136	109
46	5111	1718.24	1718.24	1718.24	1718.24	1731.12	1731.12	1731.12	1731.12				265.55	265.55	265.55	265.55	265.55	265.55	265.55	265.55
			1718.24	1718.24	1718.24		1731.15	1731.33	1731.64	0.03	0.21	0.52		181	104	82		181	104	82
45	5111	1718.39	1718.39	1718.39	1718.39	1730.08	1730.08	1730.08	1730.08				232.87	232.87	232.87	232.87	232.87	232.87	232.87	232.87
			1718.39	1718.39	1718.39		1730.13	1730.49	1730.9	0.05	0.41	0.82		174	165	155		174	165	155
44	5111	1716.99	1716.99	1716.99	1716.99	1729.78	1729.78	1729.78	1729.78				424.8	424.8	424.8	424.8	267.02	267.02	267.02	267.02
			1716.99	1716.99	1716.99		1729.86	1730.28	1730.46	0.08	0.5	0.68		262	262	190		262	262	190
43	5111	1716.57	1716.57	1716.57	1716.57	1729.62	1729.62	1729.62	1729.62				640.61	640.61	640.61	640.61	640.61	640.61	640.61	640.61
			1716.57	1716.57	1716.57		1729.64	1730.11	1730.33	0.01	0.48	0.71		450	450	425		450	450	425
42	5111	1714.8	1714.8	1714.8	1714.8	1729.6	1729.6	1729.6	1729.6				586.4	586.4	586.4	586.4	586.4	586.4	586.4	586.4
			1714.8	1714.8	1714.8		1729.62	1730.09	1730.32	0.02	0.49	0.72		450	450	450		450	450	450
41	5111	1715.93	1715.93	1715.93	1715.93	1729.61	1729.61	1729.61	1729.61				624.01	624.01	624.01	624.01	624.01	624.01	624.01	624.01
			1715.93	1715.93	1715.93		1729.64	1730.1	1730.33	0.03	0.49	0.72		485	450	410		485	450	410
40	culvert																			

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
54	639.8	639.8	639.8	639.8	7.99	7.99	7.99	7.99	5112	5110	5111	5112	7.99	7.99	7.99	7.99	539.25	539.25	539.25	539.25
		641.16	660.32	685.31		7.97	7.74	7.46						7.97	7.74	7.46		261.42	203.08	139.51
53.3292*	766.72	766.72	766.72	766.72	6.67	6.67	6.67	6.67	5114	5109	5108	5108	7.18	7.18	7.18	7.18	538.81	538.81	538.81	538.81
		765.9	800.58	842.95		6.67	6.38	6.06						7.14	6.87	6.55		261.03	202.68	139.11
53	879.41	879.41	879.41	879.41	5.81	5.81	5.81	5.81	5109	5114	5114	5110	6.78	6.78	6.78	6.78	538.46	538.46	538.46	538.46
		880.27	918.13	969.58		5.81	5.57	5.27						6.57	6.3	6		260.76	202.42	138.85
52	984.97	984.97	984.97	984.97	5.19	5.19	5.19	5.19	5112	5110	5111	5116	5.6	5.6	5.6	5.6	536.44	536.44	536.44	536.44
		994.19	1062.57	1142.01		5.14	4.81	4.48						5.54	5.19	4.83		259.89	201.57	137.99
51	1182.26	1182.26	1182.26	1182.26	4.32	4.32	4.32	4.32	5107	5109	5114	5114	4.32	4.32	4.32	4.32	535.03	535.03	535.03	535.03
		1191	1250.47	1321.48		4.29	4.09	3.87						4.29	4.09	3.87		259.21	200.89	137.31
50	1197.39	1197.39	1197.39	1197.39	4.27	4.27	4.27	4.27	5113	5107	5110	5117	4.27	4.27	4.27	4.27	531.65	531.65	531.65	531.65
		1207.33	1274.4	1353.69		4.23	4.01	3.78						4.23	4.01	3.78		258.39	200.04	136.44
48	1425.03	1425.03	1425.03	1425.03	3.59	3.59	3.59	3.59	5116	5115	5110	5118	3.59	3.59	3.59	3.59	518.95	518.95	518.95	518.95
		1436.93	1516.41	1609.39		3.56	3.37	3.18						3.56	3.37	3.18		256.33	197.93	134.29
47	1520.42	1520.42	1520.42	1520.42	3.36	3.36	3.36	3.36	5109	5112	5115	5110	4.02	4.02	4.02	4.02	507.95	507.95	507.95	507.95
		1294.08	1360.27	1243.31		3.95	3.76	4.11						4.24	4.04	4.14		254.2	195.76	132.27
46	1320	1320	1320	1320	3.87	3.87	3.87	3.87	5108	5105	5108	5112	6.29	6.29	6.29	6.29	504.46	504.46	504.46	504.46
		1206.91	904.12	801.28		4.23	5.65	6.38						6.17	7.28	7.84		251.93	194.01	130.85
45	1120.79	1120.79	1120.79	1120.79	4.56	4.56	4.56	4.56	5111	5112	5114	5114	7.48	7.48	7.48	7.48	500.92	500.92	500.92	500.92
		1026.54	1083.47	1090.34		4.98	4.72	4.69						7.33	6.88	6.77		249.42	192.1	129.17
44	1752.6	1752.6	1752.6	1752.6	2.92	2.92	2.92	2.92	5118	5119	5114	5106	4.09	4.09	4.09	4.09	496.64	496.64	496.64	496.64
		1771.11	1880.01	1422.42		2.89	2.72	3.59						4.04	3.8	4.91		246.59	189.33	126.94
43	2995.06	2995.06	2995.06	2995.06	1.71	1.71	1.71	1.71	5122	5117	5110	5109	3.16	3.16	3.16	3.16	490.11	490.11	490.11	490.11
		2357.9	2568.02	2554.54		2.17	1.99	2						3.71	3.36	3.32		242.24	184.98	123.18
42	3084.62	3084.62	3084.62	3084.62	1.66	1.66	1.66	1.66	5120	5101	5108	5117	2.3	2.3	2.3	2.3	488.26	488.26	488.26	488.26
		2643.26	2853.48	2957.52		1.93	1.79	1.73						2.5	2.33	2.25		240.9	183.64	121.88
41	3932.62	3932.62	3932.62	3932.62	1.3	1.3	1.3	1.3	5112	5103	5104	5116	2.19	2.19	2.19	2.19	487.45	487.45	487.45	487.45
		3619.12	3645.48	3503.93		1.41	1.4	1.46						2.19	2.12	2.16		240.27	183.03	121.3
40																				

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
39	5111	1716.57	1716.57 1716.57	1716.57 1716.57	1716.57 1716.57	1729.49	1729.49 1729.52	1729.49 1729.98	1729.49 1730.24	0.03	0.48	0.74	518.74	518.74 515	518.74 375	518.74 370	518.74	518.74 515	518.74 375	518.74 370
37	5111	1714.05	1714.05 1714.05	1714.05 1714.05	1714.05 1714.05	1729.13	1729.13 1729.16	1729.13 1729.62	1729.13 1729.9	0.03	0.5	0.77	194.23	194.23 192.46	194.23 109.31	194.23 109.81	194.23	194.23 192.46	194.23 109.31	194.23 109.81
36	5111	1713.26	1713.26 1713.26	1713.26 1713.26	1713.26 1713.26	1728.89	1728.89 1728.92	1728.89 1729.39	1728.89 1729.68	0.04	0.5	0.79	361.35	361.35 248.4	361.35 116.22	361.35 116.74	253.97	253.97 248.4	253.97 116.22	253.97 116.74
35	5111	1712.73	1712.73 1712.73	1712.73 1712.73	1712.73 1712.73	1728.58	1728.58 1728.63	1728.58 1728.86	1728.58 1729.2	0.05	0.28	0.62	1064.23	1064.23 292	1064.23 89.09	1064.23 89.09	335.29	335.29 292	335.29 89.09	335.29 89.09
34	5111	1713.03	1713.03 1713.03	1713.03 1713.03	1713.03 1713.03	1728.3	1728.3 1728.38	1728.3 1728.57	1728.3 1728.93	0.07	0.27	0.62	971.07	971.07 186	971.07 78.17	971.07 78.17	395.69	395.69 186	395.69 78.17	395.69 78.17
33.6666*	5111	1712.54	1712.54 1712.54	1712.54 1712.54	1712.54 1712.54	1728.25	1728.25 1728.31	1728.25 1728.58	1728.25 1728.94	0.07	0.33	0.69	443.52	443.52 178.61	443.52 100.97	443.52 101.47	234.67	234.67 178.61	234.67 100.97	234.67 101.47
33.3333*	5111	1712.04	1712.04 1712.04	1712.04 1712.04	1712.04 1712.04	1728.22	1728.22 1728.28	1728.22 1728.57	1728.22 1728.93	0.07	0.35	0.71	171.77	171.77 160.74	171.77 121.13	171.77 121.63	171.77	171.77 160.74	171.77 121.13	171.77 121.63
33	5111	1711.55	1711.55 1711.55	1711.55 1711.55	1711.55 1711.55	1728.21	1728.21 1728.27	1728.21 1728.56	1728.21 1728.92	0.07	0.35	0.72	139.21	139.21 139.39	139.21 139.84	139.21 140.34	139.21	139.21 139.39	139.21 139.84	139.21 140.34
32	5111	1713.97	1713.97 1713.97	1713.97 1713.97	1713.97 1713.97	1727.84	1727.84 1727.91	1727.84 1728.22	1727.84 1728.61	0.07	0.38	0.77	94.93	94.93 94.94	94.93 95	94.93 95.07	94.93	94.93 94.94	94.93 95	94.93 95.07
31.7	5111	1713.37	1713.37 1713.37	1713.37 1713.37	1713.37 1713.37	1726.86	1726.86 1726.95	1726.86 1727.33	1726.86 1727.8	0.09	0.47	0.94	55.8	55.8 55.86	55.8 56.1	55.8 56.39	55.8	55.8 55.86	55.8 56.1	55.8 56.39
31.5	5111	1713.27	1713.27 1713.27	1713.27 1713.27	1713.27 1713.27	1726.78	1726.78 1726.87	1726.78 1727.26	1726.78 1727.74	0.09	0.48	0.96	55.81	55.81 55.87	55.81 56.11	55.81 56.41	55.81	55.81 55.87	55.81 56.11	55.81 56.41
31	5111	1713.1	1713.1 1713.1	1713.1 1713.1	1713.1 1713.1	1726.66	1726.66 1726.76	1726.66 1727.16	1726.66 1727.65	0.09	0.49	0.98	55.85	55.85 55.9	55.85 56.16	55.85 56.46	55.85	55.85 55.9	55.85 56.16	55.85 56.46
30	5111	1714.1	1714.1 1714.1	1714.1 1714.1	1714.1 1714.1	1726.88	1726.88 1726.97	1726.88 1727.37	1726.88 1727.86	0.09	0.49	0.98	489.15	489.15 270	489.15 217	489.15 210	489.15	489.15 270	489.15 217	489.15 210
29.5*	5111	1713.77	1713.77 1713.77	1713.77 1713.77	1713.77 1713.77	1726.63	1726.63 1726.66	1726.63 1727.12	1726.63 1727.58	0.03	0.49	0.95	507.9	507.9 260	507.9 250	507.9 200	507.9	507.9 260	507.9 250	507.9 200
29	5111	1713.44	1713.44 1713.44	1713.44 1713.44	1713.44 1713.44	1726.55	1726.55 1726.56	1726.55 1726.96	1726.55 1727.23	0.01	0.41	0.68	518.04	518.04 340	518.04 245	518.04 135	518.04	518.04 340	518.04 245	518.04 135

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
39	2584.2	2584.2	2584.2	2584.2	1.98	1.98	1.98	1.98	5117	5119	5102	5115	3.25	3.25	3.25	3.25	486.69	486.69	486.69	486.69
		2598.39	2361.92	2435.54		1.97	2.16	2.1						3.23	3.24	3.13		239.6	182.48	120.78
37	1358.51	1358.51	1358.51	1358.51	3.76	3.76	3.76	3.76	5108	5117	5116	5112	4.27	4.27	4.27	4.27	483.09	483.09	483.09	483.09
		1364.52	1250.96	1281.28		3.75	4.09	3.99						4.25	4.23	4.13		236.04	180	118.32
36	1434.24	1434.24	1434.24	1434.24	3.56	3.56	3.56	3.56	5106	5118	5112	5114	4.24	4.24	4.24	4.24	480.28	480.28	480.28	480.28
		1441.61	1237.82	1272.21		3.55	4.13	4.02						4.22	4.27	4.16		233.78	178.84	117.15
35	1614.03	1614.03	1614.03	1614.03	3.17	3.17	3.17	3.17	5116	5116	5110	5115	4.52	4.52	4.52	4.52	471.77	471.77	471.77	471.77
		1603.87	1011.97	1041.69		3.19	5.05	4.91						4.43	5.32	5.17		230.65	177.57	115.88
34	1502.67	1502.67	1502.67	1502.67	3.4	3.4	3.4	3.4	5109	5106	5111	5107	4.75	4.75	4.75	4.75	463.46	463.46	463.46	463.46
		1361.57	973.5	1001.44		3.75	5.25	5.1						4.61	5.27	5.12		228.56	176.89	115.19
33.6666*	1425.23	1425.23	1425.23	1425.23	3.59	3.59	3.59	3.59	5117	5106	5115	5109	4.05	4.05	4.05	4.05	460.35	460.35	460.35	460.35
		1410.48	1253.57	1290.07		3.62	4.08	3.96						4	4.08	3.97		227.76	176.49	114.8
33.3333*	1534.53	1534.53	1534.53	1534.53	3.33	3.33	3.33	3.33	5110	5110	5115	5104	3.41	3.41	3.41	3.41	459	459	459	459
		1543.78	1536.1	1580.13		3.31	3.33	3.23						3.39	3.33	3.24		227.01	176.01	114.31
33	1771.4	1771.4	1771.4	1771.4	2.89	2.89	2.89	2.89	5119	5110	5116	5110	2.89	2.89	2.89	2.89	458.32	458.32	458.32	458.32
		1780.57	1820.69	1871.78		2.87	2.81	2.73						2.87	2.81	2.73		226.35	175.44	113.74
32	1020.85	1020.85	1020.85	1020.85	5.01	5.01	5.01	5.01	5114	5107	5116	5109	5.01	5.01	5.01	5.01	457.8	457.8	457.8	457.8
		1027.6	1057.03	1094.1		4.97	4.84	4.67						4.97	4.84	4.67		225.83	174.92	113.22
31.7	640.64	640.64	640.64	640.64	7.98	7.98	7.98	7.98	5112	5113	5109	5109	7.98	7.98	7.98	7.98	457.42	457.42	457.42	457.42
		645.59	666.92	693.21		7.92	7.66	7.37						7.92	7.66	7.37		225.45	174.53	112.84
31.5	641.67	641.67	641.67	641.67	7.97	7.97	7.97	7.97	5114	5109	5114	5111	7.97	7.97	7.97	7.97	457.38	457.38	457.38	457.38
		646.73	668.5	695.32		7.9	7.65	7.35						7.9	7.65	7.35		225.41	174.49	112.79
31	644.54	644.54	644.54	644.54	7.93	7.93	7.93	7.93	5111	5114	5109	5108	7.93	7.93	7.93	7.93	457.31	457.31	457.31	457.31
		649.77	672.21	699.76		7.87	7.6	7.3						7.87	7.6	7.3		225.35	174.43	112.73
30	2036.94	2036.94	2036.94	2036.94	2.51	2.51	2.51	2.51	5113	5118	5117	5112	4.58	4.58	4.58	4.58	455.44	455.44	455.44	455.44
		1661.6	1677.84	1733.04		3.08	3.05	2.95						4.45	4.25	4.08		224.25	173.5	111.82
29.5*	1877.03	1877.03	1877.03	1877.03	2.72	2.72	2.72	2.72	5106	5106	5104	5113	5.12	5.12	5.12	5.12	452.7	452.7	452.7	452.7
		1442.29	1523.72	1416.42		3.54	3.35	3.61						5.5	5.13	5.21		222.8	172.22	110.7
29	2216.48	2216.48	2216.48	2216.48	2.31	2.31	2.31	2.31	5120	5118	5104	5114	3.84	3.84	3.84	3.84	449.88	449.88	449.88	449.88
		1764.92	1518.93	1109.41		2.9	3.36	4.61						4.28	4.68	5.76		221.15	170.86	109.78

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
28	5111	1714.31	1714.31 1714.31	1714.31 1714.31	1714.31 1714.31	1726.4	1726.4 1726.4	1726.4 1726.51	1726.4 1726.59	0	0.11	0.19	819.42	819.42 478	819.42 193	819.42 122	619.45	619.45 478	619.45 193	619.45 122
27.2865*	5111	1713.23	1713.23 1713.23	1713.23 1713.23	1713.23 1713.23	1726.19	1726.19 1726.2	1726.19 1726.34	1726.19 1726.33	0.01	0.15	0.14	586.14	586.14 320	586.14 200	586.14 120	331.62	331.62 320	331.62 200	331.62 120
27	5529	1712.8	1712.8 1712.8	1712.8 1712.8	1712.8 1712.8	1726.03	1726.03 1726.04	1726.03 1726.24	1726.03 1726.19	0	0.21	0.16	588.9	588.9 201	588.9 194	588.9 120	201.95	201.95 201	201.95 194	201.95 120
26	5529	1712.7	1712.7 1712.7	1712.7 1712.7	1712.7 1712.7	1725.36	1725.36 1725.37	1725.36 1725.62	1725.36 1725.71	0.01	0.26	0.35	95.32	95.32 95.36	95.32 96.46	95.32 96.87	95.32	95.32 95.36	95.32 96.46	95.32 96.87
25.5U	Bridge		1712.7 1712.7	1712.7 1712.7	1712.7 1712.7		1724.95 1724.96	1724.95 1725.24	1724.95 1725.35	0.01	0.3	0.41		85.5 85.55	85.5 86.82	85.5 87.29		85.5 85.55	85.5 86.82	85.5 87.29
25.5D	Bridge		1712.48 1712.48	1712.48 1712.48	1712.48 1712.48		1724.61 1724.62	1724.61 1724.95	1724.61 1725.07	0.01	0.34	0.46		83.03 83.08	83.03 84.57	83.03 85.11		83.03 83.08	83.03 84.57	83.03 85.11
25	5529	1712.48	1712.48 1712.48	1712.48 1712.48	1712.48 1712.48	1724.68	1724.68 1724.69	1724.68 1725.01	1724.68 1725.13	0.01	0.34	0.45	91.35	91.35 91.4	91.35 92.86	91.35 93.4	91.35	91.35 91.4	91.35 92.86	91.35 93.4
24	5529	1712.25	1712.25 1712.25	1712.25 1712.25	1712.25 1712.25	1724.9	1724.9 1724.9	1724.9 1725.22	1724.9 1725.28	0	0.33	0.38	559.23	559.23 234	559.23 234	559.23 185	234	234 234	234 234	234 185
23.7736*	5529	1712.21	1712.21 1712.21	1712.21 1712.21	1712.21 1712.21	1724.69	1724.69 1724.7	1724.69 1724.82	1724.69 1725	0	0.13	0.3	560.14	560.14 385	560.14 230	560.14 215	560.14	560.14 385	560.14 230	560.14 215
23	5529	1712.07	1712.07 1712.07	1712.07 1712.07	1712.07 1712.07	1724.13	1724.13 1724.15	1724.13 1724.47	1724.13 1724.69	0.02	0.34	0.57	299.76	299.76 299.26	299.76 292.09	299.76 292.68	299.76	299.76 299.26	299.76 292.09	299.76 292.68
22	5529	1711.37	1711.37 1711.37	1711.37 1711.37	1711.37 1711.37	1722.75	1722.75 1722.85	1722.75 1723.13	1722.75 1723.51	0.09	0.38	0.75	169.79	169.79 162	169.79 110	169.79 110	169.79	169.79 162	169.79 110	169.79 110
21.5*	5529	1710.73	1710.73 1710.73	1710.73 1710.73	1710.73 1710.73	1722.79	1722.79 1722.79	1722.79 1722.97	1722.79 1723.41	0.01	0.19	0.62	416.31	416.31 301	416.31 221	416.31 221	416.31	416.31 301	416.31 221	416.31 221
21	5529	1710.1	1710.1 1710.1	1710.1 1710.1	1710.1 1710.1	1722.56	1722.56 1722.56	1722.56 1722.68	1722.56 1723.01	0	0.11	0.45	847.9	847.9 420	847.9 295	847.9 220	591.77	591.77 420	591.77 295	591.77 220
20	5529	1710.2	1710.2 1710.2	1710.2 1710.2	1710.2 1710.2	1721.87	1721.87 1721.92	1721.87 1722.17	1721.87 1722.66	0.05	0.31	0.79	571.39	571.39 450	571.39 288	571.39 288	571.39	571.39 450	571.39 288	571.39 288
19	5529	1709.79	1709.79 1709.79	1709.79 1709.79	1709.79 1709.79	1721.53	1721.53 1721.6	1721.53 1721.89	1721.53 1722.43	0.07	0.36	0.9	419.82	419.82 391	419.82 280	419.82 280	419.82	419.82 391	419.82 280	419.82 280

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
28	2987.5	2987.5	2987.5	2987.5	1.71	1.71	1.71	1.71	5109	5105	5114	5110	2.91	2.91	2.91	2.91	442.32	442.32	442.32	442.32
		2631.34	1342.17	1020.02		1.94	3.81	5.01						3.06	4.89	5.88		216.5	168.32	108.28
27.2865*	2053.64	2053.64	2053.64	2053.64	2.49	2.49	2.49	2.49	5114	5102	5116	5114	3.73	3.73	3.73	3.73	436.49	436.49	436.49	436.49
		2032.86	1644.88	1181.05		2.51	3.11	4.33						3.76	4.09	5.07		213.18	166.67	107.25
27	1640.73	1640.73	1640.73	1640.73	3.37	3.37	3.37	3.37	5529	5532	5535	5525	4.39	4.39	4.39	4.39	434.53	434.53	434.53	434.53
		1641.51	1667.16	1225.02		3.37	3.32	4.51						4.42	4.33	5.29		212.3	166.01	106.85
26	816.76	816.76	816.76	816.76	6.77	6.77	6.77	6.77	5529	5527	5528	5529	6.77	6.77	6.77	6.77	433.37	433.37	433.37	433.37
		817.55	841.4	850.54		6.76	6.57	6.5						6.76	6.57	6.5		211.8	165.52	106.48
25.5U						7.94	7.94	7.94										433.32	433.32	433.32
						7.93	7.66	7.56										211.75	165.47	106.43
25.5D						8.11	8.11	8.11										433.21	433.21	433.21
						8.1	7.79	7.68										211.64	165.36	106.32
25	764.02	764.02	764.02	764.02	7.24	7.24	7.24	7.24	5532	5531	5532	5529	7.24	7.24	7.24	7.24	433.17	433.17	433.17	433.17
		765.05	794.88	805.99		7.23	6.96	6.86						7.23	6.96	6.86		211.6	165.32	106.28
24	1363.01	1363.01	1363.01	1363.01	4.06	4.06	4.06	4.06	5534	5525	5528	5523	5.88	5.88	5.88	5.88	432.8	432.8	432.8	432.8
		1364.15	1439.7	1269.72		4.05	3.84	4.35						5.92	5.61	5.99		211.42	165.14	106.12
23.7736*	1574.02	1574.02	1574.02	1574.02	3.51	3.51	3.51	3.51	5525	5530	5529	5528	6.34	6.34	6.34	6.34	431.42	431.42	431.42	431.42
		1410.84	1112.51	1139.81		3.92	4.97	4.85						6.34	6.88	6.67		210.66	164.56	105.63
23	1200.02	1200.02	1200.02	1200.02	4.61	4.61	4.61	4.61	5532	5525	5530	5526	6.89	6.89	6.89	6.89	428.72	428.72	428.72	428.72
		1206.37	1298.22	1364.5		4.58	4.26	4.05						6.85	6.27	5.94		208.51	162.93	104.04
22	913.21	913.21	913.21	913.21	6.05	6.05	6.05	6.05	5525	5526	5527	5530	9.13	9.13	9.13	9.13	426.5	426.5	426.5	426.5
		927.13	850.37	891.97		5.96	6.5	6.2						8.91	8.95	8.52		206.32	161.02	102.13
21.5*	2034.52	2034.52	2034.52	2034.52	2.72	2.72	2.72	2.72	5534	5524	5533	5526	4.78	4.78	4.78	4.78	424.58	424.58	424.58	424.58
		1737.22	1422.34	1518.19		3.18	3.89	3.64						5.11	5.91	5.51		204.81	159.94	101.05
21	2274.31	2274.31	2274.31	2274.31	2.43	2.43	2.43	2.43	5527	5521	5526	5525	4.74	4.74	4.74	4.74	420.45	420.45	420.45	420.45
		1950.92	1565.58	1364.14		2.83	3.53	4.05						4.98	5.63	5.94		202.46	158.26	99.61
20	1633.39	1633.39	1633.39	1633.39	3.38	3.38	3.38	3.38	5521	5534	5533	5525	7.01	7.01	7.01	7.01	414.34	414.34	414.34	414.34
		1563.36	1456.12	1596.68		3.54	3.8	3.46						6.77	6.25	5.64		198.66	155.71	97.41
19	1849.79	1849.79	1849.79	1849.79	2.99	2.99	2.99	2.99	5531	5530	5534	5523	4.08	4.08	4.08	4.08	408.31	408.31	408.31	408.31
		1874.45	1820.36	1972.49		2.95	3.04	2.8						4	3.85	3.57		193.56	152.26	93.96

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
18	5529	1709.6	1709.6 1709.6	1709.6 1709.6	1709.6 1709.6	1721.04	1721.04 1721.12	1721.04 1721.39	1721.04 1722.01	0.08	0.36	0.97	216.31	216.31 216	216.31 122	216.31 122	216.31	216.31 216	216.31 122	216.31 122
17	5529	1709.87	1709.87 1709.87	1709.87 1709.87	1709.87 1709.87	1720.29	1720.29 1720.39	1720.29 1720.66	1720.29 1721.27	0.1	0.37	0.99	442.06	442.06 170	442.06 125	442.06 100	364.36	364.36 170	364.36 125	364.36 100
16	5529	1709.01	1709.01 1709.01	1709.01 1709.01	1709.01 1709.01	1720.26	1720.26 1720.31	1720.26 1720.67	1720.26 1720.96	0.05	0.41	0.7	1050.72	1050.72 554	1050.72 450	1050.72 220	586.27	586.27 554	586.27 450	586.27 220
15	5529	1707.5	1707.5 1707.5	1707.5 1707.5	1707.5 1707.5	1719.63	1719.63 1719.67	1719.63 1720.12	1719.63 1720.24	0.04	0.49	0.6	3408.42	3408.42 349	3408.42 290	3408.42 218	421.94	421.94 349	421.94 290	421.94 218
14	5529	1706.6	1706.6 1706.6	1706.6 1706.6	1706.6 1706.6	1719.17	1719.17 1719.22	1719.17 1719.3	1719.17 1719.49	0.05	0.13	0.31	2973.47	2973.47 457.23	2973.47 145	2973.47 145	457.86	457.86 457.23	457.86 145	457.86 145
13.1263*	5529	1706.49	1706.49 1706.49	1706.49 1706.49	1706.49 1706.49	1718.67	1718.67 1718.74	1718.67 1718.94	1718.67 1719.19	0.07	0.27	0.52	3208.51	3208.51 540	3208.51 488	3208.51 488	549.1	549.1 540	549.1 488	549.1 488
13	5575	1706.47	1706.47 1706.47	1706.47 1706.47	1706.47 1706.47	1718.45	1718.45 1718.53	1718.45 1718.75	1718.45 1719.02	0.08	0.3	0.57	3136.12	3136.12 373	3136.12 373	3136.12 373	373	373 373	373 373	373 373
12	5575	1704.04	1704.04 1704.04	1704.04 1704.04	1704.04 1704.04	1717.39	1717.39 1717.49	1717.39 1717.75	1717.39 1718.07	0.1	0.36	0.69	61	61 61.01	61 61.05	61 61.1	61	61 61.01	61 61.05	61 61.1
11U	Bridge		1704.04 1704.04	1704.04 1704.04	1704.04 1704.04		1717.38 1717.48	1717.38 1717.75	1717.38 1718.07	0.1	0.36	0.69		61 61.01	61 61.05	61 61.1		61 61.01	61 61.05	61 61.1
11D	Bridge		1704.97 1704.97	1704.97 1704.97	1704.97 1704.97		1717.3 1717.4	1717.3 1717.67	1717.3 1718.01	0.1	0.37	0.71		64 64.03	64 64.09	64 64.17		64 64.03	64 64.09	64 64.17
10	5575	1704.97	1704.97 1704.97	1704.97 1704.97	1704.97 1704.97	1717.3	1717.3 1717.4	1717.3 1717.67	1717.3 1718	0.1	0.37	0.71	64	64 64.03	64 64.09	64 64.17	64	64 64.03	64 64.09	64 64.17
9.18648*	5575	1706.7	1706.7 1706.7	1706.7 1706.7	1706.7 1706.7	1717.36	1717.36 1717.43	1717.36 1717.74	1717.36 1718.1	0.07	0.38	0.74	1244.89	1244.89 185.8	1244.89 185.8	1244.89 185.8	385.67	385.67 185.8	385.67 185.8	385.67 185.8
9	5575	1707.1	1707.1 1707.1	1707.1 1707.1	1707.1 1707.1	1717.37	1717.37 1717.45	1717.37 1717.74	1717.37 1718.1	0.08	0.37	0.73	1499.74	1499.74 320	1499.74 214	1499.74 214	427.34	427.34 320	427.34 214	427.34 214
8	5575	1705.06	1705.06 1705.06	1705.06 1705.06	1705.06 1705.06	1716.45	1716.45 1716.51	1716.45 1716.93	1716.45 1717.45	0.06	0.48	1	1812.91	1812.91 205.13	1812.91 207.7	1812.91 210.86	440.73	440.73 205.13	440.73 207.7	440.73 210.86
7	5575	1704.23	1704.23 1704.23	1704.23 1704.23	1704.23 1704.23	1715.9	1715.9 1716	1715.9 1716.38	1715.9 1716.81	0.1	0.48	0.92	1865.76	1865.76 998.65	1865.76 727.55	1865.76 288.08	1110.57	1110.57 998.65	1110.57 727.55	1110.57 288.08

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
18	1184.47	1184.47	1184.47	1184.47	4.67	4.67	4.67	4.67	5531	5531	5529	5529	5.13	5.13	5.13	5.13	405.53	405.53	405.53	405.53
		1202.32	1086.19	1161.56		4.6	5.09	4.76						5.07	5.1	4.77		190.91	150.49	92.19
17	1088.65	1088.65	1088.65	1088.65	5.08	5.08	5.08	5.08	5530	5528	5533	5533	6.57	6.57	6.57	6.57	402.57	402.57	402.57	402.57
		1033.22	957.19	913.06		5.35	5.78	6.06						6.51	6.56	6.54		189.13	149.35	91.18
16	2748.88	2748.88	2748.88	2748.88	2.01	2.01	2.01	2.01	5525	5535	5523	5522	2.8	2.8	2.8	2.8	393.48	393.48	393.48	393.48
		2574.58	2642.81	1496.4		2.15	2.09	3.69						3.01	2.8	4.35		184.77	145.87	89.23
15	1665.71	1665.71	1665.71	1665.71	3.32	3.32	3.32	3.32	5530	5532	5531	5529	4.72	4.72	4.72	4.72	356	356	356	356
		1641.53	1655.92	1399.73		3.37	3.34	3.95						4.68	4.44	4.87		177.22	139.66	85.54
14	1904.92	1904.92	1904.92	1904.92	2.9	2.9	2.9	2.9	5524	5533	5528	5535	5.16	5.16	5.16	5.16	320.62	320.62	320.62	320.62
		1927.81	1116.77	1143.51		2.87	4.95	4.84						5.1	6.49	6.34		172.69	137.2	83.49
13.1263*	1959.78	1959.78	1959.78	1959.78	2.82	2.82	2.82	2.82	5527	5531	5539	5523	4.37	4.37	4.37	4.37	275.41	275.41	275.41	275.41
		1989.61	2036.45	2157.31		2.78	2.72	2.56						4.29	4.08	3.86		165.56	132.7	78.98
13	1496.7	1496.7	1496.7	1496.7	3.72	3.72	3.72	3.72	5568	5573	5583	5576	4.96	4.96	4.96	4.96	267.04	267.04	267.04	267.04
		1526.79	1608.93	1710.52		3.65	3.47	3.26						4.88	4.66	4.4		164.39	131.58	77.87
12	702.21	702.21	702.21	702.21	7.94	7.94	7.94	7.94	5576	5573	5577	5573	7.94	7.94	7.94	7.94	258.99	258.99	258.99	258.99
		708.19	724.28	744.05		7.87	7.7	7.49						7.87	7.7	7.49		163.36	130.56	76.85
11U						7.94	7.94	7.94										258.99	258.99	258.99
						7.87	7.7	7.49										163.36	130.56	76.85
11D						7.94	7.94	7.94										258.95	258.95	258.95
						7.87	7.68	7.46										163.32	130.51	76.8
10	701.62	701.62	701.62	701.62	7.95	7.95	7.95	7.95	5578	5573	5573	5572	7.95	7.95	7.95	7.95	258.95	258.95	258.95	258.95
		708.16	725.6	746.94		7.87	7.68	7.46						7.87	7.68	7.46		163.31	130.51	76.8
9.18648*	1445.16	1445.16	1445.16	1445.16	3.86	3.86	3.86	3.86	5578	5575	5576	5570	4.23	4.23	4.23	4.23	254.44	254.44	254.44	254.44
		1296.49	1353.3	1420.82		4.3	4.12	3.92						4.3	4.12	3.92		162.45	129.65	75.93
9	1852.19	1852.19	1852.19	1852.19	3.01	3.01	3.01	3.01	5575	5578	5570	5577	3.45	3.45	3.45	3.45	252.28	252.28	252.28	252.28
		1737.59	1591.5	1669.82		3.21	3.5	3.34						3.48	3.51	3.34		162.05	129.33	75.62
8	1345.12	1345.12	1345.12	1345.12	4.14	4.14	4.14	4.14	5569	5570	5570	5574	4.55	4.55	4.55	4.55	228.99	228.99	228.99	228.99
		1208.18	1295.41	1404.03		4.61	4.3	3.97						4.61	4.3	3.97		157.33	125.3	71.55
7	2216.95	2216.95	2216.95	2216.95	2.51	2.51	2.51	2.51	5565	5570	5567	5580	5.14	5.14	5.14	5.14	213.36	213.36	213.36	213.36
		2228.02	1861.95	1357.63		2.5	2.99	4.11						4.92	5.16	5.43		151.84	121.02	69.22

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
6	5575	1705.1	1705.1 1705.1	1705.1 1705.1	1705.1 1705.1	1715.34	1715.34 1715.44	1715.34 1715.84	1715.34 1716.34	0.1	0.5	1	3313.43	3313.43 2006.96	3313.43 1400	3313.43 1140	2232.16	2232.16 2006.96	2232.16 1400	2232.16 1140
4	5575	1702.85	1702.85 1702.85	1702.85 1702.85	1702.85 1702.85	1713.16	1713.16 1713.25	1713.16 1713.66	1713.16 1714.15	0.1	0.5	1	2209.75	2209.75 2012.5	2209.75 1394.35	2209.75 970	2200.19	2200.19 2012.5	2200.19 1394.35	2200.19 970
2	5575	1702.2	1702.2 1702.2	1702.2 1702.2	1702.2 1702.2	1711.73	1711.73 1711.82	1711.73 1712.22	1711.73 1712.68	0.1	0.5	0.96	4204.45	4204.45 2668.49	4204.45 2916.53	4204.45 632	2935.56	2935.56 2668.49	2935.56 2916.53	2935.56 632

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity ($Q = V_T \times A$)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
6	3519.17	3519.17	3519.17	3519.17	1.58	1.58	1.58	1.58	5560	5560	5572	5581	3.58	3.58	3.58	3.58	177.38	177.38	177.38	177.38
		3369.73	3012.04	2906.85		1.65	1.85	1.92						3.61	3.61	3.54		130.89	106.12	59.14
4	2828.43	2828.43	2828.43	2828.43	1.97	1.97	1.97	1.97	5572	5580	5570	5574	4.28	4.28	4.28	4.28	85.83	85.83	85.83	85.83
		2721.74	2292.05	1955.92		2.05	2.43	2.85						4.31	4.51	4.84		63.38	58.4	22.23
2	3959.01	3959.01	3959.01	3959.01	1.41	1.41	1.41	1.41	5582	5582	5585	5579	3.53	3.53	3.53	3.53				
		3771.33	3626.61	2267.71		1.48	1.54	2.46						3.57	3.71	3.88				

Willow Creek Floodplain Study
evaluation of
1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)				Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
106	4867	1752.37	1752.37 1752.37	1752.37 1752.37	1752.37 1752.37	1764.93	1764.93 1765.03	1764.93 1765.16	1764.93 1765.72	0.1	0.24	0.8	720.39	720.39 98	720.39 98	720.39 98	720.39	720.39 98	720.39 98	720.39 98	3032.42	3032.42 794.06	3032.42 807.59	3032.42 862.06	1.6	1.6 6.13	1.6 6.03	1.6 5.65	4852	4868	4870	4871	3.01	3.01 7.56	3.01 7.44	3.01 7	897.84	897.84 539.4	897.84 400.08	897.84 282.3
105	4867	1751.7	1751.7 1751.7	1751.7 1751.7	1751.7 1751.7	1764.86	1764.86 1764.95	1764.86 1765.11	1764.86 1765.7	0.09	0.24	0.84	1249	1249 189	1249 189	1249 189	1249	1249 189	1249 189	1249 189	4534.09	4534.09 1397.57	4534.09 1426.04	4534.09 1538.52	1.07	1.07 3.48	1.07 3.41	1.07 3.16	4851	4864	4863	4862	1.99	1.99 4	1.99 3.92	1.99 3.65	888.98	888.98 538.06	888.98 398.74	888.98 280.96
104	4867	1751.77	1751.77 1751.77	1751.77 1751.77	1751.77 1751.77	1764.77	1764.77 1764.82	1764.77 1764.99	1764.77 1765.68	0.06	0.23	0.91	1109.27	1109.27 535.26	1109.27 520.26	1109.27 500.26	1109.27	1109.27 535.26	1109.27 520.26	1109.27 500.26	2811.22	2811.22 1563.23	2811.22 1602.25	2811.22 1676.86	1.73	1.73 3.11	1.73 3.04	1.73 2.59	4863	4862	4871	4861	3.7	3.7 5.51	3.7 5.34	3.7 4.49	888.24	888.24 537.83	888.24 398.52	888.24 280.75
103.5U	Bridge		1751.77 1751.77	1751.77 1751.77	1751.77 1751.77		1764.78 1764.43	1764.78 1764.67	1764.78 1762.98	-0.35	-0.12	-1.8		1072.51 620.44	1072.51 624.6	1072.51 308.38		1072.51 620.44	1072.51 624.6	1072.51 308.38						2.02 3.09	2.02 2.92	2.02 7.18										888.24 537.83	888.24 398.52	888.24 280.75
103.5D	Bridge		1751.52 1751.52	1751.52 1751.52	1751.52 1751.52		1762.02 1761.96	1762.02 1762.12	1762.02 1762.46	-0.06	0.1	0.44		278.96 245.39	278.96 312.94	278.96 245.31		278.96 245.39	278.96 312.94	278.96 245.31						10.27 10.63	10.27 9.66	10.27 8.66										887.83 537.57	887.83 398.23	887.83 280.58
103	4867	1751.52	1751.52 1751.52	1751.52 1751.52	1751.52 1751.52	1762.13	1762.13 1762.18	1762.13 1762.59	1762.13 1763.1	0.05	0.45	0.97	406.78	406.78 414.62	406.78 449.64	406.78 415.78	406.78	406.78 414.62	406.78 449.64	406.78 415.78	536.08	536.08 557.74	536.08 724.53	536.08 846.8	9.08	9.08 8.73	9.08 6.72	9.08 5.75	4868	4869	4869	4869	11.18	11.18 11.03	11.18 9.85	11.18 8.79	887.82	887.82 537.57	887.82 398.23	887.82 280.58
102	4867	1751.31	1751.31 1751.31	1751.31 1751.31	1751.31 1751.31	1763.06	1763.06 1763.07	1763.06 1763.24	1763.06 1763.57	0.02	0.18	0.52	1037.38	1037.38 785	1037.38 730	1037.38 600	1037.38	1037.38 785	1037.38 730	1037.38 600	3299.13	3299.13 3063.99	3299.13 3088.26	3299.13 2819.11	1.48	1.48 1.59	1.48 1.58	1.48 1.73	4883	4872	4879	4877	2.78	2.78 2.73	2.78 2.63	2.78 2.76	886.99	886.99 536.88	886.99 397.55	886.99 280
101	4867	1751.9	1751.9 1751.9	1751.9 1751.9	1751.9 1751.9	1762.75	1762.75 1762.79	1762.75 1762.98	1762.75 1763.37	0.03	0.23	0.61	623.52	623.52 505.76	623.52 415.76	623.52 394.63	623.52	623.52 505.76	623.52 415.76	623.52 394.63	1983.71	1983.71 1969.62	1983.71 2004.43	1983.71 2135.38	2.45	2.45 2.47	2.45 2.43	2.45 2.28	4860	4865	4871	4869	3.16	3.16 3.1	3.16 2.95	3.16 2.75	876.77	876.77 528.97	876.77 390.55	876.77 273.93
100	4867	1750.02	1750.02 1750.02	1750.02 1750.02	1750.02 1750.02	1762.17	1762.17 1762.2	1762.17 1762.42	1762.17 1762.83	0.03	0.25	0.66	647.29	647.29 575	647.29 425	647.29 300	647.29	647.29 575	647.29 425	647.29 300	1977.64	1977.64 1905.17	1977.64 1762.3	1977.64 1594.78	2.46	2.46 2.55	2.46 2.76	2.46 3.05	4865	4858	4864	4864	4.26	4.26 4.28	4.26 4.28	4.26 4.33	865	865 518.93	865 382.7	865 267.43
96	4867	1749.04	1749.04 1749.04	1749.04 1749.04	1749.04 1749.04	1760.55	1760.55 1760.56	1760.55 1760.91	1760.55 1761.43	0	0.35	0.88	855.16	855.16 575	855.16 430	855.16 275	855.16	855.16 575	855.16 430	855.16 275	1609.76	1609.76 1456.01	1609.76 1409.14	1609.76 1284.96	3.02	3.02 3.34	3.02 3.45	3.02 3.79	4861	4863	4862	4870	4.83	4.83 4.88	4.83 4.74	4.83 4.66	837.3	837.3 497.7	837.3 366.97	837.3 256.9
95	4867	1747.3	1747.3 1747.3	1747.3 1747.3	1747.3 1747.3	1759.93	1759.93 1759.98	1759.93 1760.31	1759.93 1760.89	0.06	0.38	0.96	831.25	831.25 575	831.25 276	831.25 204	831.25	831.25 575	831.25 276	831.25 204	2205.83	2205.83 2094.18	2205.83 1607.06	2205.83 1492.74	2.21	2.21 2.32	2.21 3.03	2.21 3.26	4875	4858	4869	4866	4.22	4.22 3.98	4.22 4.19	4.22 4.2	822.97	822.97 487.84	822.97 360.83	822.97 252.63
94	4867	1747.3	1747.3 1747.3	1747.3 1747.3	1747.3 1747.3	1759.27	1759.27 1759.37	1759.27 1759.77	1759.27 1760.28	0.1	0.5	1	1038.41	1038.41 714.23	1038.41 589.23	1038.41 294.23	891.6	891.6 714.23	891.6 589.23	891.6 294.23	2240.4	2240.4 2141.84	2240.4 2125.07	2240.4 1525.13	2.17	2.17 2.27	2.17 2.29	2.17 3.19	4862	4862	4866	4865	3.37	3.37 3.34	3.37 3.2	3.37 3.63	804.61	804.61 475.12	804.61 352.23	804.61 247.61
93	4867	1745.5	1745.5 1745.5	1745.5 1745.5	1745.5 1745.5	1758.31	1758.31 1758.36	1758.31 1758.69	1758.31 1759.11	0.06	0.38	0.81	896.84	896.84 735.82	896.84 590.82	896.84 370.82	896.84	896.84 735.82	896.84 590.82	896.84 370.82	2021.53	2021.53 1832.25	2021.53 1552.81	2021.53 1304.12	2.41	2.41 2.66	2.41 3.13	2.41 3.73	4872	4874	4860	4864	5.06	5.06 5.25	5.06 5.72	5.06 5.9	782.28	782.28 458.34	782.28 338.54	782.28 239.85
91	4867	1746.82	1746.82 1746.82	1746.82 1746.82	1746.82 1746.82	1757.86	1757.86 1757.88	1757.86 1758.08	1757.86 1758.46	0.03	0.22	0.61	838.09	838.09 640	838.09 515	838.09 288	702.37	702.37 640	702.37 515	702.37 288	2665.75	2665.75 2514.3	2665.75 2077.96	2665.75 1633.01	1.83	1.83 1.94	1.83 2.34	1.83 2.98	4878	4878	4862	4866	3.56	3.56 3.71	3.56 4.36	3.56 4.69	765.77	765.77 445.25	765.77 328.03	765.77 233.59
90	4867	1745.54	1745.54 1745.54	1745.54 1745.54	1745.54 1745.54	1755.42	1755.42 1755.51	1755.42 1755.67	1755.42 1755.88	0.09	0.25	0.46	298.35	298.35 297	298.35 284	298.35 214	298.35	298.35 297	298.35 284	298.35 214	682.63	682.63 709.34	682.63 751.14	682.63 682.63	7.13	7.13 6.86	7.13 6.48	7.13 7.13	4867	4866	4867	4867	9.91	9.91 9.6	9.91 9.08	9.91 9.24	756.58	756.58 437.6	756.58 321.44	756.58 229.23
89	4867	1744.92	1744.92 1744.92	1744.92 1744.92	1744.92 1744.92	1754.5	1754.5 1754.59	1754.5 1755	1754.5 1755.49	0.1	0.5	1	1207.72	1207.72 685	1207.72 350	1207.72 300	1010.33	1010.33 685	1010.33 350	1010.33 300	2273.85	2273.85 1917.3	2273.85 1473.76	2273.85 1520.85	2.14	2.14 2.54	2.14 3.3	2.14 3.2	4866	4870	4863	4867	3.15	3.15 3.64	3.15 4.09	3.15 3.8	748.67	748.67 432.31	748.67 317.89	748.67 226.29
88	4867	1746.06	1746.06 1746.06	1746.06 1746.06	1746.06 1746.06	1753.98	1753.98 1754.04	1753.98 1754.43	1753.98 1754.92	0.06	0.45	0.94	956.6	956.6 926.87	956.6 762.62	956.6 551.4	956.6	956.6 926.87	956.6 762.62	956.6 551.4	2017.36	2017.36 1981.96	2017.36 1758.4	2017.36 1516.13	2.41	2.41 2.46	2.41 2.77	2.41 3.21	4862	4876	4871	4867	4.05	4.05 4.09	4.05 4.31	4.05 4.47	738.29	738.29 424.62	738.29 312.55	738.29 222.17
87	4867	1743.1	1743.1 1743.1	1743.1 1743.1	1743.1 1743.1	1753.5	1753.5 1753.52	1753.5 1753.96	1753.5 1754.44	0.02	0.46	0.94	1031.39	1031.39 930	1031.39 525	1031.39 425	1031.39	1031.39 930	1031.39 525	1031.39 425	2904.83	2904.83 2687.73	2904.83 2334.35	2904.83 2138.68	1.68	1.68 1.81	1.68 2.08	1.68 2.28	4880	4865	4855	4876	3.5	3.5 3.68	3.5 3.49	3.5 3.63	727.99	727.99 414.97	727.99 305.47	727.99 216.48
86	4867	1743.7	1743.7 1743.7	1743.7 1743.7	1743.7 1743.7	1753.2	1753.2 1753.21	1753.2 1753.57	1753.2 1754	0.02	0.37	0.8	916.76	916.76 795	916.76 425	916.76 330	916.76	916.76 795	916.76 425	916.76 330	2654.29	2654.29 2548.56	2654.29 1800.23	2654.29 1557.01	1.83	1.83 1.91	1.83 2.7	1.83 3.13	4857	4868	4861	4873	3.69	3.69 3.63	3.69 4.44	3.69 4.9	716.87	716.87 405.16	716.87 300.14	716.87 212.27
85	4867	1741.36	1741.36 1741.36	1741.36 1741.36	1741.36 1741.36	1752.17	1752.17 1752.22	1752.17 1752.56	1752.17 1753.11	0.05	0.39	0.94	617.36	617.36 595	617.36 445	617.36 300	617.36	617.36 595	617.36 445	617.36 300	1522.53	1522.53 1533.95	1522.53 1469.32	1522.53 1418.37	3.2	3.2 3.17	3.2 3.31	3.2 3.43	4872	4863	4863	4865	5.42	5.42 5.36	5.42 5.2	5.42 4.89	706.55	706.55 395.76	706.55 294.03	706.55 207.68
84	4867	1740.66	1740.66 1740.66	1740.66 1740.66	1740.66 1740.66	1751.42	1751.42 1751.52	1751.42 1751.91	1751.42 1752.42	0.1	0.5	1	623.34	623.34 510	623.34 350	623.34 250	623.34	623.34 510	623.34 350	623.34 250	2148.93	2148.93 2061.36	2148.93 1827.74	2148.93 1545.26	2.26	2.26 2.36	2.26 2.66	2.26 3.15	4857	4865	4862	4868	4.41	4.41 4.25	4.41 4.19	4.41 4.63	695.16	695.16 385.6	695.16 286.66	695.16 202.51
83	4867	1740.15	1740.15 1740.15	1740.15 1740.15	1740.15 1740.15	1750.98	1750.98 1751.08	1750.98 1751.43	1750.98 1751.91	0.1	0.45	0.93	704.02	704.02 535	704.02 360	704.02 260	704.02	704.02 535	704.02 360	704.02 260	2064.85	2064.85 1870.51	2064.85 1531.38	2064.85 1369.92	2.36	2.36 2.6	2.36 3.18	2.36 3.55	4873	4863	4870	4863	4.46	4.46 4.57	4.46 4.94	4.46 5.14	688.26	688.26 380.18	688.26 282.97	688.26 199.85
82	4867	1740.87	1740.87 1740.87	1740.87 1740.87	1740.87 1740.87	1750.63	1750.63 1750.66	1750.63 1750.97	1750.63 1751.45	0.03	0.34	0.82	664.31	664.31 500	664.31 350	664.31 230	664.31	664.31 500	664.31 350	664.31 230	2289.59	2289.59 1932.04	2289.59 1621.53	2289.59 1400.56	2.13	2.13 2.52	2.13 3	2.13 3.48	4877	4869	4865	4874	4.19	4.19 4.59	4.19 4.99	4.19 5.2	681.59	681.59 375.11	681.59 279.48	681.59 197.43
81	4867	1740.61	1740.61 1740.61	1740.61 1740.61	1740.61 1740.61	1749.49	1749.49 1749.54	1749.49 1749.82	1749.49 1750.25	0.05	0.33	0.77	650.91	650.91 470	650.91 325	650.91 230	650.91	650.91 470	650.91 325	650.91 230	1584.8	1584.8 1496.19	1584.8 1335.27	1584.8 1171.67	3.07	3.07 3.25	3.07 3.64	3.07 4.15	4865	4863	4860	4862	6.89	6.89 6.4	6.89 6.34	6.89 6.58	669.69	669.69 366.3	669.69 273.32	669.69 193.2
80	4867	1737.81	1737.81 1737.81	1737.81 1737.81	1737.81 1737.81	1748.4	1748.4 1748.44	1748.4 1748.71	1748.4 1748.95	0.03	0.31	0.55	548.32	548.32 425	548.32 325	548.32 230	548.32	548.32 425	548.32 325	548.32 230	1834.59	1834.59 1626.85	1834.59 1448.51	1834.59 1184.99	2.65	2.65 2.99	2.65 3.36	2.65 4.11	4862	4864	4867	4870	5.39	5.39 5.63	5.39 5.88	5.39 6.64	660.58	660.58 359.5	660.58 268.36	660.58 189.67
79	4867	1737.41	1737.41 1737.41	1737.41 1737.41	1737.41 1737.41	1747.96	1747.96 1747.96	1747.96 1748.16	1747.96 1748.41	0	0.2	0.46	641.48	641.48 375	641.48 250	641.48 225	641.48	641.48 375	641.48 250	641.48 225	1970.95	1970.95 1612.38	1970.95 1331.75	1970.95 1281.82	2.47	2.47 3.02	2.47 3.65	2.47 3.8	4868	4869	4861	4871	5.2	5.2 5.31	5.2 5.76	5.2 5.85	655.4	655.4 356.01	655.4 265.86	655.4 187.69
78	4867	1737.06	1737.06 1737.06	1737.06 1737.06	1737.06 1737.06	1747.47	1747.47 1747.51	1747.47 1747.64	1747.47 1747.84	0.05	0.17	0.37	389	389 355	389 250	389 215	389	389 355	389 250	389 215	1941.91	1941.91 1943.59	1941.91 1603.27	1941.91 1460.71	2.51	2.51 2.5	2.51 3.04	2.51 3.33	4874	4859	4874	4864	4.19	4.19 4.02	4.19 4.46	4.19 4.77	648.56	648.56 351.16	648.56 262.53	648.56 184.76
77	4867	1737.1	1737.1 1737.1	1737.1 1737.1	1737.1 1737.1	1747.09	1747.09 1747.1	1747.09 1747.25	1747.09 1747.31	0.01	0.16	0.22	648.37	648.37 375	648.37 350	648.37 210	648.37	648.37 375	648.37 350	648.37 210	2375.67	2375.67 1915.06	2375.67 1915.66	2375.67 1431.48	2.05	2.05 2.54	2.05 2.54	2.05 3.4	4870	4864	4866	4867	3.86	3.86 4.04	3.86 3.94	3.86 4.66	641.31	641.31 346.07	641.31 258.36	641.31 181.81
76	4867	1733.27	1733.27 1733.27	1733.27 1733.27	1733.27 1733.27	1746.03	1746.03 1746.11	1746.03 1746.41	1746.03 1746.28	0.08	0.38	0.25	277.75	277.75 280.89	277.75 299.95	277.75 213.8	277.75	277.75 280.89	277.75 299.95	277.75 213.8	762.97	762.97 785.67	762.97 868.06	762.97 693.88	6.38	6.38 6.19	6.38 5.61	6.38 7.01	4868	4863	4870	4864	8.31	8.31 8.16	8.31 7.68	8.31 8.39	640.41	640.41 345.43	640.41 257.72	640.41 181.4
75.5U	Bridge		1733.27 1733.27	1733.27 1733.27	1733.27 1733.27		1745.05 1745.12	1745.05 1745.52	1745.05 1746.04	0.07	0.48	1		113.65 121.62	113.65 165.42	113.65 221.99		113.65 121.62	113.65 165.42	113.65 221.99						10.11 9.93	10.11 8.88	10.11 7.5										640.41 345.43	640.41 257.72	640.41 181.4
75.5D	Bridge		1733.8 1733.8	1733.8 1733.8	1733.8 1733.8		1744.59 1744.66	1744.59 1744.95	1744.59 1745.22	0.06	0.36	0.63		60.78 67.14	60.78 97.6	60.78 125.35		60.78 67.14	60.78 97.6	60.78 125.35						10.36 10.28	10.36 9.77	10.36 9.21										640.34 345.35	640.34 257.62	640.34 181.26

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)				Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
75	4867	1733.8	1733.8 1733.8	1733.8 1733.8	1733.8 1733.8	1744.81	1744.81 1744.89	1744.81 1745.24	1744.81 1745.54	0.08	0.43	0.73	140.04	140.04 144.26	140.04 173.21	140.04 197.02	140.04	140.04 144.26	140.04 173.21	140.04 197.02	533.19	533.19 544.18	533.19 600.67	533.19 654.85	9.13	9.13 8.94	9.13 8.1	9.13 7.43	4868	4865	4865	4866	9.67	9.67 9.56	9.67 9.07	9.67 8.67	640.34	640.34 345.35	640.34 257.62	640.34 181.26
74	4867	1734.37	1734.37 1734.37	1734.37 1734.37	1734.37 1734.37	1745.47	1745.47 1745.54	1745.47 1745.76	1745.47 1746	0.07	0.29	0.52	557.14	557.14 460	557.14 330	557.14 320	557.14	557.14 460	557.14 330	557.14 320	1556.63	1556.63 1515.22	1556.63 1317.75	1556.63 1357.92	3.13	3.13 3.21	3.13 3.69	3.13 3.58	4872	4864	4862	4861	5.53	5.53 5.42	5.53 5.71	5.53 5.5	640.1	640.1 345.15	640.1 257.45	640.1 181.09
73	4867	1733.62	1733.62 1733.62	1733.62 1733.62	1733.62 1733.62	1744.94	1744.94 1745.03	1744.94 1745.35	1744.94 1745.62	0.09	0.41	0.68	415.64	415.64 325	415.64 325	415.64 300	415.64	415.64 325	415.64 325	415.64 300	1690.79	1690.79 1639.96	1690.79 1742.43	1690.79 1741	2.88	2.88 2.97	2.88 2.79	2.88 2.8	4869	4871	4861	4875	3.65	3.65 3.58	3.65 3.38	3.65 3.32	632.93	632.93 339.32	632.93 252.55	632.93 176.44
72	4867	1733.9	1733.9 1733.9	1733.9 1733.9	1733.9 1733.9	1744.37	1744.37 1744.47	1744.37 1744.87	1744.37 1745.13	0.1	0.5	0.76	638.48	638.48 430	638.48 370	638.48 290	638.48	638.48 430	638.48 370	638.48 290	1948.48	1948.48 1742.63	1948.48 1756.36	1948.48 1604.34	2.5	2.5 2.79	2.5 2.77	2.5 3.03	4871	4862	4865	4861	4.83	4.83 4.8	4.83 4.52	4.83 4.62	624.82	624.82 333.51	624.82 247.19	624.82 171.88
71	4867	1734.5	1734.5 1734.5	1734.5 1734.5	1734.5 1734.5	1744.05	1744.05 1744.09	1744.05 1744.44	1744.05 1744.7	0.03	0.39	0.65	572.48	572.48 425	572.48 275	572.48 235	572.48	572.48 425	572.48 275	572.48 235	2258.28	2258.28 1876.68	2258.28 1517.63	2258.28 1424.85	2.16	2.16 2.59	2.16 3.21	2.16 3.42	4878	4861	4872	4873	2.97	2.97 3.31	2.97 3.65	2.97 3.73	617.65	617.65 328.38	617.65 243.27	617.65 168.65
70	4867	1732.21	1732.21 1732.21	1732.21 1732.21	1732.21 1732.21	1743.65	1743.65 1743.7	1743.65 1743.88	1743.65 1744.05	0.05	0.24	0.4	470.95	470.95 351	470.95 200	470.95 136	470.95	470.95 351	470.95 200	470.95 136	2015.11	2015.11 1903.5	2015.11 1347.26	2015.11 1120.51	2.42	2.42 2.56	2.42 3.61	2.42 4.34	4877	4873	4864	4863	3.39	3.39 3.31	3.39 4.04	3.39 4.42	609.36	609.36 322.2	609.36 239.46	609.36 165.66
69.5*	4867	1731.76	1731.76 1731.76	1731.76 1731.76	1731.76 1731.76	1743.52	1743.52 1743.53	1743.52 1743.67	1743.52 1743.89	0.01	0.15	0.37	465.3	465.3 300	465.3 139.67	465.3 139.67	465.3	465.3 300	465.3 139.67	465.3 139.67	2080.15	2080.15 1736.82	2080.15 1232.85	2080.15 1263.09	2.34	2.34 2.8	2.34 3.95	2.34 3.85	4868	4863	4870	4863	3.18	3.18 3.41	3.18 3.95	3.18 3.85	606.31	606.31 320.06	606.31 238.33	606.31 164.74
69	4867	1731.31	1731.31 1731.31	1731.31 1731.31	1731.31 1731.31	1743.38	1743.38 1743.41	1743.38 1743.59	1743.38 1743.79	0.03	0.21	0.41	516.72	516.72 218	516.72 200	516.72 154	218	218 218	218 200	218 154	1640.45	1640.45 1647.45	1640.45 1610.75	1640.45 1485.97	2.97	2.97 2.95	2.97 3.02	2.97 3.28	4872	4860	4864	4874	3.22	3.22 3.22	3.22 3.23	3.22 3.31	603.07	603.07 318.33	603.07 237.19	603.07 163.76
68.6	4867	1732	1732 1732	1732 1732	1732 1732	1742.99	1742.99 1743.02	1742.99 1743.23	1742.99 1743.47	0.03	0.24	0.48	126.62	126.62 100	126.62 100	126.62 100	100	100 100	100 100	100 100	903.07	903.07 906.44	903.07 926.85	903.07 951.02	5.39	5.39 5.37	5.39 5.25	5.39 5.12	4868	4868	4866	4869	5.39	5.39 5.37	5.39 5.25	5.39 5.12	602.37	602.37 317.99	602.37 236.86	602.37 163.48
68	4867	1729.85	1729.85 1729.85	1729.85 1729.85	1729.85 1729.85	1742.15	1742.15 1742.17	1742.15 1742.46	1742.15 1742.78	0.02	0.31	0.63	83.94	83.94 84.07	83.94 85.59	83.94 87.31	83.94	83.94 84.07	83.94 85.59	83.94 87.31	593.85	593.85 595.88	593.85 620.2	593.85 648.2	8.2	8.2 8.17	8.2 7.85	8.2 7.51	4870	4868	4869	4868	8.2	8.2 8.17	8.2 7.85	8.2 7.51	602.13	602.13 317.78	602.13 236.65	602.13 163.27
67.5U	Bridge		1729.85 1729.85	1729.85 1729.85	1729.85 1729.85		1741.91 1741.94	1741.91 1742.26	1741.91 1742.61	0.03	0.34	0.7		77.72 77.86	77.72 79.5	77.72 81.36		77.72 77.86	77.72 79.5	77.72 81.36						8.83 8.79	8.83 8.41	8.83 8.02										602.12 317.77	602.12 236.64	602.12 163.26
67.5D	Bridge		1728.8 1728.8	1728.8 1728.8	1728.8 1728.8		1741.26 1741.29	1741.26 1741.69	1741.26 1742.11	0.03	0.43	0.86		71.74 71.91	71.74 73.89	71.74 76		71.74 71.91	71.74 73.89	71.74 76						8.68 8.64	8.68 8.22	8.68 7.8										601.86 317.51	601.86 236.38	601.86 162.99
67	4867	1728.8	1728.8 1728.8	1728.8 1728.8	1728.8 1728.8	1741.27	1741.27 1741.31	1741.27 1741.71	1741.27 1742.13	0.04	0.44	0.86	76.82	76.82 77	76.82 78.99	76.82 81.1	76.82	76.82 77	76.82 78.99	76.82 81.1	574.34	574.34 577.04	574.34 608.26	574.34 642.23	8.47	8.47 8.43	8.47 8	8.47 7.58	4865	4864	4866	4868	8.47	8.47 8.43	8.47 8	8.47 7.58	601.85	601.85 317.5	601.85 236.37	601.85 162.98
66.1198*	4867	1730.16	1730.16 1730.16	1730.16 1730.16	1730.16 1730.16	1741.04	1741.04 1741.08	1741.04 1741.54	1741.04 1742.01	0.04	0.5	0.97	111.88	111.88 112.07	111.88 114.2	111.88 116.37	111.88	111.88 112.07	111.88 114.2	111.88 116.37	840.63	840.63 845.21	840.63 896.86	840.63 950.77	5.79	5.79 5.76	5.79 5.43	5.79 5.12	4867	4868	4870	4868	5.79	5.79 5.76	5.79 5.43	5.79 5.12	601.3	601.3 316.95	601.3 235.8	601.3 162.4
66	4867	1730.34	1730.34 1730.34	1730.34 1730.34	1730.34 1730.34	1741.02	1741.02 1741.06	1741.02 1741.52	1741.02 1741.99	0.04	0.5	0.97	116.24	116.24 116.43	116.24 118.56	116.24 120.74	116.24	116.24 116.43	116.24 118.56	116.24 120.74	882.78	882.78 887.6	882.78 941.84	882.78 998.26	5.51	5.51 5.48	5.51 5.17	5.51 4.88	4864	4864	4869	4872	5.51	5.51 5.48	5.51 5.17	5.51 4.88	601.2	601.2 316.85	601.2 235.71	601.2 162.3
65	4867	1730.46	1730.46 1730.46	1730.46 1730.46	1730.46 1730.46	1740.6	1740.6 1740.6	1740.6 1741.06	1740.6 1741.41	0	0.47	0.81	336.36	336.36 194.55	336.36 159.55	336.36 124.55	336.36	336.36 194.55	336.36 159.55	336.36 124.55	1441.99	1441.99 1191.27	1441.99 1124.63	1441.99 978.31	3.38	3.38 4.09	3.38 4.33	3.38 4.97	4874	4872	4870	4862	5.55	5.55 5.66	5.55 5.72	5.55 6.26	598.98	598.98 315.37	598.98 234.4	598.98 161.17
64	4867	1728.47	1728.47 1728.47	1728.47 1728.47	1728.47 1728.47	1739.61	1739.61 1739.66	1739.61 1740.1	1739.61 1740.56	0.06	0.49	0.95	405.48	405.48 385	405.48 120	405.48 120	405.48	405.48 385	405.48 120	405.48 120	1579.29	1579.29 1592.44	1579.29 1074.17	1579.29 1129.52	3.08	3.08 3.06	3.08 4.53	3.08 4.31	4864	4873	4866	4868	5.45	5.45 5.31	5.45 5.46	5.45 5.2	592.01	592.01 309.93	592.01 231.77	592.01 158.86
63	4867	1728.11	1728.11 1728.11	1728.11 1728.11	1728.11 1728.11	1738.91	1738.91 1738.92	1738.91 1739.41	1738.91 1739.76	0.01	0.5	0.85	394.58	394.58 345	394.58 270	394.58 165	394.58	394.58 345	394.58 270	394.58 165	1483.57	1483.57 1374.96	1483.57 1266.76	1483.57 1046.34	3.28	3.28 3.54	3.28 3.84	3.28 4.65	4866	4867	4864	4865	5.03	5.03 5.2	5.03 5.46	5.03 5.94	586.56	586.56 304.97	586.56 229.1	586.56 156.92
62	4867	1728.26	1728.26 1728.26	1728.26 1728.26	1728.26 1728.26	1738.48	1738.48 1738.48	1738.48 1738.71	1738.48 1739.04	0	0.23	0.55	743.5	743.5 690	743.5 250	743.5 195	743.5	743.5 690	743.5 250	743.5 195	2446.68	2446.68 2362.39	2446.68 1364.62	2446.68 1234.45	1.99	1.99 2.06	1.99 3.57	1.99 3.94	4869	4867	4872	4864	3.99	3.99 4.05	3.99 5.33	3.99 5.55	578.89	578.89 297.99	578.89 225.57	578.89 154.44
61	4867	1724.4	1724.4 1724.4	1724.4 1724.4	1724.4 1724.4	1737.28	1737.28 1737.29	1737.28 1737.47	1737.28 1737.88	0	0.19	0.59	398.89	398.89 390	398.89 250	398.89 170	398.89	398.89 390	398.89 250	398.89 170	1493.52	1493.52 1493.03	1493.52 1373.59	1493.52 1258.84	3.26	3.26 3.26	3.26 3.54	3.26 3.87	4869	4867	4863	4872	5.69	5.69 5.66	5.69 5.43	5.69 5.32	564.2	564.2 284.1	564.2 219.07	564.2 149.66
60	4867	1723.79	1723.79 1723.79	1723.79 1723.79	1723.79 1723.79	1736.62	1736.62 1736.63	1736.62 1736.79	1736.62 1737.07	0.01	0.17	0.45	357.75	357.75 350	357.75 250	357.75 140	357.75	357.75 350	357.75 250	357.75 140	1846.36	1846.36 1849.08	1846.36 1633.73	1846.36 1245.13	2.64	2.64 2.63	2.64 2.98	2.64 3.91	4874	4863	4869	4868	3.9	3.9 3.87	3.9 4.02	3.9 4.54	554.26	554.26 274.38	554.26 212.47	554.26 145.54
59	4867	1722.87	1722.87 1722.87	1722.87 1722.87	1722.87 1722.87	1736.48	1736.48 1736.5	1736.48 1736.67	1736.48 1736.89	0.01	0.19	0.41	466.64	466.64 455	466.64 250	466.64 140	466.64	466.64 455	466.64 250	466.64 140	2513.83	2513.83 2518.46	2513.83 2129.13	2513.83 1565.03	1.94	1.94 1.93	1.94 2.29	1.94 3.11	4877	4861	4876	4867	3.09	3.09 3.06	3.09 3.05	3.09 3.67	549.27	549.27 269.5	549.27 209.36	549.27 143.73
58	4867	1722.4	1722.4 1722.4	1722.4 1722.4	1722.4 1722.4	1736.18	1736.18 1736.2	1736.18 1736.42	1736.18 1736.66	0.02	0.24	0.49	375.55	375.55 360	375.55 325	375.55 203	375.55	375.55 360	375.55 325	375.55 203	1733.5	1733.5 1739.7	1733.5 1788.9	1733.5 1594.6	2.81	2.81 2.8	2.81 2.72	2.81 3.05	4871	4871	4866	4864	3.89	3.89 3.85	3.89 3.65	3.89 3.63	543.7	543.7 264.11	543.7 205.58	543.7 141.44
57.5*	4867	1722.3	1722.3 1722.3	1722.3 1722.3	1722.3 1722.3	1736.07	1736.07 1736.08	1736.07 1736.3	1736.07 1736.54	0.02	0.23	0.47	382.71	382.71 261	382.71 236	382.71 177	287.05	287.05 261	287.05 236	287.05 177	1670.22	1670.22 1622.14	1670.22 1612.5	1670.22 1466.88	2.91	2.91 3	2.91 3.02	2.91 3.32	4860	4866	4870	4870	3.69	3.69 3.72	3.69 3.65	3.69 3.73	541.9	541.9 262.63	541.9 204.24	541.9 140.54
57	5111	1722.21	1722.21 1722.21	1722.21 1722.21	1722.21 1722.21	1735.83	1735.83 1735.85	1735.83 1736.08	1735.83 1736.36	0.02	0.25	0.53	404.22	404.22 141.45	404.22 142.67	404.22 144.16	141.35	141.35 141.45	141.35 142.67	141.35 144.16	1233.41	1233.41 1235.95	1233.41 1268.83	1233.41 1308.99	4.14	4.14 4.14	4.14 4.03	4.14 3.9	5106	5117	5113	5105	4.32	4.32 4.34	4.32 4.22	4.32 4.1	540.03	540.03 261.68	540.03 203.34	540.03 139.78
56	5111	1722.6	1722.6 1722.6	1722.6 1722.6	1722.6 1722.6	1734.73	1734.73 1734.75	1734.73 1735.06	1734.73 1735.43	0.03	0.34	0.7	335.86	335.86 67.68	335.86 67.68	335.86 67.68	67.68	67.68 67.68	67.68 67.68	67.68 67.68	591.43	591.43 593.13	591.43 614.25	591.43 638.79	8.64	8.64 8.62	8.64 8.32	8.64 8	5110	5113	5111	5110	8.64	8.64 8.62	8.64 8.32	8.64 8	539.28	539.28 261.44	539.28 203.1	539.28 139.54
55U	Bridge		1722.6 1722.6	1722.6 1722.6	1722.6 1722.6		1732.91 1732.92	1732.91 1733.14	1732.91 1733.4	0.02	0.23	0.49													12.77 12.77	12.77 12.77	12.77 12.77										539.26 261.44	539.26 203.1	539.26 139.54
55D	Bridge		1722.25 1722.25	1722.25 1722.25	1722.25 1722.25		1733.16 1733.18	1733.16 1733.43	1733.16 1733.76	0.02	0.27	0.6		42.86 43.94	42.86 59.49	42.86 80.22		42.86 43.94	42.86 59.49	42.86 80.22						9.67 9.66	9.67 9.42	9.67 9.04										539.25 261.43	539.25 203.09	539.25 139.52
54	5111	1722.25	1722.25 1722.25	1722.25 1722.25	1722.25 1722.25	1733.43	1733.43 1733.44	1733.43 1733.69	1733.43 1733.99	0.02	0.26	0.57	77.01	77.01 77.2	77.01 79.72	77.01 82.62	77.01	77.01 77.2	77.01 79.72	77.01 82.62	639.8	639.8 641.16	639.8 660.32	639.8 685.31	7.99	7.99 7.97	7.99 7.74	7.99 7.46	5112	5110	5111	5112	7.99	7.99 7.97	7.99 7.74	7.99 7.46	539.25	539.25 261.42	539.25 203.08	539.25 139.51
53.3292*	5111	1722.24	1722.24 1722.24	1722.24 1722.24	1722.24 1722.24	1733.09	1733.09 1733.12	1733.09 1733.41	1733.09 1733.76	0.03	0.32	0.67	137.24	137.24 120	137.24 120	137.24 120	137.24	137.24 120	137.24 120	137.24 120	766.72	766.72 765.9	766.72 800.58	766.72 842.95	6.67	6.67 6.67	6.67 6.38	6.67 6.06	5114	5109	5108	5108	7.18	7.18 7.14	7.18 6.87	7.18 6.55	538.81	538.81 261.03	538.81 202.68	538.81 139.11
53	5111	1722.23	1722.23 1722.23	1722.23 1722.23	1722.23 1722.23	1732.98	1732.98 1733.05	1732.98 1733.35	1732.98 1733.72	0.06	0.37	0.73	199.12	199.12 145	199.12 140	199.12 140	199.12	199.12 145	199.12 140	199.12 140	879.41	879.41 880.27	879.41 918.13	879.41 969.58	5.81	5.81 5.81	5.81 5.57	5.81 5.27	5109	5114	5114	5110	6.78	6.78 6.57	6.78 6.3	6.78 6	538.46	538.46 260.76	538.46 202.42	538.46 138.85
52	5111	1721.3	1721.3 1721.3	1721.3 1721.3	1721.3 1721.3	1732.7	1732.7 1732.76	1732.7 1733.13	1732.7 1733.55	0.06	0.42	0.85	620.1	620.1 189	620.1 187.54	620.1 187.54	197.09	197.09 189	197.09 187.54	197.09 187.54	984.97	984.97 994.19	984.97 1062.57	984.97 1142.01	5.19	5.19 5.14	5.19 4.81	5.19 4.48	5112	5110	5111	5116	5.6	5.6 5.54	5.6 5.19	5.6 4.83	536.44	536.44 259.89	536.44 201.57	536.44 137.99

Willow Creek Floodplain Study

evaluation of

1-31-01 Analyses

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)				Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
51	5111	1720.8	1720.8 1720.8	1720.8 1720.8	1720.8 1720.8	1732.7	1732.7 1732.75	1732.7 1733.11	1732.7 1733.53	0.05	0.41	0.83	596.34	596.34 162.98	596.34 166.86	596.34 170.57	162.4	162.4 162.98	162.4 166.86	162.4 170.57	1182.26	1182.26 1191	1182.26 1250.47	1182.26 1321.48	4.32	4.32 4.29	4.32 4.09	4.32 3.87	5107	5109	5114	5114	4.32	4.32 4.29	4.32 4.09	4.32 3.87	535.03	535.03 259.21	535.03 200.69	535.03 137.31
50	5111	1720.3	1720.3 1720.3	1720.3 1720.3	1720.3 1720.3	1732.49	1732.49 1732.55	1732.49 1732.94	1732.49 1733.39	0.06	0.45	0.9	763.63	763.63 170.28	763.63 174.67	763.63 177.6	169.62	169.62 170.28	169.62 174.67	169.62 177.6	1197.39	1197.39 1207.33	1197.39 1274.4	1197.39 1353.69	4.27	4.27 4.23	4.27 4.01	4.27 3.78	5113	5107	5110	5117	4.27	4.27 4.23	4.27 4.01	4.27 3.78	531.65	531.65 258.39	531.65 200.04	531.65 136.44
48	5111	1718.1	1718.1 1718.1	1718.1 1718.1	1718.1 1718.1	1732.16	1732.16 1732.23	1732.16 1732.66	1732.16 1733.15	0.07	0.5	0.99	1406.02	1406.02 180.54	1406.02 185.63	1406.02 190.49	179.77	179.77 180.54	179.77 185.63	179.77 190.49	1425.03	1425.03 1436.93	1425.03 1516.41	1425.03 1609.39	3.59	3.59 3.56	3.59 3.37	3.59 3.18	5116	5115	5110	5118	3.59	3.59 3.56	3.59 3.37	3.59 3.18	518.95	518.95 256.33	518.95 197.93	518.95 134.29
47	5111	1718.6	1718.6 1718.6	1718.6 1718.6	1718.6 1718.6	1731.8	1731.8 1731.81	1731.8 1732.29	1731.8 1732.76	0.01	0.49	0.96	231.75	231.75 136	231.75 136	231.75 109	231.75	231.75 136	231.75 136	231.75 109	1520.42	1520.42 1294.08	1520.42 1360.27	1520.42 1243.31	3.36	3.36 3.95	3.36 3.76	3.36 4.11	5109	5112	5115	5110	4.02	4.02 4.24	4.02 4.04	4.02 4.14	507.95	507.95 254.2	507.95 195.76	507.95 132.27
46	5111	1718.24	1718.24 1718.24	1718.24 1718.24	1718.24 1718.24	1731.12	1731.12 1731.15	1731.12 1731.33	1731.12 1731.64	0.03	0.21	0.52	265.55	265.55 181	265.55 104	265.55 82	265.55	265.55 181	265.55 104	265.55 82	1320	1320 1206.91	1320 904.12	1320 801.28	3.87	3.87 4.23	3.87 5.65	3.87 6.38	5108	5105	5108	5112	6.29	6.29 6.17	6.29 7.28	6.29 7.84	504.46	504.46 251.93	504.46 194.01	504.46 130.85
45	5111	1718.39	1718.39 1718.39	1718.39 1718.39	1718.39 1718.39	1730.08	1730.08 1730.13	1730.08 1730.49	1730.08 1730.9	0.05	0.41	0.82	232.87	232.87 174	232.87 165	232.87 155	232.87	232.87 174	232.87 165	232.87 155	1120.79	1120.79 1026.54	1120.79 1083.47	1120.79 1090.34	4.56	4.56 4.98	4.56 4.72	4.56 4.69	5111	5112	5114	5114	7.48	7.48 7.33	7.48 6.88	7.48 6.77	500.92	500.92 249.42	500.92 192.1	500.92 129.17
44	5111	1716.99	1716.99 1716.99	1716.99 1716.99	1716.99 1716.99	1729.78	1729.78 1729.86	1729.78 1730.28	1729.78 1730.46	0.08	0.5	0.68	424.8	424.8 262	424.8 262	424.8 190	267.02	267.02 262	267.02 262	267.02 190	1752.6	1752.6 1771.11	1752.6 1880.01	1752.6 1422.42	2.92	2.92 2.89	2.92 2.72	2.92 3.59	5118	5119	5114	5106	4.09	4.09 4.04	4.09 3.8	4.09 4.91	496.64	496.64 246.59	496.64 189.33	496.64 126.94
43	5111	1716.57	1716.57 1716.57	1716.57 1716.57	1716.57 1716.57	1729.62	1729.62 1729.64	1729.62 1730.11	1729.62 1730.33	0.01	0.48	0.71	640.61	640.61 450	640.61 450	640.61 425	640.61	640.61 450	640.61 450	640.61 425	2995.06	2995.06 2357.9	2995.06 2568.02	2995.06 2554.54	1.71	1.71 2.17	1.71 1.99	1.71 2	5122	5117	5110	5109	3.16	3.16 3.71	3.16 3.36	3.16 3.32	490.11	490.11 242.24	490.11 184.98	490.11 123.18
42	5111	1714.8	1714.8 1714.8	1714.8 1714.8	1714.8 1714.8	1729.6	1729.6 1729.62	1729.6 1730.09	1729.6 1730.32	0.02	0.49	0.72	586.4	586.4 450	586.4 450	586.4 450	586.4	586.4 450	586.4 450	586.4 450	3084.62	3084.62 2643.26	3084.62 2853.48	3084.62 2957.52	1.66	1.66 1.93	1.66 1.79	1.66 1.73	5120	5101	5108	5117	2.3	2.3 2.5	2.3 2.33	2.3 2.25	488.26	488.26 240.9	488.26 183.64	488.26 121.88
41	5111	1715.93	1715.93 1715.93	1715.93 1715.93	1715.93 1715.93	1729.61	1729.61 1729.64	1729.61 1730.1	1729.61 1730.33	0.03	0.49	0.72	624.01	624.01 485	624.01 450	624.01 410	624.01	624.01 485	624.01 450	624.01 410	3932.62	3932.62 3619.12	3932.62 3645.48	3932.62 3503.93	1.3	1.3 1.41	1.3 1.4	1.3 1.46	5112	5103	5104	5116	2.19	2.19 2.19	2.19 2.12	2.19 2.16	487.45	487.45 240.27	487.45 183.03	487.45 121.3
40	culvert																																							
39	5111	1716.57	1716.57 1716.57	1716.57 1716.57	1716.57 1716.57	1729.49	1729.49 1729.52	1729.49 1729.98	1729.49 1730.24	0.03	0.48	0.74	518.74	518.74 515	518.74 375	518.74 370	518.74	518.74 515	518.74 375	518.74 370	2584.2	2584.2 2598.39	2584.2 2361.92	2584.2 2435.54	1.98	1.98 1.97	1.98 2.16	1.98 2.1	5117	5119	5102	5115	3.25	3.25 3.23	3.25 3.24	3.25 3.13	486.69	486.69 239.6	486.69 182.48	486.69 120.78
37	5111	1714.05	1714.05 1714.05	1714.05 1714.05	1714.05 1714.05	1729.13	1729.13 1729.16	1729.13 1729.62	1729.13 1729.9	0.03	0.5	0.77	194.23	194.23 192.46	194.23 109.31	194.23 109.81	194.23	194.23 192.46	194.23 109.31	194.23 109.81	1358.51	1358.51 1364.52	1358.51 1250.96	1358.51 1281.28	3.76	3.76 3.75	3.76 4.09	3.76 3.99	5108	5117	5116	5112	4.27	4.27 4.25	4.27 4.23	4.27 4.13	483.09	483.09 236.04	483.09 180	483.09 118.32
36	5111	1713.26	1713.26 1713.26	1713.26 1713.26	1713.26 1713.26	1728.89	1728.89 1728.92	1728.89 1729.39	1728.89 1729.68	0.04	0.5	0.79	361.35	361.35 248.4	361.35 116.22	361.35 116.74	253.97	253.97 248.4	253.97 116.22	253.97 116.74	1434.24	1434.24 1441.61	1434.24 1237.82	1434.24 1272.21	3.56	3.56 3.55	3.56 4.13	3.56 4.02	5106	5118	5112	5114	4.24	4.24 4.22	4.24 4.27	4.24 4.16	480.28	480.28 233.78	480.28 178.84	480.28 117.15
35	5111	1712.73	1712.73 1712.73	1712.73 1712.73	1712.73 1712.73	1728.58	1728.58 1728.63	1728.58 1728.86	1728.58 1729.2	0.05	0.28	0.62	1064.23	1064.23 292	1064.23 89.09	1064.23 89.09	335.29	335.29 292	335.29 89.09	335.29 89.09	1614.03	1614.03 1603.87	1614.03 1011.97	1614.03 1041.69	3.17	3.17 3.19	3.17 5.05	3.17 4.91	5116	5116	5110	5115	4.52	4.52 4.43	4.52 5.32	4.52 5.17	471.77	471.77 230.65	471.77 177.57	471.77 115.88
34	5111	1713.03	1713.03 1713.03	1713.03 1713.03	1713.03 1713.03	1728.3	1728.3 1728.38	1728.3 1728.57	1728.3 1728.93	0.07	0.27	0.62	971.07	971.07 186	971.07 78.17	971.07 78.17	395.69	395.69 186	395.69 78.17	395.69 78.17	1502.67	1502.67 1361.57	1502.67 973.5	1502.67 1001.44	3.4	3.4 3.75	3.4 5.25	3.4 5.1	5109	5106	5111	5107	4.75	4.75 4.61	4.75 5.27	4.75 5.12	463.46	463.46 228.56	463.46 176.89	463.46 115.19
33.6666*	5111	1712.54	1712.54 1712.54	1712.54 1712.54	1712.54 1712.54	1728.25	1728.25 1728.31	1728.25 1728.58	1728.25 1728.94	0.07	0.33	0.69	443.52	443.52 178.61	443.52 100.97	443.52 101.47	234.67	234.67 178.61	234.67 100.97	234.67 101.47	1425.23	1425.23 1410.48	1425.23 1253.57	1425.23 1290.07	3.59	3.59 3.62	3.59 4.08	3.59 3.96	5117	5106	5115	5109	4.05	4.05 4	4.05 4.08	4.05 3.97	460.35	460.35 227.76	460.35 176.49	460.35 114.8
33.3333*	5111	1712.04	1712.04 1712.04	1712.04 1712.04	1712.04 1712.04	1728.22	1728.22 1728.28	1728.22 1728.57	1728.22 1728.93	0.07	0.35	0.71	171.77	171.77 160.74	171.77 121.13	171.77 121.63	171.77	171.77 160.74	171.77 121.13	171.77 121.63	1534.53	1534.53 1543.78	1534.53 1536.1	1534.53 1580.13	3.33	3.33 3.31	3.33 3.33	3.33 3.23	5110	5110	5115	5104	3.41	3.41 3.39	3.41 3.33	3.41 3.24	459	459 227.01	459 176.01	459 114.31
33	5111	1711.55	1711.55 1711.55	1711.55 1711.55	1711.55 1711.55	1728.21	1728.21 1728.27	1728.21 1728.56	1728.21 1728.92	0.07	0.35	0.72	139.21	139.21 139.39	139.21 139.84	139.21 140.34	139.21	139.21 139.39	139.21 139.84	139.21 140.34	1771.4	1771.4 1780.57	1771.4 1820.69	1771.4 1871.78	2.89	2.89 2.87	2.89 2.81	2.89 2.73	5119	5110	5116	5110	2.89	2.89 2.87	2.89 2.81	2.89 2.73	458.32	458.32 226.35	458.32 175.44	458.32 113.74
32	5111	1713.97	1713.97 1713.97	1713.97 1713.97	1713.97 1713.97	1727.84	1727.84 1727.91	1727.84 1728.22	1727.84 1728.61	0.07	0.38	0.77	94.93	94.93 94.94	94.93 95	94.93 95.07	94.93	94.93 94.94	94.93 95	94.93 95.07	1020.85	1020.85 1027.6	1020.85 1057.03	1020.85 1094.1	5.01	5.01 4.97	5.01 4.84	5.01 4.67	5114	5107	5116	5109	5.01	5.01 4.97	5.01 4.84	5.01 4.67	457.8	457.8 225.83	457.8 174.92	457.8 113.22
31.7	5111	1713.37	1713.37 1713.37	1713.37 1713.37	1713.37 1713.37	1726.86	1726.86 1726.95	1726.86 1727.33	1726.86 1727.8	0.09	0.47	0.94	55.8	55.8 55.86	55.8 56.1	55.8 56.39	55.8	55.8 55.86	55.8 56.1	55.8 56.39	640.64	640.64 645.59	640.64 666.92	640.64 693.21	7.98	7.98 7.92	7.98 7.66	7.98 7.37	5112	5113	5109	5109	7.98	7.98 7.92	7.98 7.66	7.98 7.37	457.42	457.42 225.45	457.42 174.53	457.42 112.84
31.5	5111	1713.27	1713.27 1713.27	1713.27 1713.27	1713.27 1713.27	1726.78	1726.78 1726.87	1726.78 1727.26	1726.78 1727.74	0.09	0.48	0.96	55.81	55.81 55.87	55.81 56.11	55.81 56.41	55.81	55.81 55.87	55.81 56.11	55.81 56.41	641.67	641.67 646.73	641.67 668.5	641.67 695.32	7.97	7.97 7.9	7.97 7.65	7.97 7.35	5114	5109	5114	5111	7.97	7.97 7.9	7.97 7.65	7.97 7.35	457.38	457.38 225.41	457.38 174.49	457.38 112.79
31	5111	1713.1	1713.1 1713.1	1713.1 1713.1	1713.1 1713.1	1726.66	1726.66 1726.76	1726.66 1727.16	1726.66 1727.65	0.09	0.49	0.98	55.85	55.85 55.9	55.85 56.16	55.85 56.46	55.85	55.85 55.9	55.85 56.16	55.85 56.46	644.54	644.54 649.77	644.54 672.21	644.54 699.76	7.93	7.93 7.87	7.93 7.6	7.93 7.3	5111	5114	5109	5108	7.93	7.93 7.87	7.93 7.6	7.93 7.3	457.31	457.31 225.35	457.31 174.43	457.31 112.73
30	5111	1714.1	1714.1 1714.1	1714.1 1714.1	1714.1 1714.1	1726.88	1726.88 1726.97	1726.88 1727.37	1726.88 1727.86	0.09	0.49	0.98	489.15	489.15 270	489.15 217	489.15 210	489.15	489.15 270	489.15 217	489.15 210	2036.94	2036.94 1661.6	2036.94 1677.84	2036.94 1733.04	2.51	2.51 3.08	2.51 3.05	2.51 2.95	5113	5118	5117	5112	4.58	4.58 4.45	4.58 4.25	4.58 4.08	455.44	455.44 224.25	455.44 173.5	455.44 111.82
29.5*	5111	1713.77	1713.77 1713.77	1713.77 1713.77	1713.77 1713.77	1726.63	1726.63 1726.66	1726.63 1727.12	1726.63 1727.58	0.03	0.49	0.95	507.9	507.9 260	507.9 250	507.9 200	507.9	507.9 260	507.9 250	507.9 200	1877.03	1877.03 1442.29	1877.03 1523.72	1877.03 1416.42	2.72	2.72 3.54	2.72 3.35	2.72 3.61	5106	5106	5104	5113	5.12	5.12 5.5	5.12 5.13	5.12 5.21	452.7	452.7 222.8	452.7 172.22	452.7 110.7
29	5111	1713.44	1713.44 1713.44	1713.44 1713.44	1713.44 1713.44	1726.55	1726.55 1726.56	1726.55 1726.96	1726.55 1727.23	0.01	0.41	0.68	518.04	518.04 340	518.04 245	518.04 135	518.04	518.04 340	518.04 245	518.04 135	2216.48	2216.48 1764.92	2216.48 1518.93	2216.48 1109.41	2.31	2.31 2.9	2.31 3.36	2.31 4.61	5120	5118	5104	5114	3.84	3.84 4.28	3.84 4.68	3.84 5.76	449.88	449.88 221.15	449.88 170.86	449.88 109.78
28	5111	1714.31	1714.31 1714.31	1714.31 1714.31	1714.31 1714.31	1726.4	1726.4 1726.4	1726.4 1726.51	1726.4 1726.59	0	0.11	0.19	819.42	819.42 478	819.42 193	819.42 122	619.45	619.45 478	619.45 193	619.45 122	2987.5	2987.5 2631.34	2987.5 1342.17	2987.5 1020.02	1.71	1.71 1.94	1.71 3.81	1.71 5.01	5109	5105	5114	5110	2.91	2.91 3.06	2.91 4.89	2.91 5.88	442.32	442.32 216.5	442.32 168.32	442.32 108.28
27.2865*	5111	1713.23	1713.23 1713.23	1713.23 1713.23	1713.23 1713.23	1726.19	1726.19 1726.2	1726.19 1726.34	1726.19 1726.33	0.01	0.15	0.14	586.14	586.14 320	586.14 200	586.14 120	331.62	331.62 320	331.62 200	331.62 120	2053.64	2053.64 2032.86	2053.64 1644.88	2053.64 1181.05	2.49	2.49 2.51	2.49 3.11	2.49 4.33	5114	5102	5116	5114	3.73	3.73 3.76	3.73 4.09	3.73 5.07	436.49	436.49 213.18	436.49 166.67	436.49 107.25
27	5529	1712.8	1712.8 1712.8	1712.8 1712.8	1712.8 1712.8	1726.03	1726.03 1726.04	1726.03 1726.24	1726.03 1726.19	0	0.21	0.16	588.9	588.9 201	588.9 194	588.9 120	201.95	201.95 201	201.95 194	201.95 120	1640.73	1640.73 1641.51	1640.73 1667.16	1640.73 1225.02	3.37	3.37 3.37	3.37 3.32	3.37 4.51	5529	5532	5535	5525	4.39	4.39 4.42	4.39 4.33	4.39 5.29	434.53	434.53 212.3	434.53 166.01	434.53 106.85
26	5529	1712.7	1712.7 1712.7	1712.7 1712.7	1712.7 1712.7	1725.36	1725.36 1725.37	1725.36 1725.62	1725.36 1725.71	0.01	0.26	0.35	95.32	95.32 95.36	95.32 96.46	95.32 96.87	95.32	95.32 95.36	95.32 96.46	95.32 96.87	816.76	816.76 817.55	816.76 841.4	816.76 850.54	6.77	6.77 6.76	6.77 6.57	6.77 6.5	5529	5527	5528	5529	6.77	6.77 6.76	6.77 6.57	6.77 6.5	433.37	433.37 211.8	433.37 165.52	433.37 106.48
25.5U	Bridge		1712.7 1712.7	1712.7 1712.7	1712.7 1712.7		1724.95 1724.96	1724.95 1725.24	1724.95 1725.35	0.01	0.3	0.41		85.5 85.55	85.5 86.82	85.5 87.29		85.5 85.55	85.5 86.82	85.5 87.29						7.94 7.93	7.94 7.66	7.94 7.56										433.32 211.75	433.32 165.47	433.32 106.43
25.5D	Bridge		1712.48 1712.48	1712.48 1712.48	1712.48 1712.48		1724.61 1724.62	1724.61 1724.95	1724.61 1725.07	0.01	0.34	0.46		83.03 83.08	83.03 84.57	83.03 85.11		83.03 83.08	83.03 84.57	83.03 85.11						8.11 8.1	8.11 7.79	8.11 7.68										433.21 211.64	433.21 165.36	433.21 106.32
25	5529	1712.48	1712.48 1712.48	1712.48 1712.48	1712.48 1712.48	1724.68	1724.68 1724.69	1724.68 1725.01	1724.68 1725.13	0.01	0.34	0.45	91.35	91.35 91.4	91.35 92.86	91.35 93.4	91.35	91.35 91.4	91.35 92.86	91.35 93.4	764.02	764.02 765.05	764.02 794.88	764.02 805.99	7.24	7.24 7.23	7.24 6.96	7.24 6.86	5532	5531	5532	5529	7.24	7.24 7.23	7.24 6.96	7.24 6.86	433.17	433.17 211.6	433.17 165.32	433.17 106.28

River Station	Total Flow (cfs) 100-year	Minimum Channel Elevation (ft.)				100-year Water Surface Elevation (ft.)				Delta Water Surface (ft.)			Top Width (ft.)				Effective Top Width (ft.)				Flow Area (sq. ft.)				Total Velocity (ft/sec)				Continuity (Q = V_T x A)				Channel Velocity (ft/sec)				Surface Area Total (acres)			
		Storm Analysis	1.0' Encr.	0.5' Encr.	0.1' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.	Storm Analysis	0.1' Encr.	0.5' Encr.	1.0' Encr.
24	5529	1712.25	1712.25 1712.25	1712.25 1712.25	1712.25 1712.25	1724.9	1724.9 1724.9	1724.9 1725.22	1724.9 1725.28	0	0.33	0.38	559.23	559.23 234	559.23 234	559.23 185	234	234 234	234 234	234 185	1363.01	1363.01 1364.15	1363.01 1439.7	1363.01 1269.72	4.06	4.06 4.05	4.06 3.84	4.06 4.35	5534	5525	5528	5523	5.88	5.88 5.92	5.88 5.61	5.88 5.99	432.8	432.8 211.42	432.8 165.14	432.8 106.12
23.7736*	5529	1712.21	1712.21 1712.21	1712.21 1712.21	1712.21 1712.21	1724.69	1724.69 1724.7	1724.69 1724.82	1724.69 1725	0	0.13	0.3	560.14	560.14 385	560.14 230	560.14 215	560.14	560.14 385	560.14 230	560.14 215	1574.02	1574.02 1410.84	1574.02 1112.51	1574.02 1139.81	3.51	3.51 3.92	3.51 4.97	3.51 4.85	5525	5530	5529	5528	6.34	6.34 6.34	6.34 6.88	6.34 6.67	431.42	431.42 210.66	431.42 164.56	431.42 105.63
23	5529	1712.07	1712.07 1712.07	1712.07 1712.07	1712.07 1712.07	1724.13	1724.13 1724.15	1724.13 1724.47	1724.13 1724.69	0.02	0.34	0.57	299.76	299.76 299.26	299.76 292.09	299.76 292.68	299.76	299.76 299.26	299.76 292.09	299.76 292.68	1200.02	1200.02 1206.37	1200.02 1298.22	1200.02 1364.5	4.61	4.61 4.58	4.61 4.26	4.61 4.05	5532	5525	5530	5526	6.89	6.89 6.85	6.89 6.27	6.89 5.94	428.72	428.72 208.51	428.72 162.93	428.72 104.04
22	5529	1711.37	1711.37 1711.37	1711.37 1711.37	1711.37 1711.37	1722.75	1722.75 1722.85	1722.75 1723.13	1722.75 1723.51	0.09	0.38	0.75	169.79	169.79 162	169.79 110	169.79 110	169.79	169.79 162	169.79 110	169.79 110	913.21	913.21 927.13	913.21 850.37	913.21 891.97	6.05	6.05 5.96	6.05 6.5	6.05 6.2	5525	5526	5527	5530	9.13	9.13 8.91	9.13 8.95	9.13 8.52	426.5	426.5 206.32	426.5 161.02	426.5 102.13
21.5*	5529	1710.73	1710.73 1710.73	1710.73 1710.73	1710.73 1710.73	1722.79	1722.79 1722.79	1722.79 1722.97	1722.79 1723.41	0.01	0.19	0.62	416.31	416.31 301	416.31 221	416.31 221	416.31	416.31 301	416.31 221	416.31 221	2034.52	2034.52 1737.22	2034.52 1422.34	2034.52 1518.19	2.72	2.72 3.18	2.72 3.89	2.72 3.64	5534	5524	5533	5526	4.78	4.78 5.11	4.78 5.91	4.78 5.51	424.58	424.58 204.81	424.58 159.94	424.58 101.05
21	5529	1710.1	1710.1 1710.1	1710.1 1710.1	1710.1 1710.1	1722.56	1722.56 1722.56	1722.56 1722.68	1722.56 1723.01	0	0.11	0.45	847.9	847.9 420	847.9 295	847.9 220	591.77	591.77 420	591.77 295	591.77 220	2274.31	2274.31 1950.92	2274.31 1565.58	2274.31 1364.14	2.43	2.43 2.83	2.43 3.53	2.43 4.05	5527	5521	5526	5525	4.74	4.74 4.98	4.74 5.63	4.74 5.94	420.45	420.45 202.46	420.45 158.26	420.45 99.61
20	5529	1710.2	1710.2 1710.2	1710.2 1710.2	1710.2 1710.2	1721.87	1721.87 1721.92	1721.87 1722.17	1721.87 1722.66	0.05	0.31	0.79	571.39	571.39 450	571.39 288	571.39 288	571.39	571.39 450	571.39 288	571.39 288	1633.39	1633.39 1563.36	1633.39 1456.12	1633.39 1596.68	3.38	3.38 3.54	3.38 3.8	3.38 3.46	5521	5534	5533	5525	7.01	7.01 6.77	7.01 6.25	7.01 5.64	414.34	414.34 198.66	414.34 155.71	414.34 97.41
19	5529	1709.79	1709.79 1709.79	1709.79 1709.79	1709.79 1709.79	1721.53	1721.53 1721.6	1721.53 1721.89	1721.53 1722.43	0.07	0.36	0.9	419.82	419.82 391	419.82 280	419.82 280	419.82	419.82 391	419.82 280	419.82 280	1849.79	1849.79 1874.45	1849.79 1820.36	1849.79 1972.49	2.99	2.99 2.95	2.99 3.04	2.99 2.8	5531	5530	5534	5523	4.08	4.08 4	4.08 3.85	4.08 3.57	408.31	408.31 193.56	408.31 152.26	408.31 93.96
18	5529	1709.6	1709.6 1709.6	1709.6 1709.6	1709.6 1709.6	1721.04	1721.04 1721.12	1721.04 1721.39	1721.04 1722.01	0.08	0.36	0.97	216.31	216.31 216	216.31 122	216.31 122	216.31	216.31 216	216.31 122	216.31 122	1184.47	1184.47 1202.32	1184.47 1086.19	1184.47 1161.56	4.67	4.67 4.6	4.67 5.09	4.67 4.76	5531	5531	5529	5529	5.13	5.13 5.07	5.13 5.1	5.13 4.77	405.53	405.53 190.91	405.53 150.49	405.53 92.19
17	5529	1709.87	1709.87 1709.87	1709.87 1709.87	1709.87 1709.87	1720.29	1720.29 1720.39	1720.29 1720.66	1720.29 1721.27	0.1	0.37	0.99	442.06	442.06 170	442.06 125	442.06 100	364.36	364.36 170	364.36 125	364.36 100	1088.65	1088.65 1033.22	1088.65 957.19	1088.65 913.06	5.08	5.08 5.35	5.08 5.78	5.08 6.06	5530	5528	5533	5533	6.57	6.57 6.51	6.57 6.56	6.57 6.54	402.57	402.57 189.13	402.57 149.35	402.57 91.18
16	5529	1709.01	1709.01 1709.01	1709.01 1709.01	1709.01 1709.01	1720.26	1720.26 1720.31	1720.26 1720.67	1720.26 1720.96	0.05	0.41	0.7	1050.72	1050.72 554	1050.72 450	1050.72 220	586.27	586.27 554	586.27 450	586.27 220	2748.88	2748.88 2574.58	2748.88 2642.81	2748.88 1496.4	2.01	2.01 2.15	2.01 2.09	2.01 3.69	5525	5535	5523	5522	2.8	2.8 3.01	2.8 2.8	2.8 4.35	393.48	393.48 184.77	393.48 145.87	393.48 89.23
15	5529	1707.5	1707.5 1707.5	1707.5 1707.5	1707.5 1707.5	1719.63	1719.63 1719.67	1719.63 1720.12	1719.63 1720.24	0.04	0.49	0.6	3408.42	3408.42 349	3408.42 290	3408.42 218	421.94	421.94 349	421.94 290	421.94 218	1665.71	1665.71 1641.53	1665.71 1655.92	1665.71 1399.73	3.32	3.32 3.37	3.32 3.34	3.32 3.95	5530	5532	5531	5529	4.72	4.72 4.68	4.72 4.44	4.72 4.87	356	356 177.22	356 139.66	356 85.54
14	5529	1706.6	1706.6 1706.6	1706.6 1706.6	1706.6 1706.6	1719.17	1719.17 1719.22	1719.17 1719.3	1719.17 1719.49	0.05	0.13	0.31	2973.47	2973.47 457.23	2973.47 145	2973.47 145	457.86	457.86 457.23	457.86 145	457.86 145	1904.92	1904.92 1927.81	1904.92 1116.77	1904.92 1143.51	2.9	2.9 2.87	2.9 4.95	2.9 4.84	5524	5533	5528	5535	5.16	5.16 5.1	5.16 6.49	5.16 6.34	320.62	320.62 172.69	320.62 137.2	320.62 83.49
13.1263*	5529	1706.49	1706.49 1706.49	1706.49 1706.49	1706.49 1706.49	1718.67	1718.67 1718.74	1718.67 1718.94	1718.67 1719.19	0.07	0.27	0.52	3208.51	3208.51 540	3208.51 488	3208.51 488	549.1	549.1 540	549.1 488	549.1 488	1959.78	1959.78 1989.61	1959.78 2036.45	1959.78 2157.31	2.82	2.82 2.78	2.82 2.72	2.82 2.56	5527	5531	5539	5523	4.37	4.37 4.29	4.37 4.08	4.37 3.86	275.41	275.41 165.56	275.41 132.7	275.41 78.98
13	5575	1706.47	1706.47 1706.47	1706.47 1706.47	1706.47 1706.47	1718.45	1718.45 1718.53	1718.45 1718.75	1718.45 1719.02	0.08	0.3	0.57	3136.12	3136.12 373	3136.12 373	3136.12 373	373	373 373	373 373	373 373	1496.7	1496.7 1526.79	1496.7 1608.93	1496.7 1710.52	3.72	3.72 3.65	3.72 3.47	3.72 3.26	5568	5573	5583	5576	4.96	4.96 4.88	4.96 4.66	4.96 4.4	267.04	267.04 164.39	267.04 131.58	267.04 77.87
12	5575	1704.04	1704.04 1704.04	1704.04 1704.04	1704.04 1704.04	1717.39	1717.39 1717.49	1717.39 1717.75	1717.39 1718.07	0.1	0.36	0.69	61	61 61.01	61 61.05	61 61.1	61	61 61.01	61 61.05	61 61.1	702.21	702.21 708.19	702.21 724.28	702.21 744.05	7.94	7.94 7.87	7.94 7.7	7.94 7.49	5576	5573	5577	5573	7.94	7.94 7.87	7.94 7.7	7.94 7.49	258.99	258.99 163.36	258.99 130.56	258.99 76.85
11U	Bridge		1704.04 1704.04	1704.04 1704.04	1704.04 1704.04		1717.38 1717.48	1717.38 1717.75	1717.38 1718.07	0.1	0.36	0.69		61 61.01	61 61.05	61 61.1		61 61.01	61 61.05	61 61.1						7.94 7.87	7.94 7.7	7.94 7.49										258.99 163.36	258.99 130.56	258.99 76.85
11D	Bridge		1704.97 1704.97	1704.97 1704.97	1704.97 1704.97		1717.3 1717.4	1717.3 1717.67	1717.3 1718.01	0.1	0.37	0.71		64 64.03	64 64.09	64 64.17		64 64.03	64 64.09	64 64.17						7.94 7.87	7.94 7.68	7.94 7.46										258.95 163.32	258.95 130.51	258.95 76.8
10	5575	1704.97	1704.97 1704.97	1704.97 1704.97	1704.97 1704.97	1717.3	1717.3 1717.4	1717.3 1717.67	1717.3 1718	0.1	0.37	0.71	64	64 64.03	64 64.09	64 64.17	64	64 64.03	64 64.09	64 64.17	701.62	701.62 708.16	701.62 725.6	701.62 746.94	7.95	7.95 7.87	7.95 7.68	7.95 7.46	5578	5573	5573	5572	7.95	7.95 7.87	7.95 7.68	7.95 7.46	258.95	258.95 163.31	258.95 130.51	258.95 76.8
9.18648*	5575	1706.7	1706.7 1706.7	1706.7 1706.7	1706.7 1706.7	1717.36	1717.36 1717.43	1717.36 1717.74	1717.36 1718.1	0.07	0.38	0.74	1244.89	1244.89 185.8	1244.89 185.8	1244.89 185.8	385.67	385.67 185.8	385.67 185.8	385.67 185.8	1445.16	1445.16 1296.49	1445.16 1353.3	1445.16 1420.82	3.86	3.86 4.3	3.86 4.12	3.86 3.92	5578	5575	5576	5570	4.23	4.23 4.3	4.23 4.12	4.23 3.92	254.44	254.44 162.45	254.44 129.65	254.44 75.93
9	5575	1707.1	1707.1 1707.1	1707.1 1707.1	1707.1 1707.1	1717.37	1717.37 1717.45	1717.37 1717.74	1717.37 1718.1	0.08	0.37	0.73	1499.74	1499.74 320	1499.74 214	1499.74 214	427.34	427.34 320	427.34 214	427.34 214	1852.19	1852.19 1737.59	1852.19 1591.5	1852.19 1669.82	3.01	3.01 3.21	3.01 3.5	3.01 3.34	5575	5578	5570	5577	3.45	3.45 3.48	3.45 3.51	3.45 3.34	252.28	252.28 162.05	252.28 129.33	252.28 75.62
8	5575	1705.06	1705.06 1705.06	1705.06 1705.06	1705.06 1705.06	1716.45	1716.45 1716.51	1716.45 1716.93	1716.45 1717.45	0.06	0.48	1	1812.91	1812.91 205.13	1812.91 207.7	1812.91 210.86	440.73	440.73 205.13	440.73 207.7	440.73 210.86	1345.12	1345.12 1208.18	1345.12 1295.41	1345.12 1404.03	4.14	4.14 4.61	4.14 4.3	4.14 3.97	5569	5570	5570	5574	4.55	4.55 4.61	4.55 4.3	4.55 3.97	228.99	228.99 157.33	228.99 125.3	228.99 71.55
7	5575	1704.23	1704.23 1704.23	1704.23 1704.23	1704.23 1704.23	1715.9	1715.9 1716	1715.9 1716.38	1715.9 1716.81	0.1	0.48	0.92	1865.76	1865.76 998.65	1865.76 727.55	1865.76 288.08	1110.57	1110.57 998.65	1110.57 727.55	1110.57 288.08	2216.95	2216.95 2228.02	2216.95 1861.95	2216.95 1357.63	2.51	2.51 2.5	2.51 2.99	2.51 4.11	5565	5570	5567	5580	5.14	5.14 4.92	5.14 5.16	5.14 5.43	213.36	213.36 151.84	213.36 121.02	213.36 69.22
6	5575	1705.1	1705.1 1705.1	1705.1 1705.1	1705.1 1705.1	1715.34	1715.34 1715.44	1715.34 1715.84	1715.34 1716.34	0.1	0.5	1	3313.43	3313.43 2006.96	3313.43 1400	3313.43 1140	2232.16	2232.16 2006.96	2232.16 1400	2232.16 1140	3519.17	3519.17 3369.73	3519.17 3012.04	3519.17 2906.85	1.58	1.58 1.65	1.58 1.85	1.58 1.92	5560	5560	5572	5581	3.58	3.58 3.61	3.58 3.61	3.58 3.54	177.38	177.38 130.89	177.38 106.12	177.38 59.14
4	5575	1702.85	1702.85 1702.85	1702.85 1702.85	1702.85 1702.85	1713.16	1713.16 1713.25	1713.16 1713.66	1713.16 1714.15	0.1	0.5	1	2209.75	2209.75 2012.5	2209.75 1394.35	2209.75 970	2200.19	2200.19 2012.5	2200.19 1394.35	2200.19 970	2828.43	2828.43 2721.74	2828.43 2292.05	2828.43 1955.92	1.97	1.97 2.05	1.97 2.43	1.97 2.85	5572	5580	5570	5574	4.28	4.28 4.31	4.28 4.51	4.28 4.84	85.83	85.83 63.38	85.83 58.4	85.83 22.23
2	5575	1702.2	1702.2 1702.2	1702.2 1702.2	1702.2 1702.2	1711.73	1711.73 1711.82	1711.73 1712.22	1711.73 1712.68	0.1	0.5	0.96	4204.45	4204.45 2668.49	4204.45 2916.53	4204.45 632	2935.56	2935.56 2668.49	2935.56 2916.53	2935.56 632	3959.01	3959.01 3771.33	3959.01 3626.61	3959.01 2267.71	1.41	1.41 1.48	1.41 1.54	1.41 2.46	5582	5582	5585	5579	3.53	3.53 3.57	3.53 3.71	3.53 3.88				