Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: June 19, 2001

TO: Joe Tram, P.E. - FCDMC

FROM: W. Scott Ogden, P.E.

RE: FCDMC On Call 2000C013 – Task 11
Detailed Floodplain Delineation
T1SR6WS13 and T1NR6WS12
Zone A Study Stations 90 to 100

CC: Jon Fuller, P.E. – JE Fuller

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Registered Professional Engineer (Civil) CERTIFICATE 28857 W. SCOTT OGDEN Date Signed 6/19/01 ARIZONA, U.S.A.

INTRODUCTION

This technical memorandum summarizes the assumptions made and procedures implemented for conducting the hydrology, hydraulics, floodplain delineation and floodplain mapping work of Task 11 of the FCDMC 2000C013 on-call contract. The purpose of Task 11 was to perform sufficient analyses, modeling, and floodplain delineation mapping to update a target reach of wash from Zone A to a Zone AE complete with base flood elevations and a jurisdictional floodway. The results of this task will be used by the Flood Control District of Maricopa County (District) to perform in-house floodplain management of the newly created Zone A floodplains.

PROJECT LOCATION

The project area is located in the northwest quarter of Section 12, Township 1 North, Range 6 West, Gila & Salt River Base & Meridian, Maricopa County, Arizona. The specific study area is in Unincorporated Maricopa County and is generally located at the southwest corner of Van Buren Road and 355th Avenue. A recent FCDMC floodplain delineation contract entitled; *Zone A – Floodplain Delineation of Watershed "PP", Luke Wash* [1] (herein referred to as the Zone A Study), has delineated and mapped several unnumbered A zone flood hazard areas for Watershed "PP" using approximate methods. Two watercourses within that study area, T1SR6WS13 and T1NR6WS12 are the focus of this detailed floodplain delineation analyses. More specifically, the reaches of those two washes that lie between Sections 90 and 100 of T1SR6WS13 are to studied. T1SR6WS13 (also know as Phillips Wash) represents the continuous flow path north and south of the study reach. T1NR6WS12 is considered to be tributary to T1SR6WS13. Pertinent excerpts from the Zone A Study are provided in Appendix A for reference.

[1] Entellus, 2000, *Zone A – Floodplain Delineation of Watershed "PP", Luke Wash*, FCD 99-03, Technical Data Notebook Volumes 1 and 2.

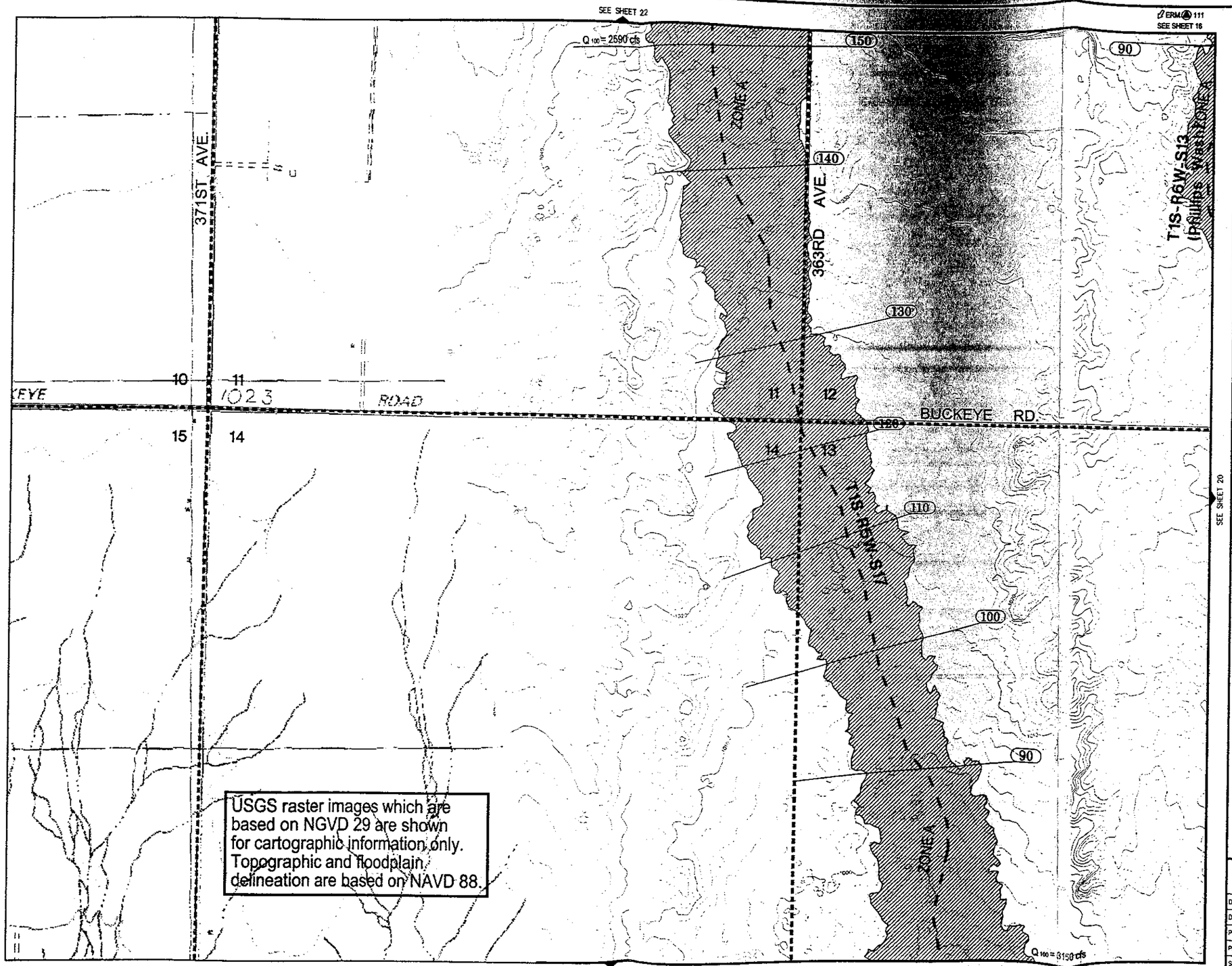
PROJECT MAPPING

Base topographic mapping, orthophotography, and mass point files for this project were provided by the District and were originally developed as a part of the Zone A Study. The topographic mapping is based on LIDAR technology, which is capable of producing an extremely dense network of individual elevation points. The mapping provided, however, does not accurately depict the topography along the wash banks and bottoms, and other areas where heavy vegetation exists. This is due to LIDAR's inability to effectively remove those points that are actually shots on the tree canopy or the top of a bush, etc. These tree and bush top points tend to skew the contour mapping in the more heavily vegetated areas and in this case, along the banks of the washes and areas of ponding. Supplemental survey data was therefore acquired along each of the cross section locations modeled, to better define the actual ground geometry in these areas of discrepancy. A coordinate and elevation listing of the surveyed points is provided in Appendix B along with an plan indicating the location of the points surveyed.

REACH DESCRIPTIONS

A field visit was conducted to visually inspect each of the wash reaches to be modeled. The extension of those reaches approximately 1-mile upstream and downstream was also observed. Within the study reach, both washes are characterized by a well incised, sand-bed channel that ranges from 10 to 25 feet wide and is typically 4 to 6 feet deep. The side banks are very steep and are often vertical due to erosion processes. It appears that degradation of both washes is occurring downstream of Van Buren Road and is likely attributable to the culvert crossings that tend to trap the sediment on the upstream side and release sediment hungry water to the watercourse downstream. Both washes are heavily vegetated along the immediate bank lines. The density of vegetation significantly reduces however, as one moves into the overbank areas. Both washes confluence at the southern end of the detailed study limits, approximately 250 feet upstream of the Zone A Study Section 90.

On a larger scale, both washes are generally situated in a ridge and valley formation of the piedmont. The valley area is approximately 1,800 feet wide and is flanked on either side by significant ridges that rise 15 to 20 feet above the valley floor. This ridge and valley feature extends for about 1.5 miles south and 0.75 miles the north of the target delineation reaches. For the approximate 3-mile reach of the formation, T1SR6WS13 (Phillips Wash) meanders across the entire width of the valley floor. Bifurcations occur at several locations forming two distinct flow paths that ultimately confluence at a location further downstream. and then rejoining. Inspection of the surfaces between some of these twin flow paths indicate that it is unlikely for the entire valley floor to be inundated during a 100-year event and that a divided flow condition should be expected for some portions of the valley.



USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING - EAGLE SCAN NOVEMBER 1999

FILE: 310\310010a\Draw\000_Plan_19.dwg DATE: 03/13/2001

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A DELINEATION OF WATERSHED "PP" LUKE WASH

F.C.D. CONTRACT NO. 99-03

LEGEND

100-YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
SECTION CORNER	29 28 / 32 33
WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

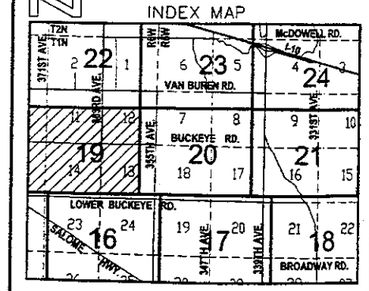
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
111	981.39	Brass Cap in Handhole in Center of Salome Hwy. Approximately 2.35 miles southeasterly of Wintersburg Rd (See sheet 16.)

NOTES

NGVD 29 + 1.97 FEET = NAVD 88

INDEX MAP



400' 0' 400' 800'

SCALE: 1" = 400'

CONTOUR INTERVAL = 10 - 20 FEET

SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

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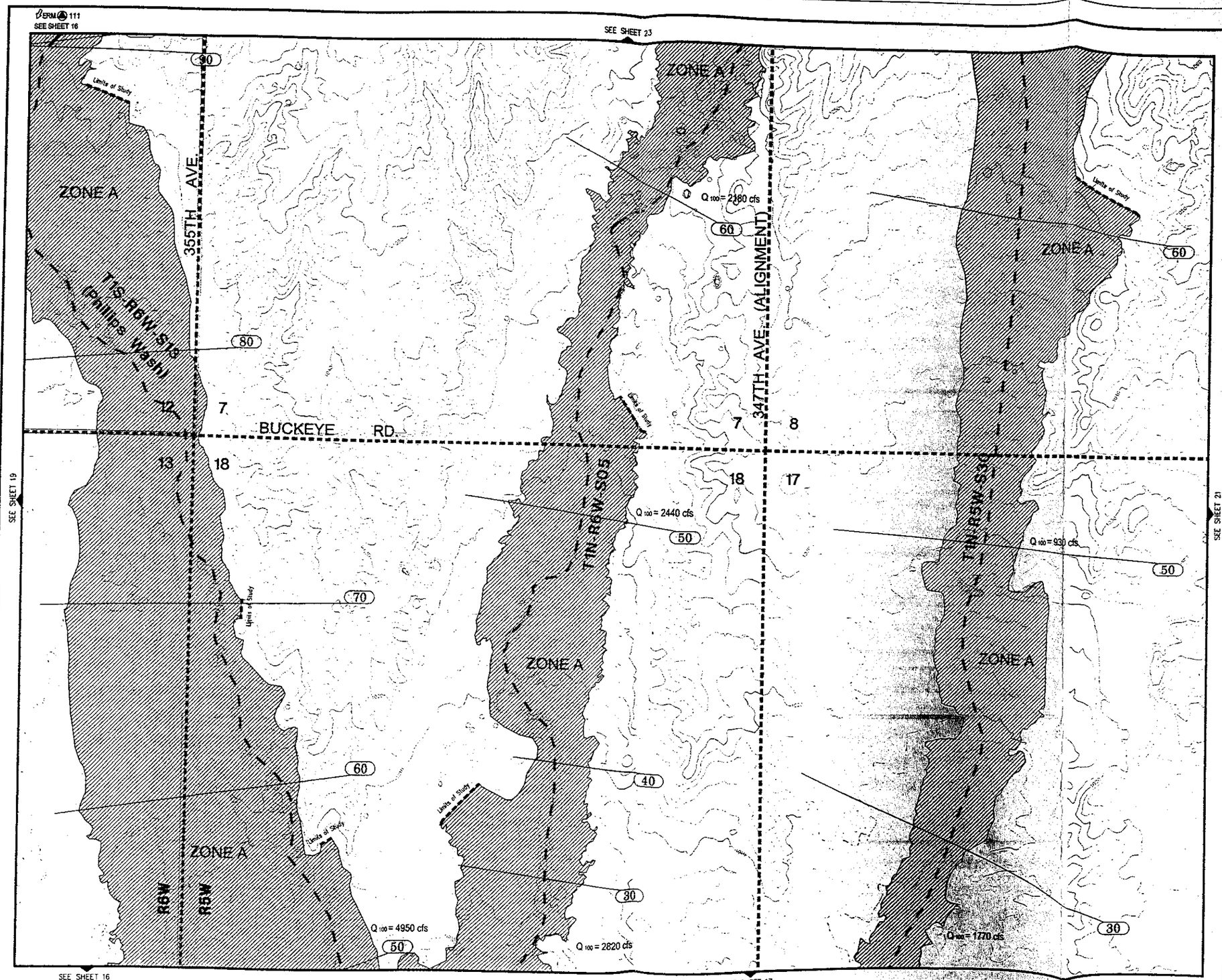
DESIGN	HAA/JCS	03/2001
DESIGN CHK.	SEK	03/2001
PLANS	GLT/RCS	03/2001
PLANS CHK.	MAA	03/2001
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER



FILE: J:\0\110010\Draw\000_Plan_20.Dwg DATE: 03/13/2001

USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING – EAGLE SCAN NOVEMBER 1999

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A DELINEATION OF WATERSHED "PP" LUKE WASH

F.C.D. CONTRACT NO. 99–03

LEGEND

100–YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
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WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
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NOTES

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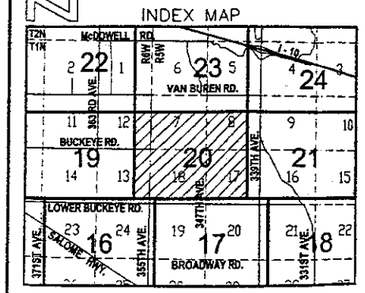
INDEX MAP



400' 0' 400' 800'

SCALE: 1" = 400'

CONTOUR INTERVAL = 10 – 20 FEET

SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

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PLANS	GLT/RCS	03/2001
PLANS CHK.	HAA	03/2001
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 20 OF 38

HYDROLOGY

The peak 100-year discharges estimated in the Zone A Study for cross sections 90 and 100 were respectively reported as 4,950 cfs and 4,760 cfs. These discharges will be used as the base hydrology for this study as well.

Figure 1 in Appendix C is a topographic aerial map of the area upstream of Van Buren Road. It can be seen from Figure 1 that a significant bifurcation occurs at (Point A), which is on T1SR6WS13 approximately 2,000 feet north of Van Buren Road. Flows in the left branch (orientation looking downstream) of this bifurcation are directed to T1NR6WS12. Field inspection of the area upstream of that bifurcation indicates that other, less obvious diversions of flow to the west exist, and especially for large magnitude storms such as the 100-year. According to the Zone A Study (see Appendix A for excerpts), the flows in T1SR6WS13 at Cross Section 120 (4,460 cfs) are completely contained within the watercourse corridor. However, at Cross Section 110, which is downstream of 120, the 100-year discharge inundates the both T1SR6WS13 and T1NR6WS12 and spans across the entire valley floor. It is noted that Cross Section 110 is still upstream of the bifurcation at Point A, indicating that some flows must spill from T1SR6WS13 to T1NR6WS12 prior to Point A. Cross Section 100 indicates that T1SR6WS13 is slightly perched when compared to T1NR6WS12 and that any flows exceeding the containment capacity of T1SR6WS13 will spill directly to T1NR6WS12. It is therefore evident that a significant portion of the flows in T1SR6WS13 at Cross Section 120 will spill or be diverted to T1NR6WS12 by the time the flows reach Van Buren Road.

T1NR6WS12 – A combination of normal depth calculations and weir flow analyses were performed to assist in estimating the peak discharges for each wash. The procedure used for estimating the peak discharge in T1NR6WS12 is summarized below. Refer to Figure 1 in Appendix C for a map depicting the points described below.

1. Using normal depth hydraulic analyses, the capacity of T1SR6WS13 at a location approximately 430 feet upstream of Van Buren Road (See Figure 1 in Appendix C, line between points B and C) is estimated. The normal depth hydraulics are computed using Haestad Methods FlowMaster®, version 6.1. Geometry, slope and roughness coefficients for the section were estimated from the topographic mapping and from notes made during the field visit. Output from FlowMaster® is included in Appendix D. In summary, the wash at section B-C has a capacity of approximately 1,840 cfs. Accordingly, it is assumed that all flows exceeding this amount have already spilled to T1NR6WS12 prior to reaching this location.

2. Stage versus discharge rating curves for the profile section between points C and D and points D and E are approximated assuming broad-crested weir hydraulics. The C-D weir is considered to be the right bank containment elevation for T1SR6WS13. Any flow above this profile will spill to T1NR6WS12. The D-E weir is a profile along Van Buren Road. Weir hydraulics are calculated using an uneven weir computer program that incorporates a weir coefficient versus weir depth relation developed by USACE. Output from the program for each weir is included in Appendix D.

3. Estimate a stage versus discharge rating curve for the two, double barrel corrugated metal pipe culvert crossings on T1SR6WS13. Pipe geometries were not surveyed and the aggregate conveyance capacity of both crossings is approximated by four, 48-inch diameter pipes. Hydraulic calculations were performed using HY8. Output from the program is included in Appendix D.
4. The data generated for Steps 2 and 3 are combined to create an overall rating relation for T1SR6WS13 just above Van Buren Road. Rating curves of discharge versus elevation for this step are plotted on Figure 2 in Appendix D.
5. Using Figure 2 and the 1,840 cfs capacity calculated in Step 1, it is estimated that approximately 1,400 cfs will be able to continue southerly within T1SR6WS13. The remaining flows will spill to T1NR6WS12.
6. According to the Zone A Study, the peak discharge for Cross Section 100 is 4,760 cfs. Assuming only 1,400 cfs is capable of continuing southerly within T1SR6WS13, then a potential peak discharge of approximately 3,400 cfs is in T1NR6WS12 at Van Buren Road.

T1SR6WS13 – The uncertainties associated with the mapping and the inherent limitations of the previous analyses warrant a conservative assumption of the peak discharge to be used in modeling T1SR6WS13. It is therefore assumed that half of the peak discharge at Cross Section 120 (4,600 cfs ÷2 = 2,300 cfs) continues to the reach downstream of Van Buren Road.

In summary, the peak discharge estimates for this task are as follows:

Description	Peak 100-year Discharge
T1SR6WS13 below confluence with T1NR6WS12	4,950 cfs
T1SR6WS13 above confluence with T1NR6WS12	2,300 cfs
T1NR6WS12 above confluence with T1SR6WS13	3,400 cfs

HECRAS Hydraulic Modeling

HECRAS version 2.2 is used to hydraulically model the wash reaches for this task. The following discussions briefly summarize the procedures used to develop the modeling parameters and geometry.

Reach Geometry – there are two rivers, three reaches, one junction, and ten cross sections modeled in this task. The river designations follow the Zone A Study naming conventions. The reaches are named to correspond to the reach between the Zone A Study cross section numbers. Cross sections are numbered consecutively from downstream to upstream. The junction for T1SR6WS13 and T1NR6WS12 is located between cross sections 91 and 92. This location was selected for the junction because cross section 92 (actually 92.1 and 92.2) is approximately where the divided flow begins.

The following table summarizes the rivers, reaches, and cross sections modeled using HECRAS in this task.

River: T1SR6WS13	Reach: 90_100 Lower	Cross Sections: 90 and 91
River: T1SR6WS13	Reach: 90_100 Upper	Cross Sections: 92.1, 93.1, 94.1, and 95.1
River: T1NR6WS12	Reach: 90_100	Cross Sections: 92.2, 93.2, 94.2, and 95.2

Roughness Coefficients – the Manning's n values used in the Zone A Study are adopted for this task with only minor adjustments to the main channel values. The selected values are summarized in the HECRAS output provided in Appendix E.

C & E Coefficients – all C&E coefficients are set to 0.1 and 0.3, since the overall floodplain limits appear to change gradually.

Cross Sections – the cross sections for this task were generated using both the LIDAR mass point files and the survey section data at the washes. A baseline station of 1+00 (100) is set for all of the cross sections at approximately the center line of 355th Avenue. Cross sections 92.1 and 92.2, 93.1 and 93.2, 94.1 and 94.2, and 95.1 and 95.2 share a common end station that is approximately located on the ridge dividing T1SR6WS13 and T1NR6WS12. The cross sections are oriented to be perpendicular to the 100-year floodplain and not necessarily to the main wash. Left and right bank stations were set to bracket the main wash plus any significant secondary channels that occur in the immediate overbank areas. Cross section plots are included with HECRAS output in Appendix E.

Boundary Conditions – the downstream and upstream starting water surface conditions were set to start with normal depth. The approximate energy slope was set equal to the slope used in the Zone A Study for those reaches (see Plate 3 in the Zone A Study)

Floodway Encroachments – initial encroachment stations were estimated using floodway Method 4 (equal conveyance reduction), with a target value of 1.0 foot and a 10-foot setback from the top of bank stations. Once the encroachment limits were acceptable and the rise in water surface was less than 1.0 foot, the Method 4 results were then converted to Method 1 (user defined values).

VAN BUREN ROAD HYDRAULIC MODELING

As previously noted, the upstream limit of the HECRAS modeling is cross sections 95.1 and 95.2. Other methods were used to estimate the flood elevation and floodplain widths at the Van Buren Road crossings, which are identified as 96.1(reach T1SR6WS13) and 96.2 (reach T1NR6WS12). The floodplain width and elevation for cross sections 96.1 and 96.2 are dictated by the combination of weir and culvert flow. Weir and culvert rating tables and figures were developed for each cross section.

The rating relations for cross section 96.1 (reach T1SR6WS13) were previously discussed in the Hydrology section of this report, and are provided in Appendix D (see Figure 2). Using Figure 2, it can be estimated that at a water urface elevation of 1055.8

feet based on the combined discharge of the D-E weir and the culvert flow, equates to a discharge of approximately 2,300 cfs. It should be noted that no encroachment is modeled at cross section 96.1, and that the floodway between cross sections 95.1 and 96.1 is transitioned to coincide with floodplain limits at cross section 96.1.

Cross section 96.2 (reach T1NR6WS12) was analyzed using the same techniques and computer programs as cross section 96.1. The resulting program output and rating relations are provided in Appendix F (see Figure 3). The culvert at cross section 96.2 is a triple barrel culvert comprised of corrugated metal pipe. The pipe geometry was visually inspected but not surveyed and is approximated using 36-inch diameter pipes. The culvert capacity rating curve is developed using HY8. Van Buren Road is assumed to function as a broad-crested weir and is analyzed using the uneven weir program for both the floodplain and floodway analysis. The entire roadway profile is coded as input to the weir program for the floodplain analysis. The weir profile is arbitrarily truncated at the left and right stations shown on Exhibit 1 in Appendix H and on Plate 1 which is included in a pocket in Appendix H. The floodway limits are considered to be an interim, conservative measure and approximate a transitional flaring of the floodway from the downstream section to Van Buren Road. Further HECRAS modeling will be required to extend the reach upstream to better define a more accurate floodway limit. Output from HY8 and the uneven weir program are provided in Appendix F. Figure 3 in Appendix F summarizes both the floodplain and floodway rating relation with a plot of discharges versus water surface elevations. Using Figure 3, a floodplain water surface elevation of 1053.0 feet equates to a peak discharge of approximately 3,400 cfs. Similarly, a floodway water surface elevation of 1053.18 equates to a peak discharge of approximately 3,400 cfs.

FINAL RESULTS

The HECRAS floodplain and floodway modeling results are summarized in a tabular format similar to the typical FIS study data tables and provided in Appendix G. General output from the HECRAS model, including cross section plots, are provided in Appendix E. The floodplain and floodway limits, along with base flood and floodway elevations, are indicated on Exhibit 1 in Appendix H and on Plate 1 which is included in a pocket in Appendix H. A diskette with the HECRAS files is provided in Appendix I.

As previously discussed, the floodway delineation between cross sections 95.1 and 96.1, and 95.2 and 96.2 are considered a conservative approximation and are mapped to provide a transitional continuity of the floodway line to the upstream end of the study. It is anticipated that the Van Buren Road crossings will be hydraulic controls for the floodplain and floodway mapping of each reach upstream of the road. Accordingly, the floodway limits should be more accurately located with any future continuation of the detailed floodplain delineation modeling to the north.

APPENDIX A

Flood Control District of Maricopa County

ZONE A - FLOOPLAIN DELINEATION OF WATERSHED "PP" LUKE WASH F.C.D. CONTRACT NO. 99-03

Technical Data Notebook

Volume 1 of 2

Prepared by:

Intelligent Engineering
Environmental *Solutions*

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October, 2000

Table E.5-1
Slope Calculations

(listed from south to north, west to east)

Wash	Reach	Cross Sections	Reach Length [ft]	Interval Length [ft]	Change in Elevation [ft]	Slope
T1S-R5W-S29	1	10 – 40	4004	4004	20	0.0049
T1S-R5W-S29W	1	10 – 50	6401	6401	40	0.0075
T1S-R5W-S29E	1	80 – 130	8912	1755	10	0.0057
	2	10 – 60	11016	6858	40	0.0058
T1S-R5W-S17	1	90 – 250	17924	17924	40	0.0055
	2	70 – 85	13312	13312	40	0.0047
	3	1 – 60	19123	19123	40	0.0041
T2N-R6W-S35	1	10 – 160	16558	3333	20	0.0060
T1N-R6W-S11	1	10 – 40	9373	1891	10	0.0053
T2N-R6W-S36	1	220 – 350	14146	9231	60	0.0065
	2	10 – 210	17344	7547	40	0.0053
T2N-R6W-S36W	1	10 – 50	7490	4255	20	0.0047
T1S-R5W-S32	1	10 – 160	22855	22855	30	0.0043
(LUKE WASH)						
T1N-R5W-S32	1	10 – 70	9558	1611	10	0.0062
T1N-R6W-S12	1	10 – 60	6626	1358	10	0.0074
T1S-R6W-S13	5	140	2603	1514	10	0.0066
(Phillips Wash South)	6	100 – 130	7092	3974	20	0.0050
	7	50 – 90	12120	6657	30	0.0045
	8	10 – 40	4605	3437	20	0.0058
T3N-R5W-S19	1	320 – 540	13008	13008	60	0.0080
(Phillips Wash North)	2	180 – 310	17298	11321	60	0.0053
	3	140 – 170	4524	10487	60	0.0057
	4	10 – 130	15509	15509	50	0.0064
T2N-R5W-S19	1	10 – 70	10783	3974	20	0.0050
T2N-R5W-S08	1	10 – 90	5812	2100	20	0.0095
T3N-R5W-S31	1	10 – 50	3643	2500	20	0.0080
T3N-R5W-S30	1	1 – 50	2659	2557	20	0.0078
T1N-R6W-S05	1	70 – 110	9847	1534	10	0.0065
(Dickey Wash South)	2	60	3315	2065	10	0.0048
	3	10 – 50	5458	2287	10	0.0044
T2N-R5W-S31	1	140 – 160	5242	2710	20	0.0074
(Dickey Wash North)	2	100 – 130	2686	2686	30	0.0069
	3	10 – 90	8225	8225	30	0.0039
T1N-R5W-S30	1	10 – 80	16876	16876	40	0.0062
T2N-R5W-S32	1	10 – 120	7127	7127	30	0.0079
T1S-R5W-S08	1	10 – 50	4293	4293	30	0.0070
T1S-R5W-S09	1	10 – 130	15063	1817	10	0.0055
T1N-R5W-S33W	1	30 – 100	6596	1488	10	0.0067

Table E.5-1
Slope Calculations

(listed from south to north, west to east)

Wash	Reach	Cross Sections	Reach Length [ft]	Interval Length [ft]	Change in Elevation [ft]	Slope
	2	10 – 20	660	1818	10	0.0055
T1N-R5W-S33N	1	10 – 60	7121	1713	10	0.0058
T1N-R5W-S28W	1	10 – 80	6267	6267	40	0.0061
T1S-R5W-S09W	1	10 – 100	6228	1525	10	0.0066
T1N-R5W-S33E	1	10 – 50	4954	1214	10	0.0082
T1N-R5W-S28E	1	10 – 60	6544	6557	40	0.0058
T1S-R5W-S16	1	10 – 50	5720	5720	30	0.0088
T1S-R5W-S22N	1	10 – 150	8976	658	10	0.0152
T1S-R5W-S22S	1	1 – 110	6872	1843	10	0.0054
T1N-R5W-S22	1	10 – 190	9039	9039	50	0.0085
T1N-R5W-S15	1	10 – 60	6426	1068	10	0.0094
T1N-R5W-S10	1	10 – 90	6554	6554	30	0.0063
T1N-R5W-S04	1	10 – 50	6232	1095	10	0.0091
T2N-R5W-S33E	1	130 – 470	28656	28656	60	0.0043
	2	10 – 120	15395	5714	40	0.0070
T2N-R5W-S33W	1	10 – 120	8095	8095	40	0.0080
T2N-R5W-S21	1	10 – 20	2800	2354	20	0.0085
T2N-R5W-S05E	1	10 – 30	4414	3136	20	0.0064
T3N-R5W-S32E	1	10 – 60	3749	3757	20	0.0053
T2N-R5W-S28	1	10 – 60	5818	2941	20	0.0068
T2N-R5W-S05W	1	10 – 50	4685	2097	20	0.0095
T2N-R5W-S27S	1	10 – 100	10446	3024	20	0.0067
T2N-R5W-S27N	1	110 – 200	10791	2974	20	0.0067
T2N-R5W-S04	1	10 – 50	7772	2268	20	0.0088
T3N-R5W-S28S	1	10 – 50	3393	2293	20	0.0087
T3N-R5W-S28N	1	10 – 160	11103	11103	60	0.0070
T3N-R5W-S20	1	10 – 50	4409	2800	20	0.0071
T3N-R5W-S21S	1	10 – 60	3958	2143	20	0.0093
T3N-R5W-S21N	1	50 – 60	877	832	10	0.0120
	2	10 – 40	2030	4832	20	0.0041

WashSlopesFinal_9_26.wb3

SECTION 4: HYDROLOGY

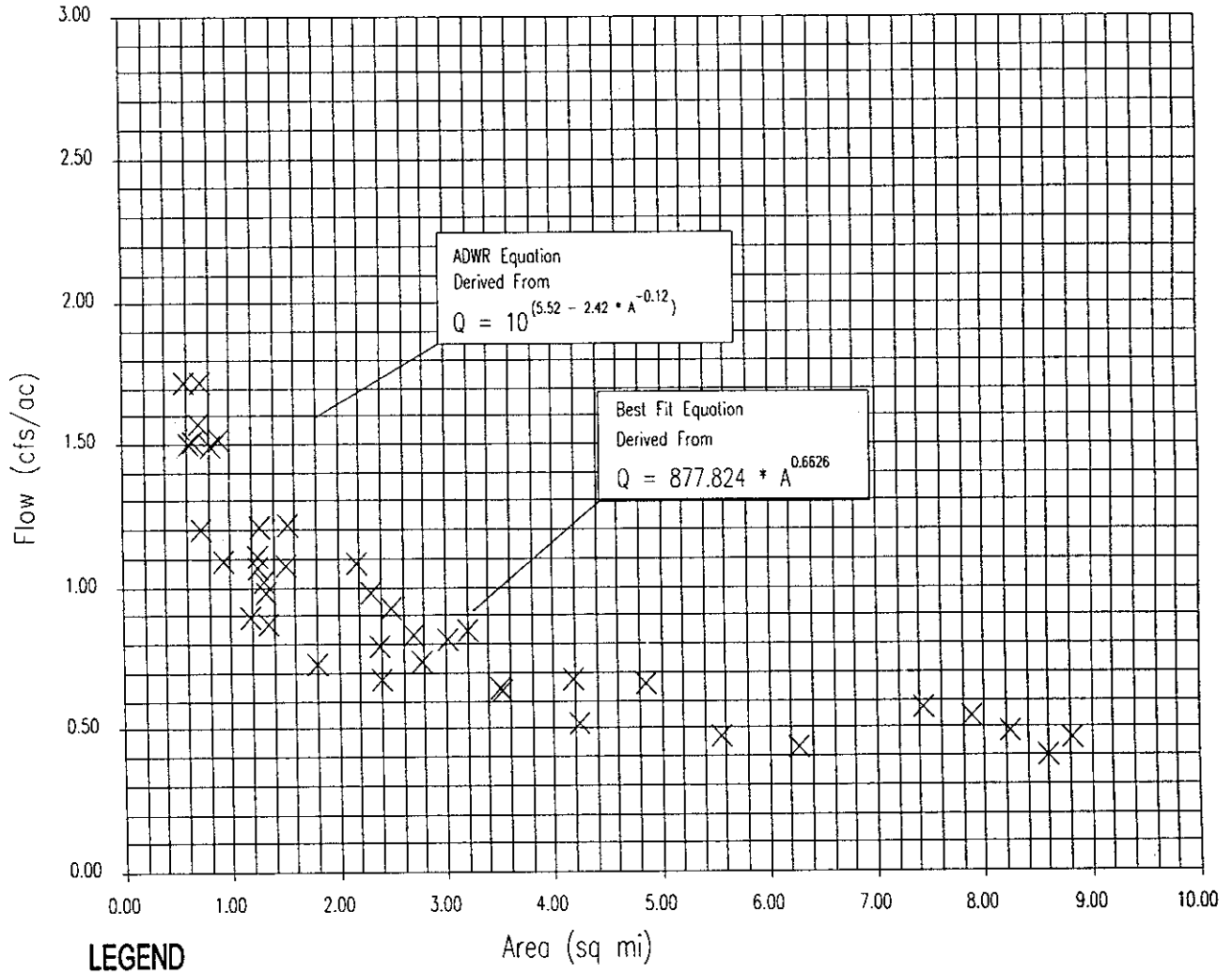
4.1 Method Description

An area/runoff relationship was developed as a means of calculating the 100-year peak flows for this project. This relationship was based on the results of a HEC-1 model developed for the *Luke Wash Flood Insurance Study* prepared by Coe & Van Loo Consultants, Inc. in 1992 (**Reference 3**). The model developed by Coe & Van Loo covers most of the watershed contributing to the washes to be delineated. However, concentration point locations and level of detail encountered in the model are not adequate to develop peak flows for individual washes within the watershed. To obtain the level of detail desired for this project, the flow values obtained from the Luke Wash FIS study were plotted against the contributing area as shown in **Figure 2**. It is apparent that most of the plotted values fall into a narrow band. A line falling at the upper limit of this band was considered to be a conservative estimate of the flow for this particular area. Based on this line, an equation was developed to estimate flows at desired concentration points. The only required parameter for this equation is the contributing area.

4.2 Parameter Estimation

4.2.1 Drainage Area Boundary

Based on the topographic mapping information and aerial photography, the watershed was divided into several sub-basins to obtain the contributing area for desired concentration points. The basin boundaries are shown in **Plates 1 and 2** located in the pockets at the end of this report and half size copies are included at the end of this section.



LEGEND

ADWR Region 13 Equation

Best-Fit Equation for HEC-I Results

× Results from Arlington ADMS

A = Area (sq mi)

Q = 100-yrt Peak Flow (cfs)

FIGURE 2
Relationship Between Watershed Area and Peak Flow

The basins previously developed under the *Luke Wash Flood Insurance Study* (**Reference 3**) were not used in this study because they do not accurately depict the drainage conditions, in the upstream reaches of the watershed. The hydrology developed under the FIS focused on the lower portion of Luke Wash. Upstream boundaries, even though adequate for the FIS, were not accurate nor detailed enough for the purpose of this study.

4.2.2 Watershed Work Map

The watershed map was based on USGS 7.5 quadrangle topographic maps (**Reference 14**), 1996 aerial photography geo-registered on the State Plain Coordinates System (**Reference 2**), and the LIDAR mapping as described in **Section 3** of this report. The watershed maps are presented in **Plates 1 and 2** located in the pockets at the end of this report. Also half size versions are included at the end of **Section 4 – Hydrology.**

4.2.3 Gage Data

Most of the watercourses in this study are wide shallow streams that are not very well suited for gaging. No gaging stations are located within the study area and it is unlikely that watersheds similar to the study area are gaged.

4.2.4 Statistical Parameters

The Arizona Department of Water Resources (ADWR) developed regional regression equations for the area (**Reference 4**). However, these equations are very general and, as shown in **Figure 2,** tend to significantly overestimate the peak runoff in the study area. ADWR regression equations were developed based on gage date across the entire region and is better representative of larger, better-defined watercourses.

4.2.5 Precipitation

The methodology used to develop the hydrology for this study does not require the use of precipitation values. The original *Luke Wash FIS*

(**Reference 3**) contains precipitation Values that were use to generate the HEC-1 for the study area.

4.2.6 Physical Parameters

4.2.6.1 Watershed parameters

The only parameter required to develop the hydrology for this project is the drainage area. Drainage contributing areas were estimated from the project's work maps (See **Plates 1** and **2**).

4.2.6.2 Storage routing parameters

Storage does not appear to play a large part in reducing peak flows within the study area. However, both Interstate 10 and the Southern Pacific Railroad could provide some storage. According to the *Luke Wash FIS* (**Reference 3**) the railroad will be overtopped by flows much less than the 100-year event and most likely will be breached by the time the 100-year runoff reaches the railroad. The same study shows that the reduction of flow at Interstate-10 is not significant due to many culvert crossings (see **Appendix E-4**) and limited storage volume available. The methodology used in developing the flows for this project does not consider storage directly. However, since the original study used to develop the peak flow equation includes storage upstream of Interstate-10, this parameter is factored in the calculation of the peak flows. For more details see **Section 4.3**

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

4.3.1.1 CAP Overchute

There is an overchute crossing the CAP Canal on the northern boundary of the study. The design flow for this structure was not available, and since the area is outside the Luke Wash watershed, it was not included in the FIS model. Developing the hydrology upstream from this structure was outside the scope of work for this project. However, in order to obtain an approximate flow in Wash T3N-R5W-S28N, an analysis was performed to estimate this flow. It was assumed that during a 100-year event, the overchute would be flowing at maximum capacity. The capacity of the structure was estimated assuming critical depth at the drop on the downstream end of the overchute. To be consistent with the rest of the study, this flow was converted to an equivalent drainage area that can be added to the downstream contributing areas to obtain the total downstream flows. For detailed calculations see **Appendix D**.

4.3.1.2 Storage reduction

Storage reduction was not included for this study. However, the hydrological equation developed for this study was based on the flows obtained from the *Luke Wash FIS*, which accounts for storage at Interstate 10. Therefore, the equation reflects some of the effects of storage at Interstate 10 as estimated in the *Luke Wash FIS*.

The flow/area points plotted in **Figure 2** include both areas upstream and downstream from Interstate-10 that do not include storage. However, for the larger areas encountered as flows combine and move downstream crossing Interstate-10, storage effects are included in the plotted points.

4.4 Calibration

Flows estimated for this project are based on the Luke Wash FIS hydrology model previously approved by FEMA. In addition, the results obtained during this study

were plotted and compared with gage data collected for the Flood Control District of Maricopa County **(Reference 5)** to insure that the results were reasonable as shown on **Figure 3**.

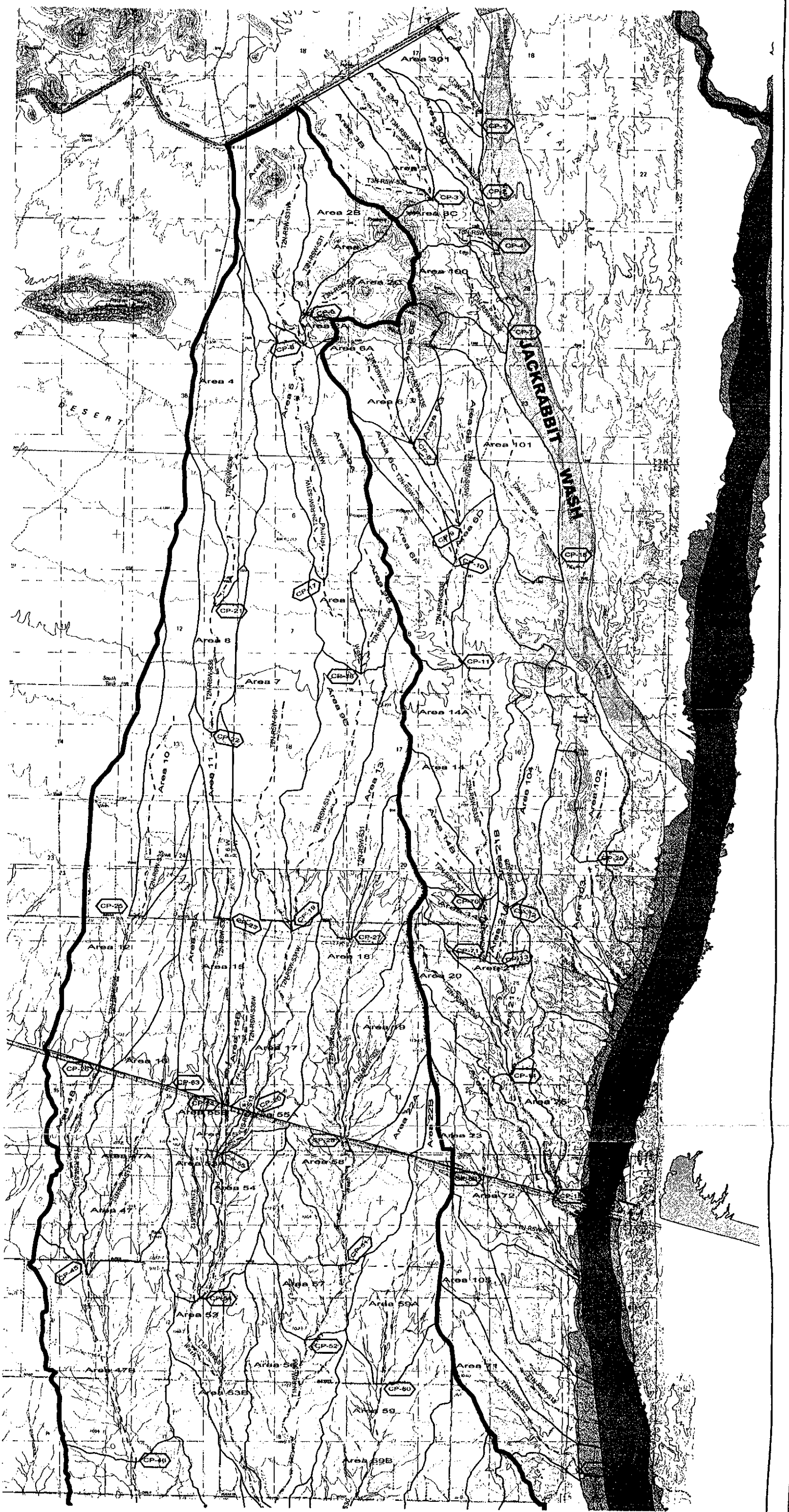
4.5 Final Results

4.5.1 Hydrologic Analysis

The final results of the hydrologic analysis are presented in **Table D-2**.

4.5.2 Verification of Results

The results of the hydrologic analysis were compared with the original set of data obtained from the *Luke Wash FIS* and the original equation line. All of the results fall within the expected region. Additionally, comparison with the Flood Control District gage data shows the results are within the lower portion of the data envelope. This is expected considering the physical characteristics of the watershed.



LEGEND

- WASH BASELINE
- T2N-R5W-S04 WASH I.D. LABEL
- PROJECT LIMITS
- BASIN BOUNDARIES
- Area 100 BASIN NUMBER
- CP-1 CONCENTRATION POINTS
- EXISTING FLOODPLAIN
- EXISTING FLOODWAY
- EXISTING ZONE A

Zone - A floodplain Delineation of Watershed "PP" Luke Wash	Luke Wash FIS Approximated Equivalent Concentration Points
CP-17	S5
CP-25	S10
CP-23	S40
CP-19	C20
CP-26	C245
CP-63	S225
CP-24	C55
CP-20	C30
CP-55	C60
CP-28	C90
CP-60	S135
Others	N/I

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Phoenix, AZ 85008-3279
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FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

PLATE 1

HYDROLOGY MAP

Table D-1
Basin Areas

Basin ID	Area s-ft	Area Acres	Area s-miles
1	25,306,851	581	0.908
2	31,855,170	731	1.143
2A	1,754,495	40	0.063
2B	16,091,257	369	0.577
2C	14,009,418	322	0.503
3	35,798,208	822	1.284
3A	11,433,080	262	0.410
3B	14,850,614	341	0.533
3C	9,514,515	218	0.341
4	31,900,532	732	1.144
5	14,835,226	341	0.532
6	75,383,527	1,731	2.704
6A	14,018,549	322	0.503
6B	13,277,006	305	0.476
6C	8,216,052	189	0.295
6D	4,240,957	97	0.152
6E	9,438,619	217	0.339
6F	21,382,899	491	0.767
6G	4,809,445	110	0.173
7	65,952,557	1,514	2.366
8	15,067,652	346	0.540
9	62,062,529	1,425	2.226
9A	24,376,486	560	0.874
9B	8,726,648	200	0.313
9C	28,959,395	665	1.039
10	33,164,265	761	1.190
11	11,491,508	264	0.412
12	53,158,085	1,220	1.907
13	22,661,704	520	0.813
14	64,371,582	1,478	2.309
14A	44,528,721	1,022	1.597
14B	12,916,483	297	0.463
14C	6,926,378	159	0.248
15	38,779,303	890	1.391
15A	23,671,218	543	0.849
15B	15,108,085	347	0.542
16	8,720,989	200	0.313
17	21,463,250	493	0.770
18	33,974,797	780	1.219
19	22,214,481	510	0.797
20	14,292,768	328	0.513
21	24,630,028	565	0.883
21A	3,032,458	70	0.109
21B	10,173,267	234	0.365
21C	11,424,303	262	0.410
22A	5,727,230	131	0.205
22B	2,790,737	64	0.100
23	7,591,127	174	0.272
24	15,968,893	367	0.573
25	6,693,951	154	0.240
40	21,174,639	486	0.760
41	33,396,534	767	1.198
42	14,155,360	325	0.508
43	42,644,746	979	1.530
44	65,638,270	1,507	2.354

Table D-1
Basin Areas

Basin ID	Area s-ft	Area Acres	Area s-miles
45	137,098,096	3,147	4.918
46	43,600,104	1,001	1.564
47	80,154,530	1,840	2.875
47A	30,053,731	690	1.078
47B	50,100,799	1,150	1.797
48	17,429,759	400	0.625
50	75,351,705	1,730	2.703
51	57,909,033	1,329	2.077
51A	32,672,072	750	1.172
51B	25,236,961	579	0.905
52	8,759,240	201	0.314
53	39,260,625	901	1.408
53A	17,945,547	412	0.644
53B	21,315,078	489	0.765
54	15,643,677	359	0.561
55	5,265,552	121	0.189
55A	2,398,409	55	0.086
55B	2,867,143	66	0.103
56	31,421,870	721	1.127
57	20,567,505	472	0.738
58	25,341,074	582	0.909
59	77,324,681	1,775	2.774
59A	27,389,486	629	0.982
59B	49,935,195	1,146	1.791
60	13,161,943	302	0.472
61	37,151,984	853	1.333
61A	32,616,891	749	1.170
61B	4,535,093	104	0.163
62	63,523,417	1,458	2.279
62A	3,498,438	80	0.125
62B	46,121,651	1,059	1.654
62C	13,903,328	319	0.499
63	18,935,665	435	0.679
64	59,854,661	1,374	2.147
64A	13,825,292	317	0.496
64B	46,029,369	1,057	1.651
65	8,127,157	187	0.292
66	20,334,237	467	0.729
67	17,187,432	395	0.617
70	16,215,186	372	0.582
71	18,678,876	429	0.670
72	12,578,181	289	0.451
100	12,158,040	279	0.436
101	27,575,946	633	0.989
102	17,487,507	401	0.627
103	23,130,300	531	0.830
104	28,202,205	647	1.012
105	23,241,019	534	0.834
106	15,589,052	358	0.559
107	18,990,482	436	0.681
108	7,179,775	165	0.258
300	5,714,321	131	0.205
301	9,989,656	229	0.358
CAP shute	324,000,000	7,438	11.622

FinalBasinAreas_10_2.wb3

Table D.2
Flow Calculations

(listed from south to north, west to east)

Wash	Basin ID No.	Conc. Point	Location	Area [sqmls]	100 yr Flow [cfs]
T1S-R5W-S29	44,43,42,41,40	44	Arlington Canal	6.349	2990
T1S-R5W-S29W	42,41	43L	Ray Rd. Align.	1.706	1250
	42,41,44,43	43C	Ray Rd. Align.	5.590	2750
T1S-R5W-S29E	44	42	Southern Pac R/R	2.354	1550
	44.43	43R	Extension	3.884	2160
	44,43,42,41	43C	Extension	5.590	2750
T1S-R5W-S17	10,12,48	45L	Van Buren	3.722	2100
	10,12,48,47A,16	45C	Van Buren	5.112	2590
	10,12,48,47,16	46	Lower Buckeye	6.910	3160
	10,12,48,47,16,46	47	Salome Highway	8.474	3620
	10,12,48,47,16,46,45	48	Southern Pac R/R	13.391	4900
T2N-R6W-S35	10	25	Indian School Rd	1.190	990
	10,12	26	I-10	3.096	1860
T1N-R6W-S11	16	63	I-10	0.313	410
	16,47A	45R	Van Buren	1.391	1090
T2N-R6W-S36	4	21	Glendale Ave	1.144	960
	4,8	22	Bethany Home Rd.	1.685	1240
	4,8,11	23	Indian School Rd	2.097	1430
	4,8,11,15A	24L	I-10	2.946	1800
	4,8,11,15(15A,15B)	24	I-10	3.488	2010
	4,8,11,15,55B	55L	McDowell	3.591	2050
T2N-R6W-S36W	15B	24R	I-10	0.542	590
T1S-R5W-S32	Phillips,59	59C	Broadway Align.	18.537	6930
(LUKE WASH)	Phillips,59,51B	50R	Salome Highway	22.216	7650
	Phillips,59,51	50C	Salome Highway	23.388	7880
	Phillips,59,51,50	49	Southern Pac R/R	26.091	8390
T1N-R5W-S32	51A	50L	Salome Highway	1.172	980
T1N-R6W-S12	53A	54L	Van Buren	0.644	660
T1S-R6W-S13	1,2,5,9,7,17	20	I-10	7.944	3470
(PHILLIPS SOUTH)	1,2,5,9,7,17,55A	55R	McDowell	8.030	3490
	1,2,5,9,7,17,55A,(4,8,11,15,55B)	55C	McDowell	11.621	4460
	1,2,5,9,7,17,55A,(4,8,11,15,55B),54	54R	Van Buren	12.182	4600
	1,2,5,9,7,17,4,8,11,15,55,54,53A	54C	Van Buren	12.826	4760
	1,2,5,9,7,17,4,8,11,15,55,54,53	53L	Lower Buckeye	13.591	4950
	1,2,5,9,7,17,4,8,11,15,55,54,53,Dickey	53C	Confluenc Dickey	19.398	6260
	1,2,5,9,7,17,4,8,11,15,55,54,53,Dickey,52	59L	Broadway Align.	19.712	6330
T2N-R5W-S31W	1	6L	Dunlap	0.908	820
(PHIILLIPS NORTH)	1,2	6	Dunlap	2.050	1410
	1,2,5	17	Glendale Ave	2.583	1650
	1,2,5,9A	18L	Bethany Home Rd.	3.457	2000
	1,2,5,9A,9B	18	Bethany Home Rd.	3.770	2120
	1,2,5,9(9A,9B,9C)	19R	Indian School Rd	4.809	2490
	1,2,5,9,7	19C	Indian School Rd	7.174	3240
	1,2,5,9,7,17	20	I-10	7.944	3470
T2N-R5W-S19	7	19L	Indian School Rd	2.366	1550
T2N-R5W-S08	9B	18R	Bethany Home Rd.	0.313	410

Table D.2
Flow Calculations

(listed from south to north, west to east)

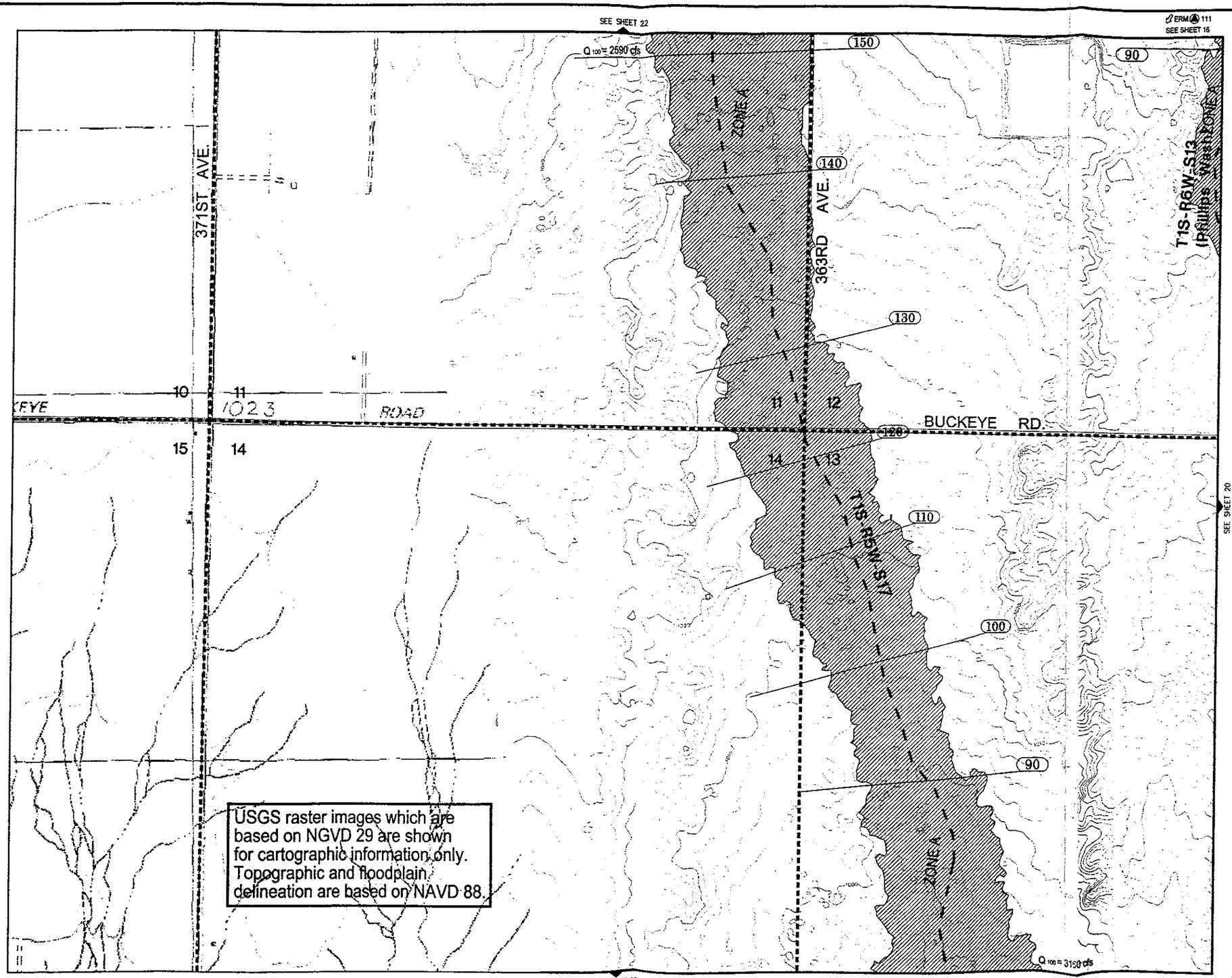
Wash	Basin ID No.	Conc. Point	Location	Area [sqmls]	100 yr Flow [cfs]
T3N-R5W-S31	2B	5L	Peoria Ave.	0.577	610
T3N-R5W-S30	2C	5R	Peoria Ave.	0.503	560
	2B,2C	5C	Peoria Ave.	1.080	920
	2(2A,2B,2C)	6R	Peoria Ave.	1.143	960
T1N-R6W-S05	13,18,19	28C	I-10 Dickey/2n5w 32	2.828	1750
(DICKEY SOUTH)	13,18,19,58,22A	51	Van Buren	3.943	2180
	13,18,19,58,22A,57	52	Buckeye Rd.	4.681	2440
	13,18,19,58,22A,57,56	53R	Lower Buckeye	5.808	2820
T2N-R5W-S31	13	27	Indian School Rd	0.813	770
(DICKEY NORTH)	13,18	28L	I-10	2.032	1400
	13,18,19	28C	I-10 Dickey/2n5w 32	2.828	1750
T1N-R5W-S30	22B,59A	60	Buckeye Align.	1.083	930
	22B,59A,59B	59R	Broadway Align.	2.874	1770
T2N-R5W-S32	19	28R	I-10	0.797	760
	13,18,19	28C	I-10 Dickey/2n5w 32	2.828	1750
T1S-R5W-S08	60	61	Southern Pac R/R	0.472	530
T1S-R5W-S09	67,66,65	35R	Baseline	1.637	1220
	67,66,65,64B	35C	Baseline	3.289	1930
	67,66,65,64	36	Salome Highway	3.784	2120
	67,66,65,64,62C,62A,63	56	Baseline	5.088	2580
	67,66,65,64,63,62	37	Southern Pac R/R	6.742	3110
	67,66,65,64,63,62,61A	62L	Southern Pac R/R	6.905	3160
	67,66,65,64,63,62,61	62	Southern Pac R/R	7.214	3250
T1N-R5W-S33W	63	57	Baseline	0.679	680
	63,62A	56L	Dobbins Rd.	0.805	760
T1N-R5W-S33N	64B	35L	Baseline	1.651	1220
T1N-R5W-S28W	67	34L	Southern Rd.	0.617	640
	67,66	34	Southern Rd.	1.346	1070
T1S-R5W-S09W	61A	62R	I-10	1.170	970
T1N-R5W-S33E	62C	56R	Dobbins Rd.	0.499	550
T1N-R5W-S28E	66	34R	Southern Rd.	0.729	710
	66,67	34C	Southern Rd.	1.346	1070
T1S-R5W-S16	70	38	Elliot Align.	0.582	610
T1S-R5W-S22N	106	39		0.559	600
T1S-RW-S22S	107	40		0.681	680
	107,108	41		0.939	840
T1N-R5W-S22	71	33	Lower Buckeye	0.670	670
T1N-R5W-S15	105	32	Buckeye Rd.	0.834	780
T1N-R5W-S10	23,72	31	I-10	0.723	710
T1N-R5W-S04	24	15L	I-10	0.573	610

Table D.2
Flow Calculations

(listed from south to north, west to east)

Wash	Basin ID No.	Conc. Point	Location	Area [sqmls]	100 yr Flow [cfs]
T2N-R5W-S33E	6E	8R	Peoria	0.339	430
	6E,6A	8C	Peoria	0.841	780
	6E,6A,6G	9L	Northern Ave.	1.014	890
	6E,6A,6G,6B	9C	Northern Ave.	1.490	1140
	6E,6A,6G,6B,6D	10R	Northern Ave.	1.642	1220
	6E,6A,6G,6B,6D,6C	10C	Northern Ave.	1.937	1360
	6	11	Glendale Ave	2.704	1700
	6,14A	70R	Camelback Rd.	4.301	2310
	6,14A,14B	70C	Camelback Rd.	4.765	2470
	6,14	13L	Indian School Rd	5.013	2550
	6,14,21A,21B	13C	Indian School Rd	5.487	2710
	6,14,21	14R	Thomas Rd.	5.897	2840
	6,14,21,20	14C	Thomas Rd.	6.409	3010
	6,14,21,20,25	15R	I-10	6.649	3080
	6,14,21,20,25,24	15C	I-10	7.222	3250
T2N-R5W-S33W	20	14L	Thomas Rd.	0.513	560
T2N-R5W-S21	14B	70L	Camelback Rd.	0.463	530
T2N-R5W-S05E	6C	10L	Northern Ave.	0.295	390
T3N-R5W-S32E	6A	8L	Dunlap	0.503	560
T2N-R5W-S28	21B	12	Camelback Rd.	0.365	450
	21B,21A	13R	Indian School Rd	0.474	540
T2N-R5W-S05W	6B	9R	Northern Ave.	0.476	540
T2N-R5W-S27S	104	72(30L)	Indian School Rd	1.012	890
T2N-R5W-S27N	102	29	Camelback Rd.	0.627	640
	102,103	30(30R)	Indian School Rd	1.457	1130
		30C	Hassayampa Confl.	2.469	1600
T2N-R5W-S04	101	16	Northern Ave.	0.989	870
T3N-R5W-S28S	100	7	Peoria Ave.	0.436	510
T3N-R5W-S28N	Upstream of CAP estimate		CAP Overshute		4460
	3A	3R	Cactus	0.410	4950
	3A,3B	3C	Cactus	0.943	5300
	3(3A,3B,3C)	4	Peoria Ave.	1.284	5500
T3N-R5W-S20	3B	3L	Cactus	0.533	580
T3N-R5W-S21S	300	2	Cactus	0.205	310
T3N-R5W-S21N	301	1	Thunderbird Rd.	0.358	450
Railroad Crossing	Phillips,59,51,50,10,12,48,47,16,46,45	48,49	Railroad	39.482	10030
at T1S-R5W-S32 and					
T1S-R5W-S17					

FinalFlowSummary_9_26.wb3



USGS raster images which are based on NGVD 29 are shown for cartographic information only. Topographic and floodplain delineation are based on NAVD 88.

USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING – EAGLE SCAN NOVEMBER 1999

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A DELINEATION OF WATERSHED "PP" LUKE WASH

F.C.D. CONTRACT NO. 99-03

LEGEND

100-YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
SECTION CORNER	29 28 / 32 33
WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

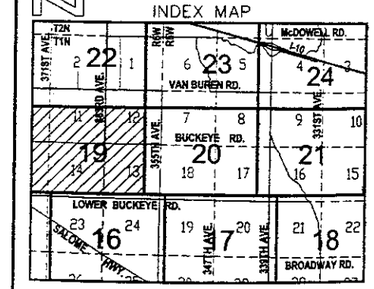
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
111	981.39	Brass Cap in Hanhole in Center of Salome Hwy. Approximately 2.35 miles southeasterly of Wintersburg Rd (See sheet 16.)

NOTES

NGVD 29 + 1.97 FEET = NAVD 88

INDEX MAP



400' 0' 400' 800'

SCALE: 1" = 400'

CONTOUR INTERVAL = 10 – 20 FEET

SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

Entellus
2355 N. 44th Street Suite 135
Phoenix, AZ 85008-3279
Tel 602.344.9500
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	BY	DATE
DESIGN	HAA/JCS	03/2001
DESIGN CHK.	SEK	03/2001
PLANS	GLT/RCS	03/2001
PLANS CHK.	HAA	03/2001

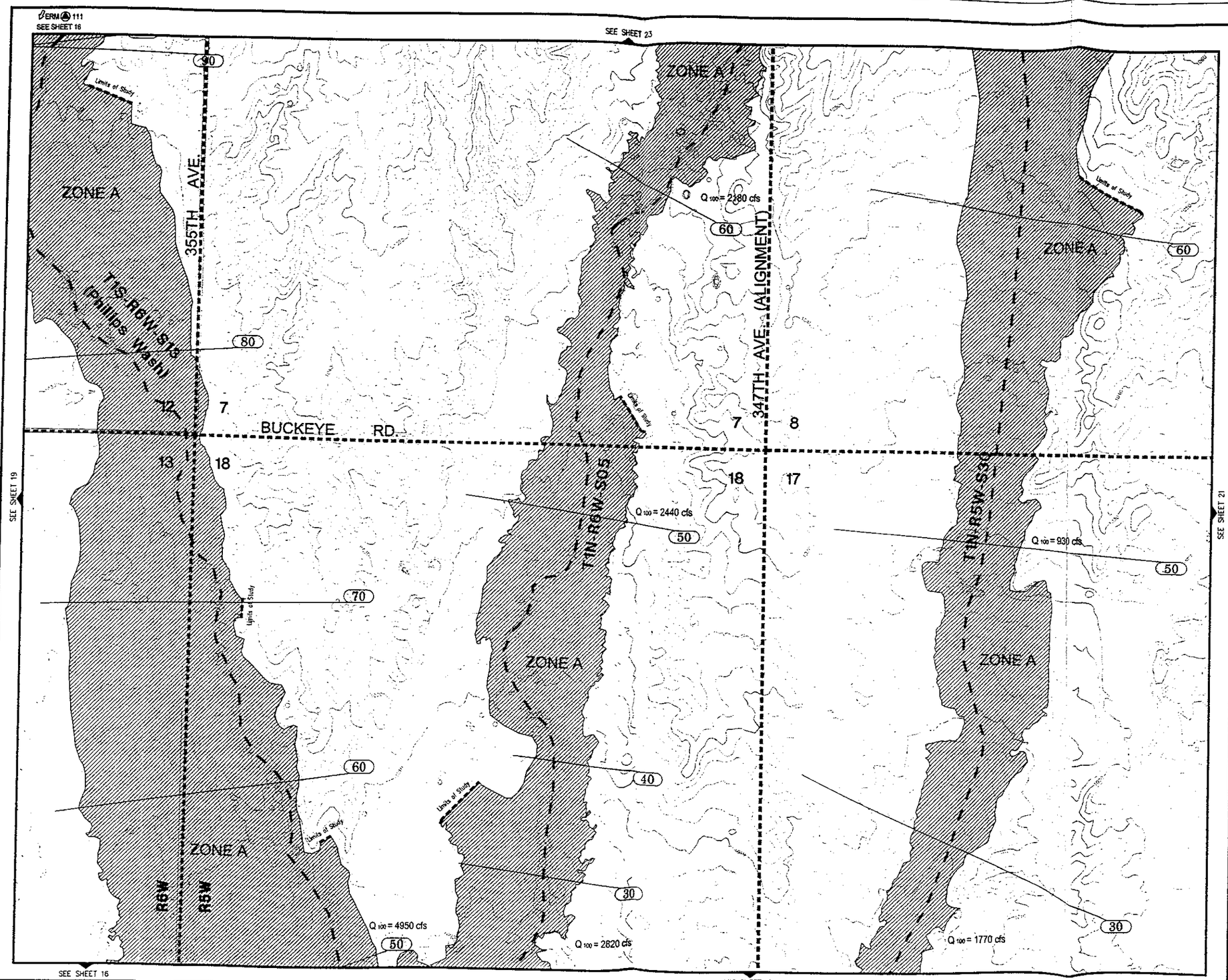
SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A
DELINEATION OF WATERSHED "PP"
LUKE WASH

F.C.D. CONTRACT NO. 99-03

LEGEND

100-YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
SECTION CORNER	29 28 / 32 33
WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

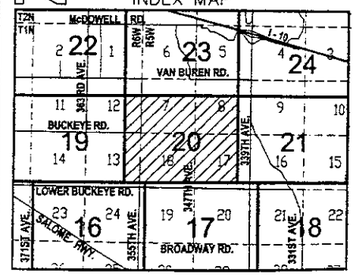
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
111	981.39	Brass Cap in Handhole in Center of Salome Hwy. Approximately 2.35 miles Southeasterly of Wintersburg Rd. (See sheet 16)

NOTES

NGVD 29 + 1.97 FEET = NAVD 88

INDEX MAP



400' 0' 400' 800'

SCALE: 1" = 400'
CONTOUR INTERVAL = 10 – 20 FEET
SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

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Phoenix, AZ 85008-2279
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E-mail www.entellus.com

	BY	DATE
DESIGN	HAA/JCS	03/2001
DESIGN CHK.	SEK	03/2001
PLANS	GLT/RCS	03/2001
PLANS CHK.	HAA	03/2001
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

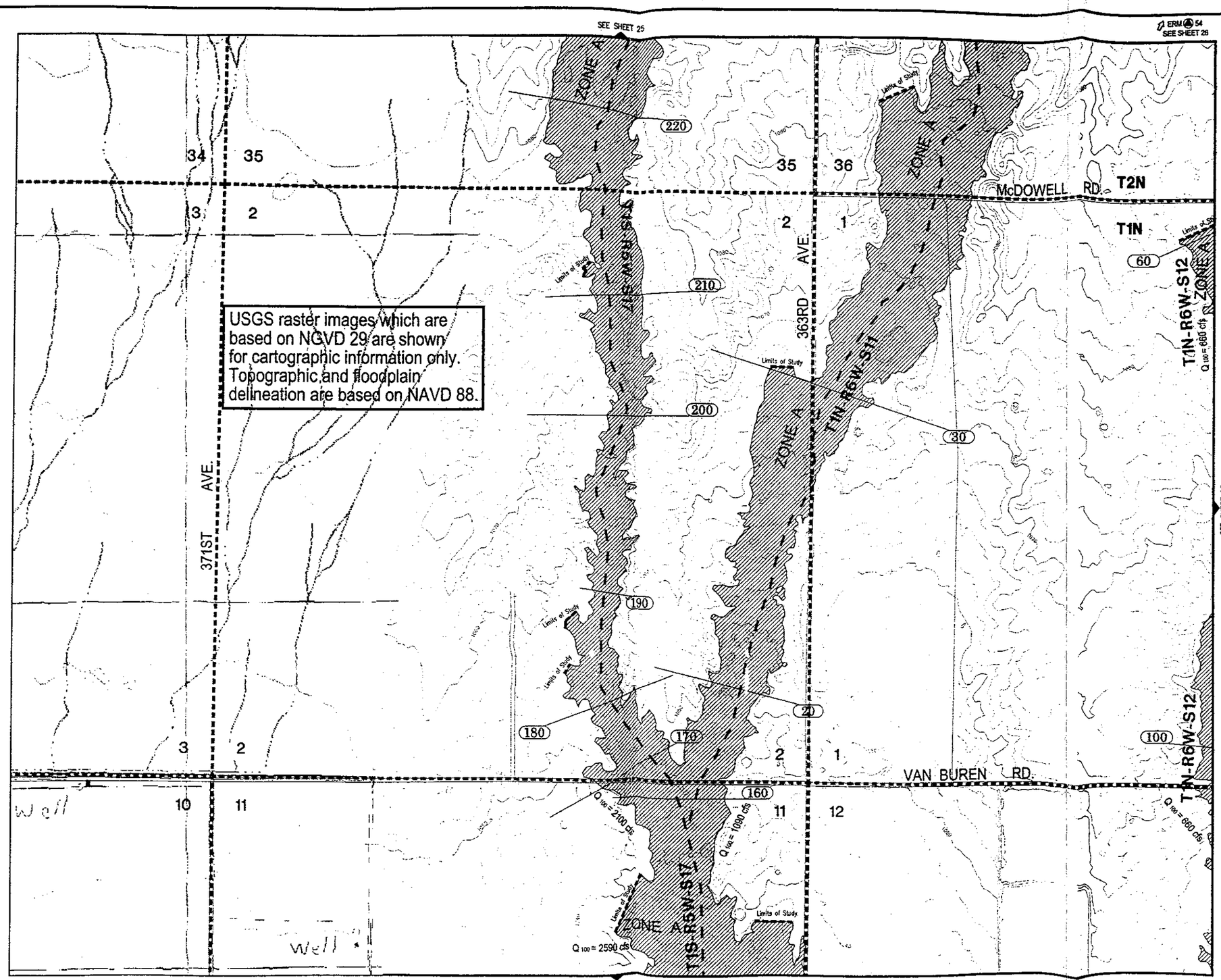
APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 20 OF 38

FILE: 310\310010\Dwg\000_Plan_20.Dwg DATE: 03/13/2001

USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING - EAGLE SCAN NOVEMBER 1999



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A DELINEATION OF WATERSHED "PP" LUKE WASH

F.C.D. CONTRACT NO. 99-03

LEGEND

100-YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
SECTION CORNER	29 28 / 32 33
WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

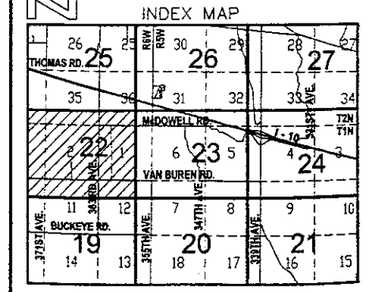
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
54	1094.57	Fd Brass Cap in top of concrete headwall on southside of Intrstate 10, 250' west of 355th Ave. alignment. Stamped "5345+62.25 ELEV 1092.81 Wash-4" (See sheet 26.)

NOTES

NGVD 29 + 1.97 FEET = NAVD 88

INDEX MAP



400' 0' 400' 800'

SCALE: 1"= 400'

CONTOUR INTERVAL = 10 - 20 FEET

SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

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	BY	DATE
DESIGN	HAA/JCS	03/2001
DESIGN CHK.	SEK	03/2001
PLANS	GLT/RCS	03/2001
PLANS CHK.	HAA	03/2001

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

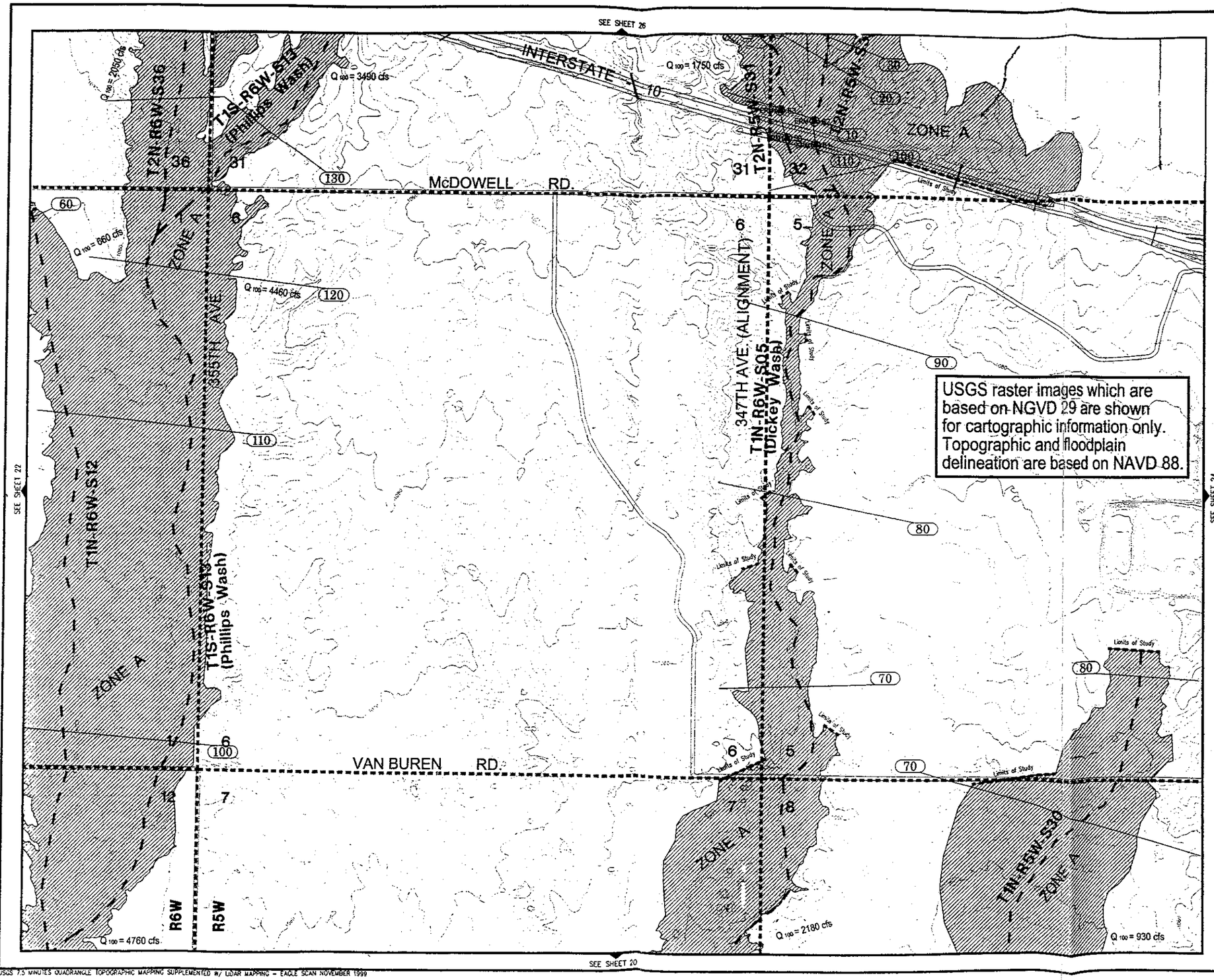
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 22 OF 38

FILE: 310\310010s\Dwg\000_Plan_22.dwg DATE: 03/13/2001

USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING - EAGLE SCAN NOVEMBER 1999

ERM 54



USGS raster images which are based on NGVD 29 are shown for cartographic information only. Topographic and floodplain delineation are based on NAVD 88.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ZONE A DELINEATION OF WATERSHED "PP" LUKE WASH

F.C.D. CONTRACT NO. 99-03

LEGEND

100-YR APPROXIMATED ZONE A FLOODPLAIN BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	30
ELEVATION REFERENCE MARK	ERM 6
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
LIMITS OF STUDY	Limits of Study
SECTION LINES	
SECTION CORNER	29 28 / 32 33
WASH I.D. LABEL	T1S-R5W-S22N
EXISTING ZONE A	
EXISTING FLOOD PLAIN	
EXISTING FLOODWAY	
FLOW AT DOWNSTREAM CONC. POINT	Q_{100} = 850 cfs

ELEVATION REFERENCE MARKS

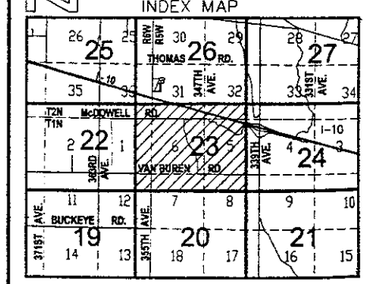
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
59	1077.71	Fd Brass Cap in top of concrete housewall on south side of Interstate 10, 5300 east of 355th Ave. Stamped "ELEV 1076.02 Wash-2"
61	1076.83	Fd Brass Cap in top of concrete housewall on north side of Interstate 10, 5800 east of 355th Ave. Stamped "ELEV 1075.17 Wash-1"
62	1078.86	Fd Brass Cap in top of concrete housewall on south side of Interstate 10, 5300 east of 355th Ave. alignment
63	1078.85	Fd Brass Cap in top of concrete housewall on north side of Interstate 10, 5300 east of 355th Ave. alignment

NOTES

NGVD 29 + 1.97 FEET = NAVD 88

INDEX MAP



400' 0' 400' 800'

SCALE: 1" = 400'

CONTOUR INTERVAL = 10 – 20 FEET

SUPPLEMENTAL LIDAR MAPPING CI. = 2 FEET

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	BY	DATE
DESIGN	HAA/JCS	03/2001
DESIGN CHK.	SEK	03/2001
PLANS	GLT/RCS	03/2001
PLANS CHK.	HAA	03/2001
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

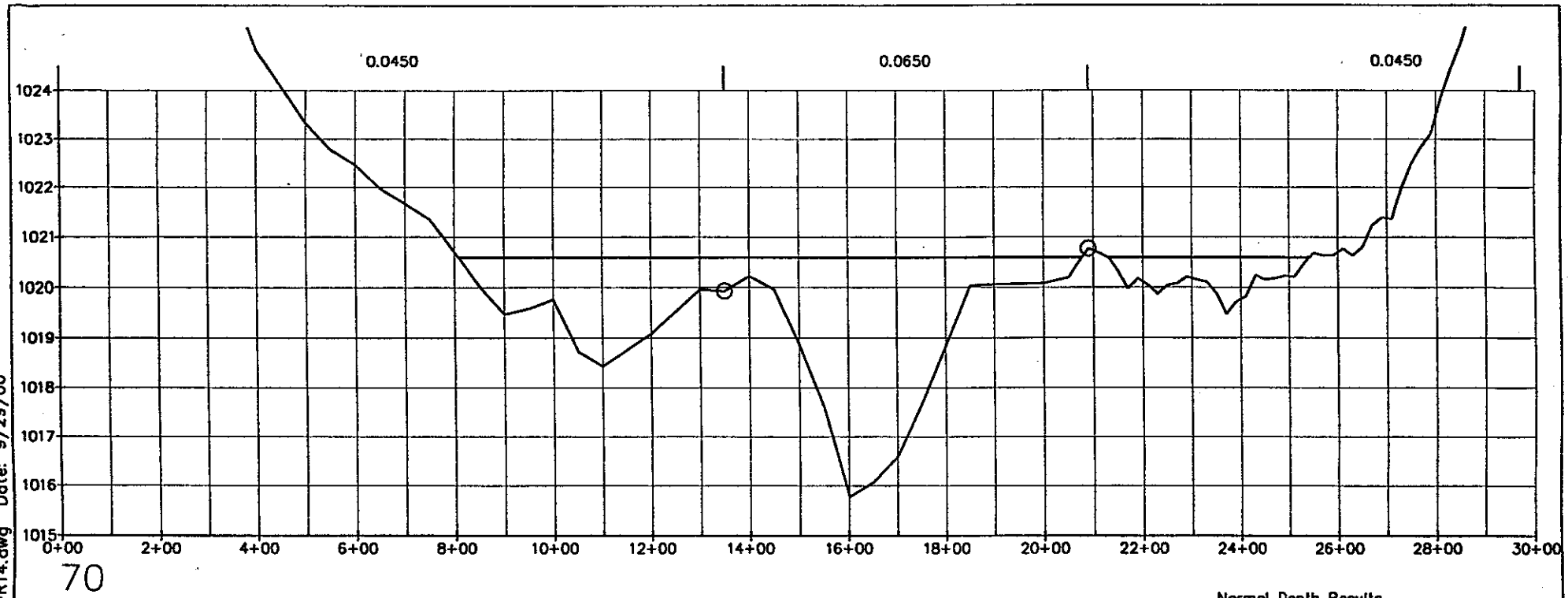
APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 23 OF 38

FILE: 310\310010s\Dwg\000_Plan_23.Dwg DATE: 03/13/2001

USGS 7.5 MINUTES QUADRANGLE TOPOGRAPHIC MAPPING SUPPLEMENTED W/ LIDAR MAPPING – EAGLE SCAN NOVEMBER 1999



Normal Depth Results

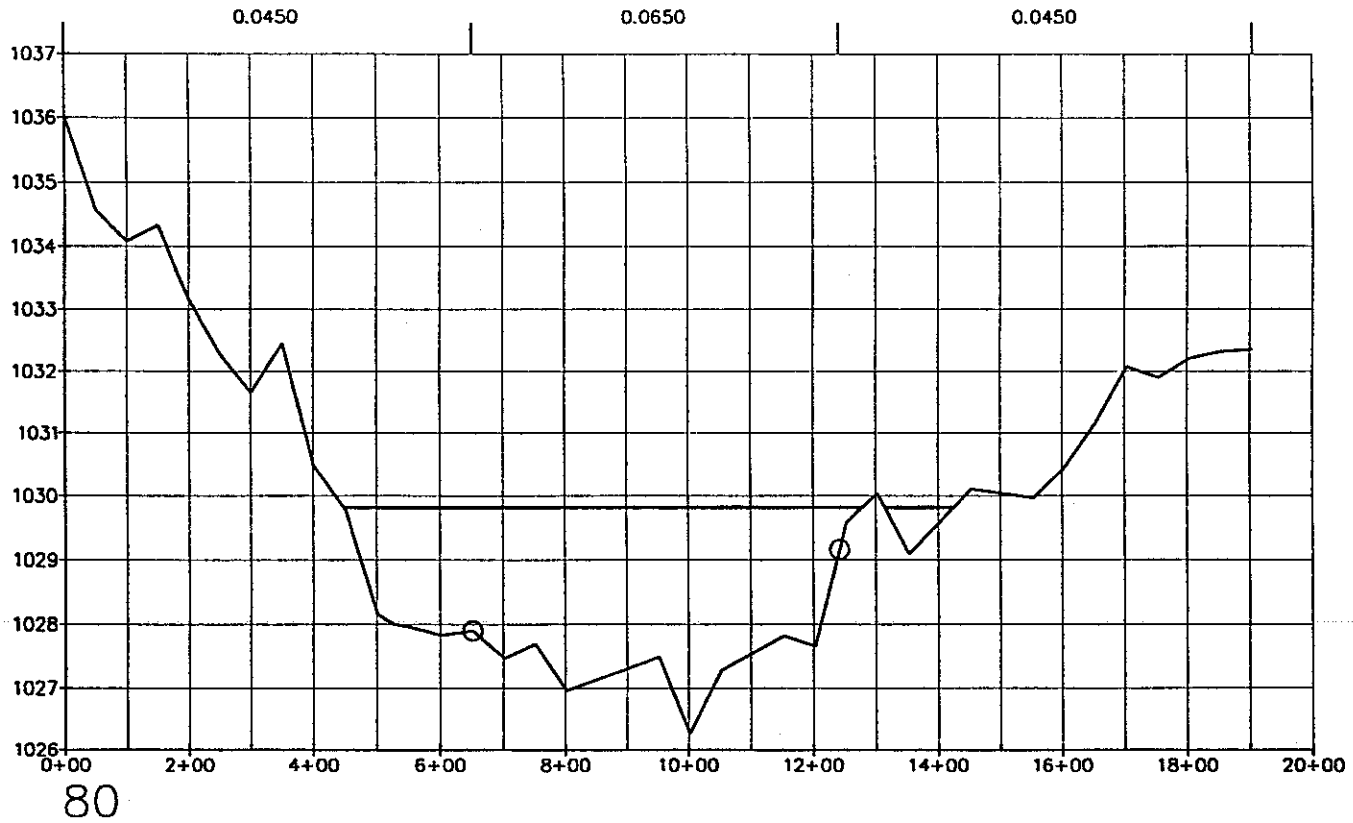
Cross-Section:	70	
Elevation:	1020.59	ft MSL
Depth:	4.82	ft
Discharge:	4950.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.1828	
Flow Regime:	Subcritical	
Flow Area:	2174.96	sq ft
Average Velocity:	2.27	ft/s
Maximum Velocity:	2.49	ft/s
Composite n:	0.0541	
Hydraulic Radius:	1.29	ft
Wetted Perimeter:	1681.54	ft
Wetted Top Width:	1681.38	ft
Critical Slope:	0.145	ft/ft

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 – WASH: T1S–R6W–S13(PHILLIPS–SOUTH)–70

Entellus™

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00



Normal Depth Results

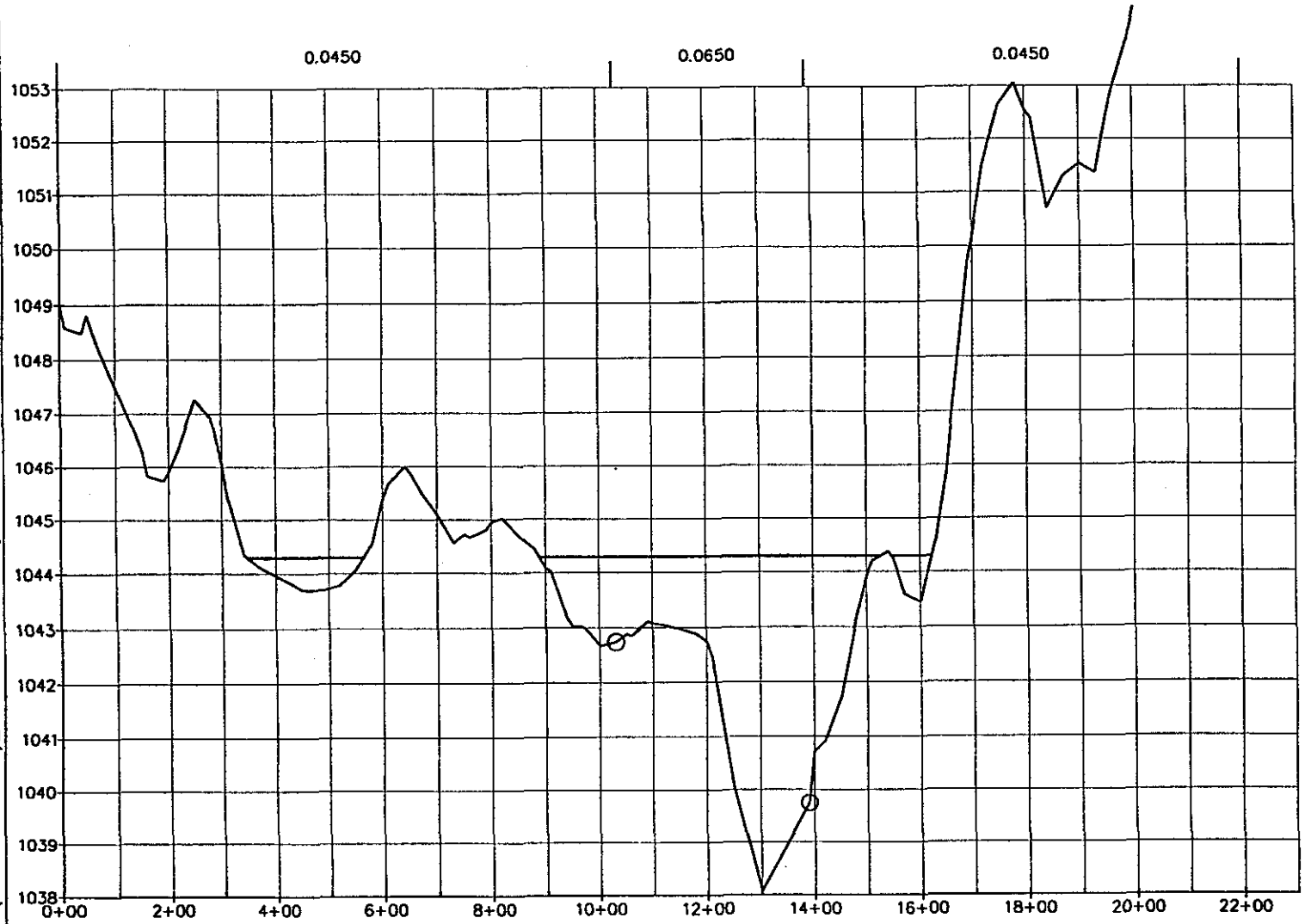
Cross-Section:	80	
Elevation:	1029.81	ft MSL
Depth:	3.54	ft
Discharge:	4950.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.2588	
Flow Regime:	Subcritical	
Flow Area:	1791.12	sq ft
Average Velocity:	2.76	ft/s
Maximum Velocity:	3.04	ft/s
Composite n:	0.0579	
Hydraulic Radius:	1.91	ft
Wetted Perimeter:	939.39	ft
Wetted Top Width:	939.28	ft
Critical Slope:	0.073	ft/ft

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 – WASH: T1S–R6W–S13(PHILLIPS–SOUTH)–80

Entellus™

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00



90

Normal Depth Results

Cross-Section:	90	
Elevation:	1044.29	ft MSL
Depth:	6.21	ft
Discharge:	4950.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.2101	
Flow Regime:	Subcritical	
Flow Area:	1665.83	sq ft
Average Velocity:	2.96	ft/s
Maximum Velocity:	3.26	ft/s
Composite n:	0.0531	
Hydraulic Radius:	1.78	ft
Wetted Perimeter:	933.66	ft
Wetted Top Width:	933.37	ft
Critical Slope:	0.1176	ft/ft

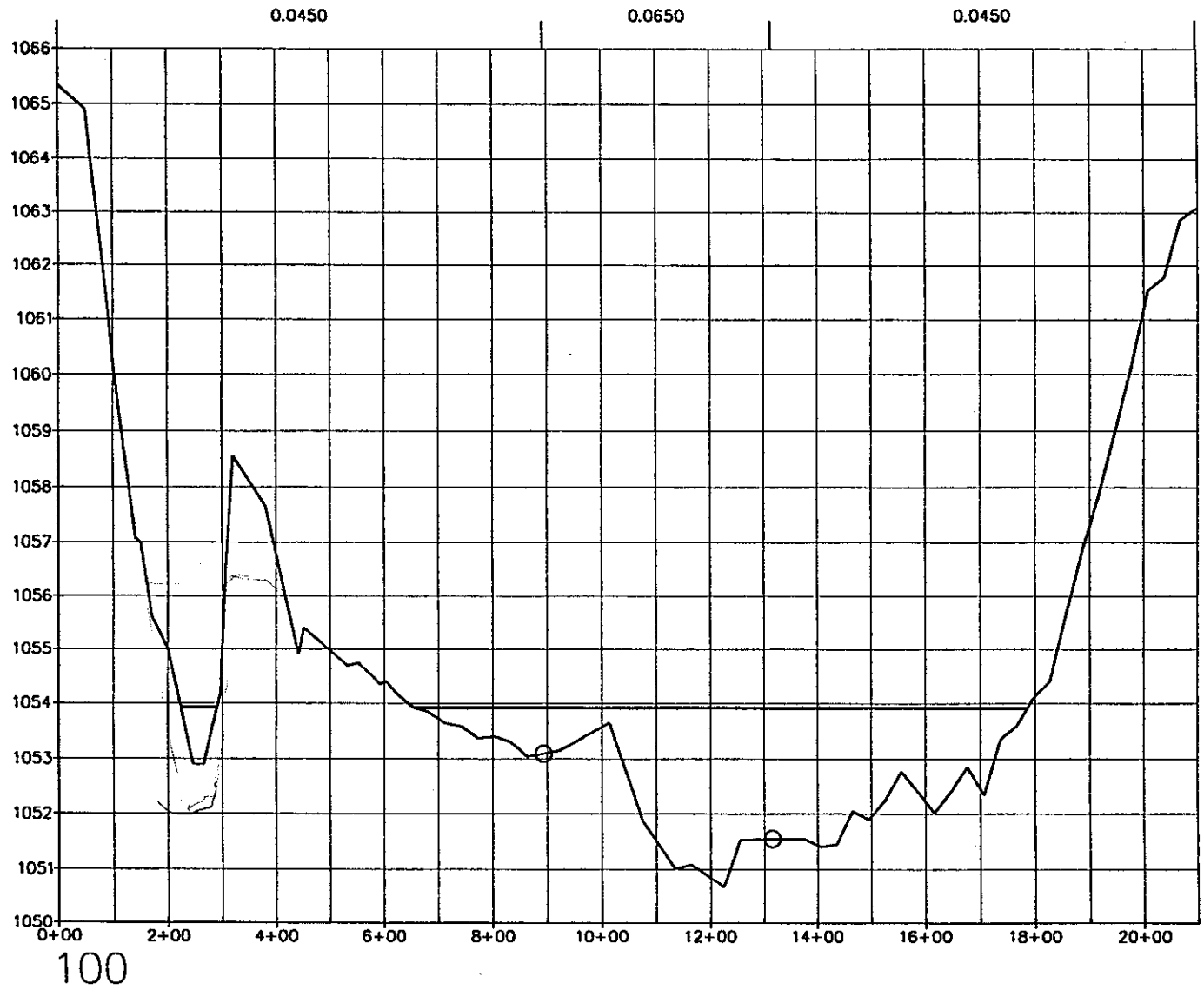
File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00

ZONE A - DELINEATION OF WATERSHED "PP"

LUKE WASH FCD 99-03

FIGURE E2 – WASH: T1S-R6W-S13(PHILLIPS-SOUTH)-90

Entellus™



Normal Depth Results

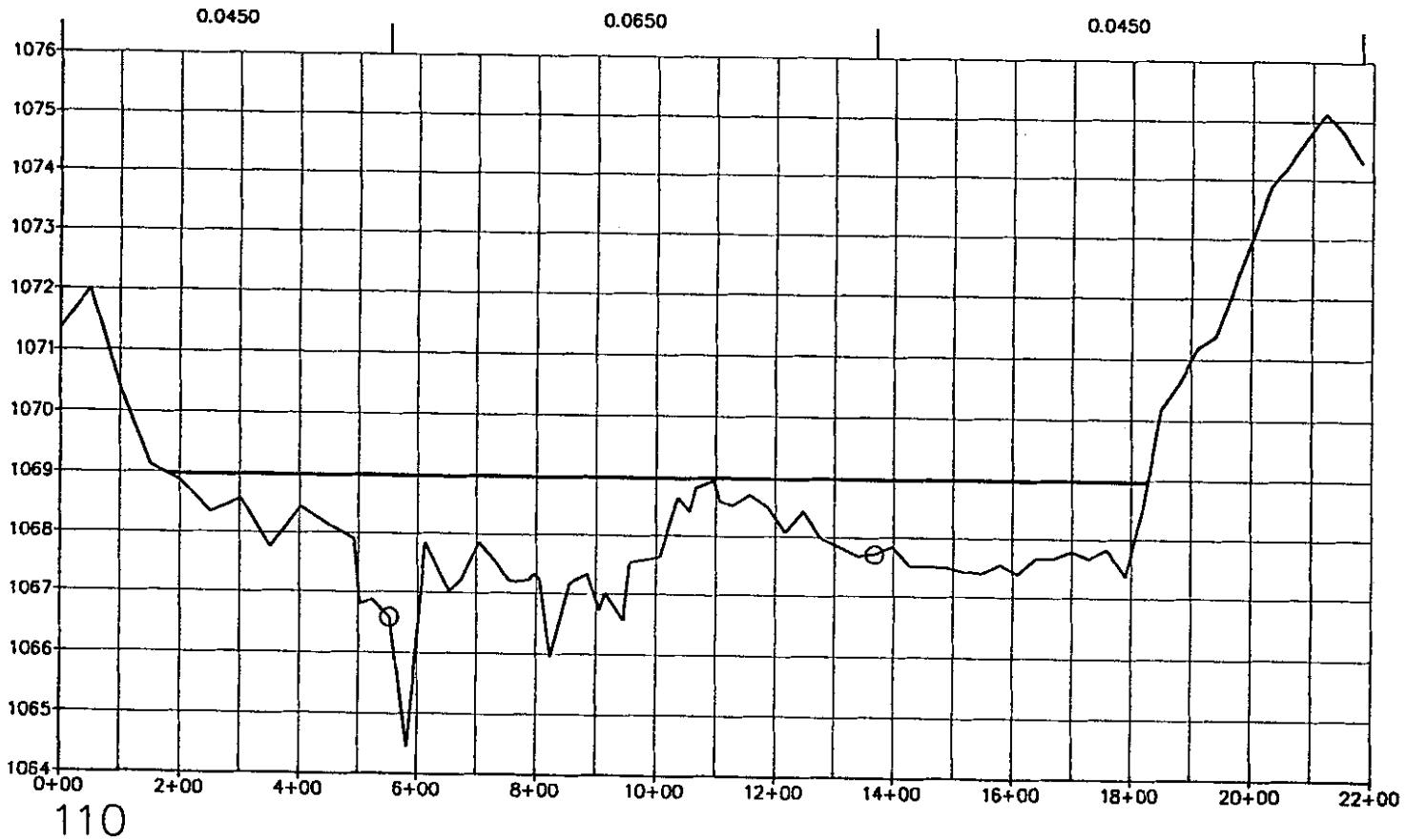
Cross-Section:	100	
Elevation:	1053.92	ft MSL
Depth:	3.24	ft
Discharge:	4760.00	cfs
Energy Gradient:	0.005	ft/ft
Froude Number:	0.2703	
Flow Regime:	Subcritical	
Flow Area:	1724.18	sq ft
Average Velocity:	2.75	ft/s
Maximum Velocity:	3.29	ft/s
Composite n:	0.0524	
Hydraulic Radius:	1.44	ft
Wetted Perimeter:	1196.51	ft
Wetted Top Width:	1196.37	ft
Critical Slope:	0.0794	ft/ft

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 – WASH: T1S–R6W–S13(PHILLIPS–SOUTH)–100

Entellus™

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00



Normal Depth Results

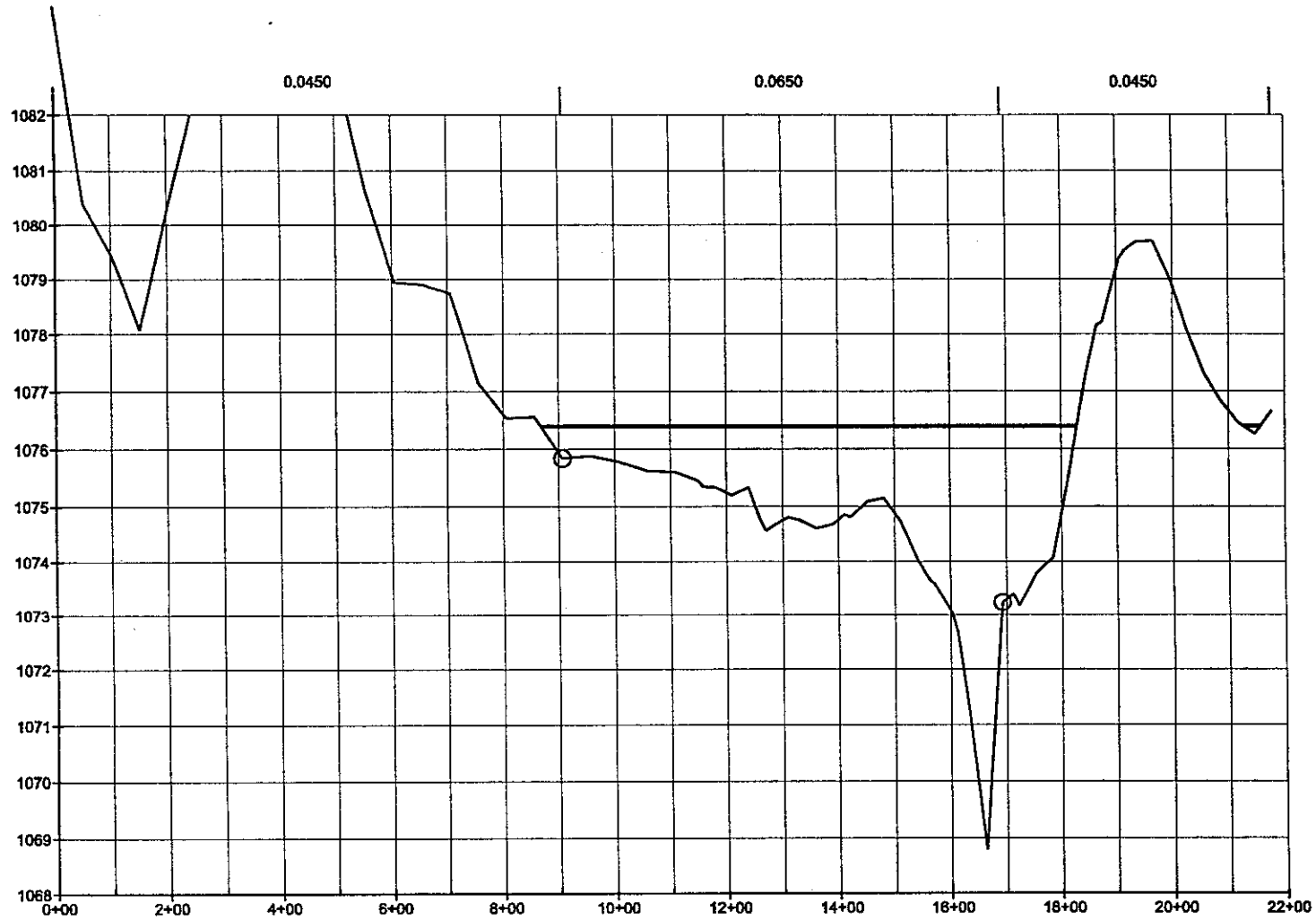
Cross-Section:	110	
Elevation:	1068.97	ft MSL
Depth:	4.53	ft
Discharge:	4760.00	cfs
Energy Gradient:	0.005	ft/ft
Froude Number:	0.1903	
Flow Regime:	Subcritical	
Flow Area:	2071.14	sq ft
Average Velocity:	2.28	ft/s
Maximum Velocity:	2.84	ft/s
Composite n:	0.0553	
Hydraulic Radius:	1.26	ft
Wetted Perimeter:	1648.45	ft
Wetted Top Width:	1647.87	ft
Critical Slope:	0.1484	ft/ft

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 – WASH: T1S–R6W–S13(PHILLIPS–SOUTH)–110

Entellus™

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00



120

Normal Depth Results

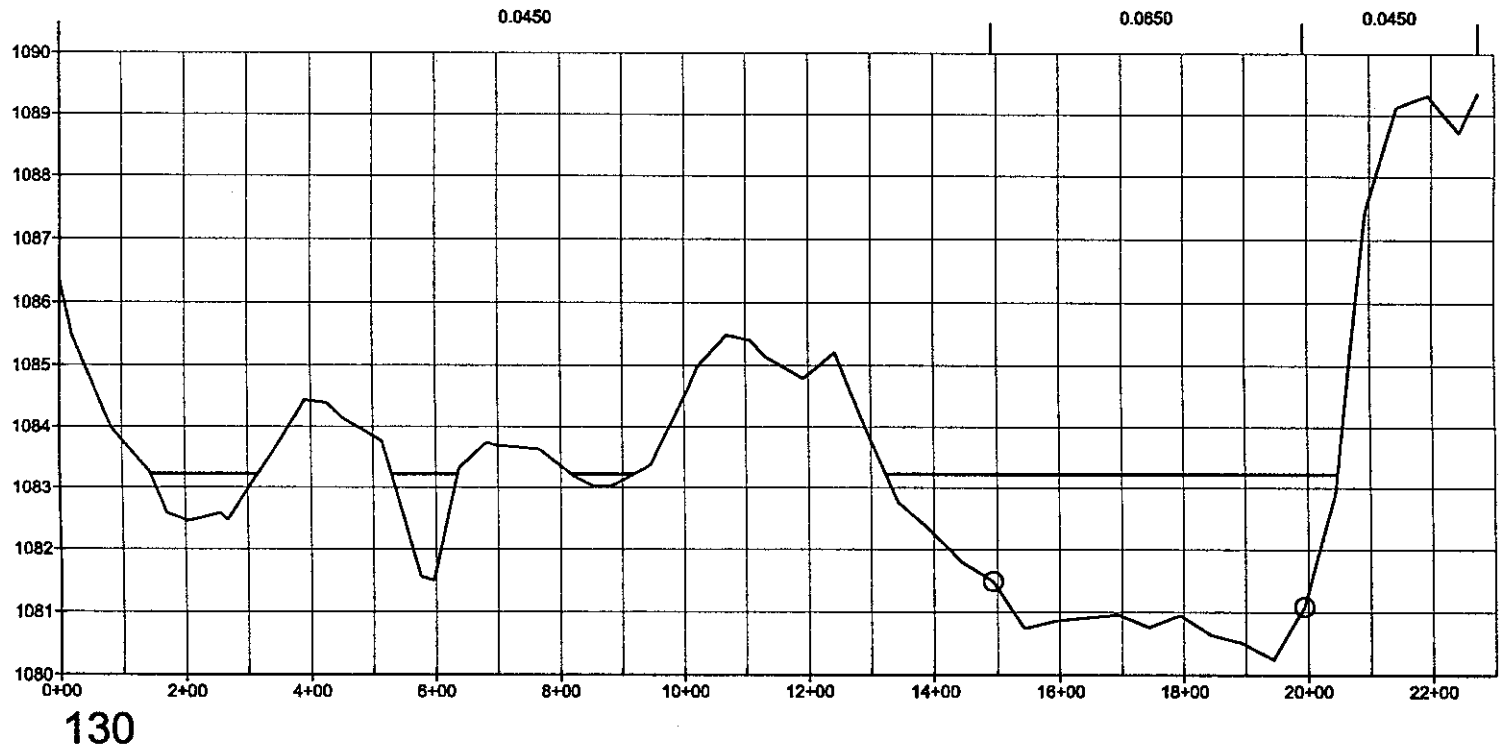
Cross-Section:	120	
Elevation:	1076.39	ft MSL
Depth:	7.59	ft
Discharge:	4460.00	cfs
Energy Gradient:	0.005	ft/ft
Froude Number:	0.1654	
Flow Regime:	Subcritical	
Flow Area:	1724.94	sq ft
Average Velocity:	2.59	ft/s
Maximum Velocity:	3.56	ft/s
Composite n:	0.0611	
Hydraulic Radius:	1.74	ft
Wetted Perimeter:	990.93	ft
Wetted Top Width:	990.34	ft
Critical Slope:	0.1965	ft/ft

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 - WASH: T1S-R6W-S13(PHILLIPS-SOUTH)-120

Entellus™



Normal Depth Results

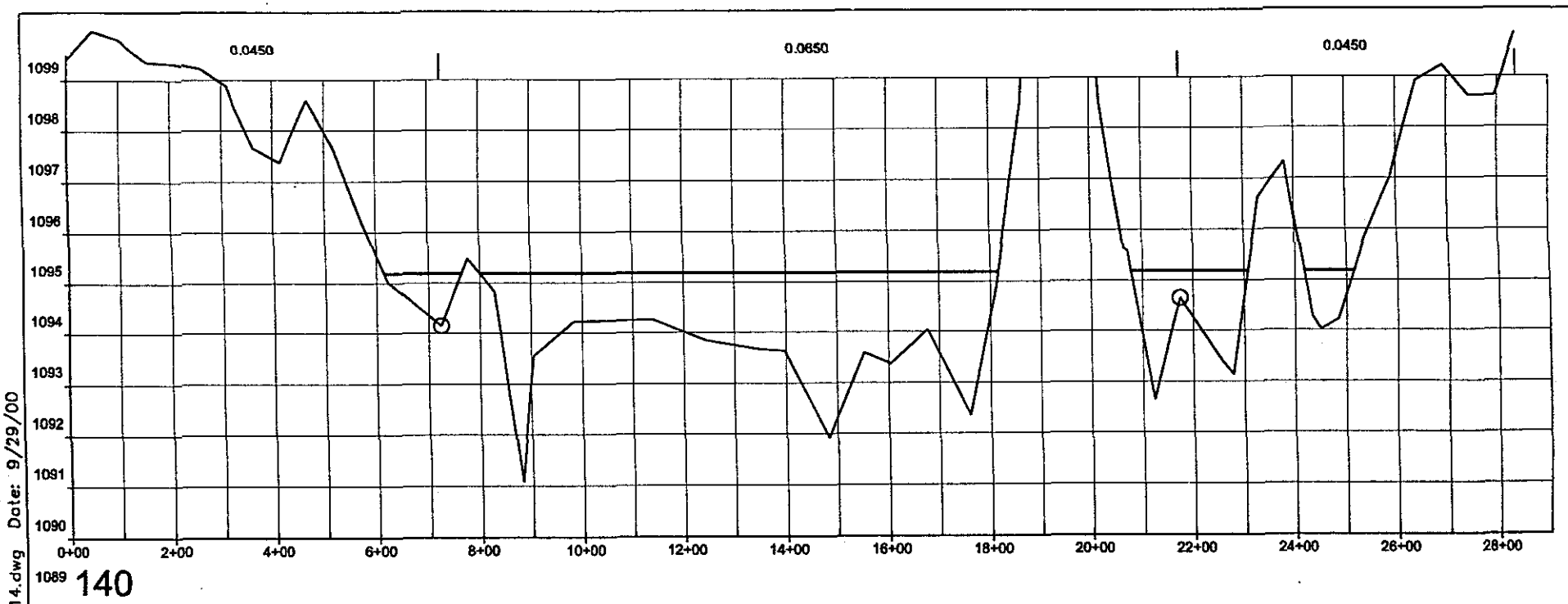
Cross-Section:	130	
Elevation:	1083.22	ft MSL
Depth:	2.97	ft
Discharge:	4460.00	cfs
Energy Gradient:	0.005	ft/ft
Froude Number:	0.2734	
Flow Regime:	Subcritical	
Flow Area:	1668.40	sq ft
Average Velocity:	2.67	ft/s
Maximum Velocity:	2.93	ft/s
Composite n:	0.0545	
Hydraulic Radius:	1.52	ft
Wetted Perimeter:	1099.82	ft
Wetted Top Width:	1099.66	ft
Critical Slope:	0.0734	ft/ft

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 - WASH: T1S-R6W-S13(PHILLIPS-SOUTH)-130

Entellus™



Normal Depth Results

Cross-Section:	140	
Elevation:	1093.19	ft MSL
Depth:	4.11	ft
Discharge:	4480.00	cfs
Energy Gradient:	0.005	ft/ft
Froude Number:	0.1878	
Flow Regime:	Subcritical	
Flow Area:	2065.93	sq ft
Average Velocity:	2.16	ft/s
Maximum Velocity:	2.43	ft/s
Composite n:	0.0607	
Hydraulic Radius:	1.38	ft
Wetted Perimeter:	1494.80	ft
Wetted Top Width:	1494.14	ft
Critical Slope:	0.1425	ft/ft

ZONE A - DELINEATION OF WATERSHED "PP"
LUKE WASH FCD 99-03

FIGURE E2 - WASH: T1S-R6W-S13(PHILLIPS-SOUTH)-140

Entellus™

File: WASH-T1S-R6W-S13(PHILLIPS-SOUTH)_X-SECTION-R14.dwg Date: 9/29/00

APPENDIX B

Pt. No.	Northing	Easting	Elevation	Description
104	891087.3	424701.9	1040.962	BB
105	891087.3	424696.1	1041.727	TB
106	891086.3	424680.7	1042.995	TB
107	891085.4	424636.6	1042.547	TB
108	891086	424629	1040.966	FL
109	891085.2	424620.6	1042.62	TB
110	891084.2	424610	1041.953	TB
111	891086.3	424595.5	1037.679	BB
112	891086.2	424588.4	1037.436	BB
113	891085.1	424575.4	1042.813	TB
114	891089.3	424845.1	1042.752	TB
115	891087.8	424856.1	1039.346	BB
116	891087.7	424883.5	1040.541	BB
117	891088.2	424895.2	1044.932	TB
118	890695.5	424450.6	1041.025	TB
119	890697.6	424439.4	1035.667	BB
120	890701.2	424417.4	1036.217	BB
121	890704.9	424396.1	1039.7	TB
122	891467.3	424608.6	1044.632	TB
123	891465.3	424578.2	1044.606	TB
124	891465.9	424573.1	1042.362	BB
125	891466.4	424567.4	1042.289	BB
126	891466.2	424558.5	1043.931	TB
127	891467.7	424621.3	1040.373	BB
128	891467	424628	1040.324	BB
129	891469.6	424645.4	1044.192	TB
130	891758	424590.6	1045.392	TB
131	891757.9	424581	1042.145	BB
132	891757.6	424575.6	1041.947	C1
133	891757.7	424570.7	1045.489	TB
134	892111.4	424581.7	1046.529	TB
135	892111.6	424587	1043.538	BB
136	892111.4	424595.2	1043.805	BB
137	892111.7	424604.2	1048.143	TB

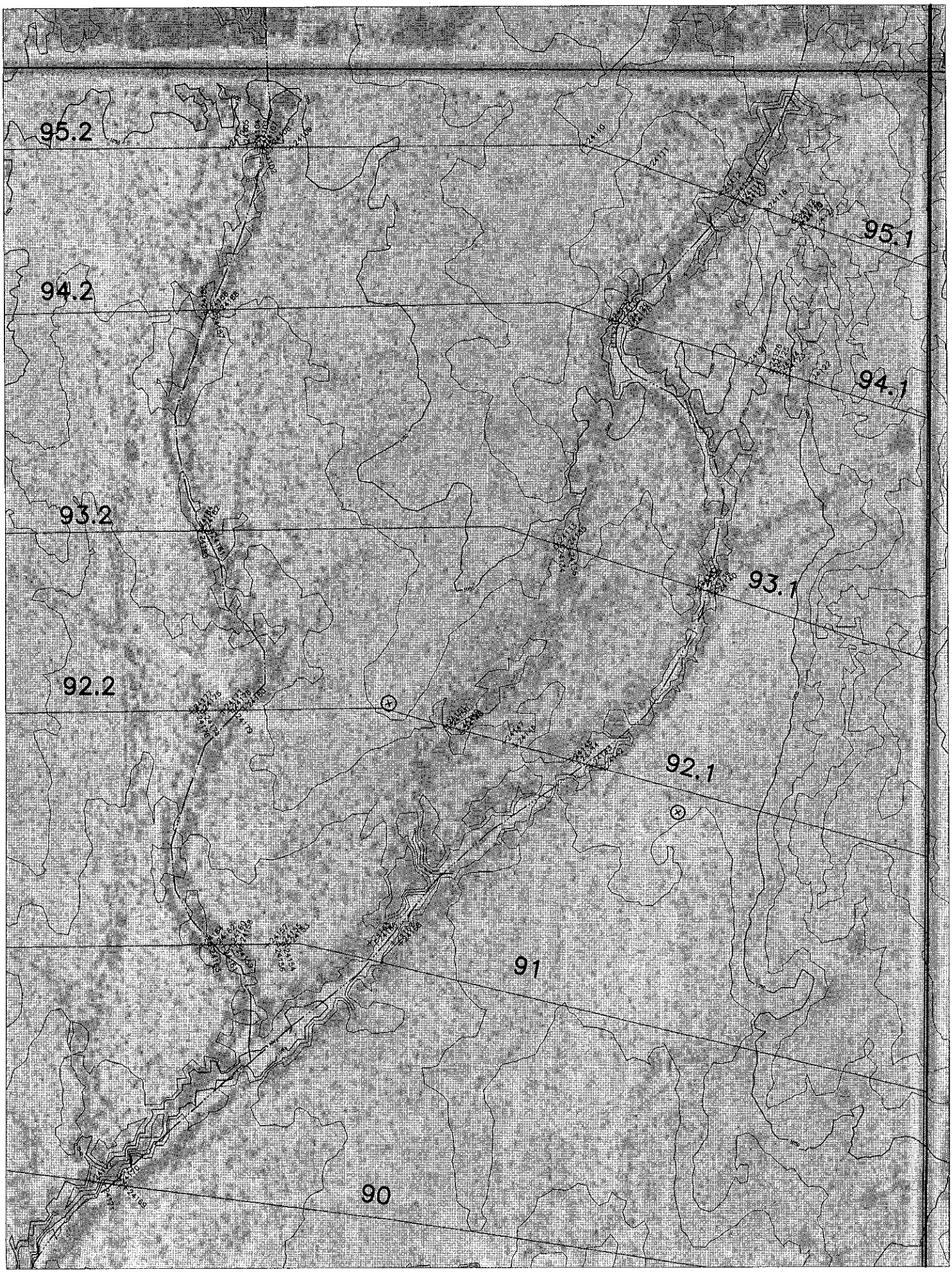
TB – Top of Bank
BB – Bottom of Bank
GS – Ground Shot

Pt. No.	Northing	Easting	Elevation	Description
104	891087.3	424701.9	1040.962	BB
105	891087.3	424696.1	1041.727	TB
106	891086.3	424680.7	1042.995	TB
107	891085.4	424636.6	1042.547	TB
108	891086	424629	1040.966	FL
109	891085.2	424620.6	1042.62	TB
110	891084.2	424610	1041.953	TB
111	891086.3	424595.5	1037.679	BB
112	891086.2	424588.4	1037.436	BB
113	891085.1	424575.4	1042.813	TB
114	891089.3	424845.1	1042.752	TB
115	891087.8	424856.1	1039.346	BB
116	891087.7	424883.5	1040.541	BB
117	891088.2	424895.2	1044.932	TB
118	890695.5	424450.6	1041.025	TB
119	890697.6	424439.4	1035.667	BB
120	890701.2	424417.4	1036.217	BB
121	890704.9	424396.1	1039.7	TB
122	891467.3	424608.6	1044.632	TB
123	891465.3	424578.2	1044.606	TB
124	891465.9	424573.1	1042.362	BB
125	891466.4	424567.4	1042.289	BB
126	891466.2	424558.5	1043.931	TB
127	891467.7	424621.3	1040.373	BB
128	891467	424628	1040.324	BB
129	891469.6	424645.4	1044.192	TB
130	891758	424590.6	1045.392	TB
131	891757.9	424581	1042.145	BB
132	891757.6	424575.6	1041.947	C1
133	891757.7	424570.7	1045.489	TB
134	892111.4	424581.7	1046.529	TB
135	892111.6	424587	1043.538	BB
136	892111.4	424595.2	1043.805	BB
137	892111.7	424604.2	1048.143	TB

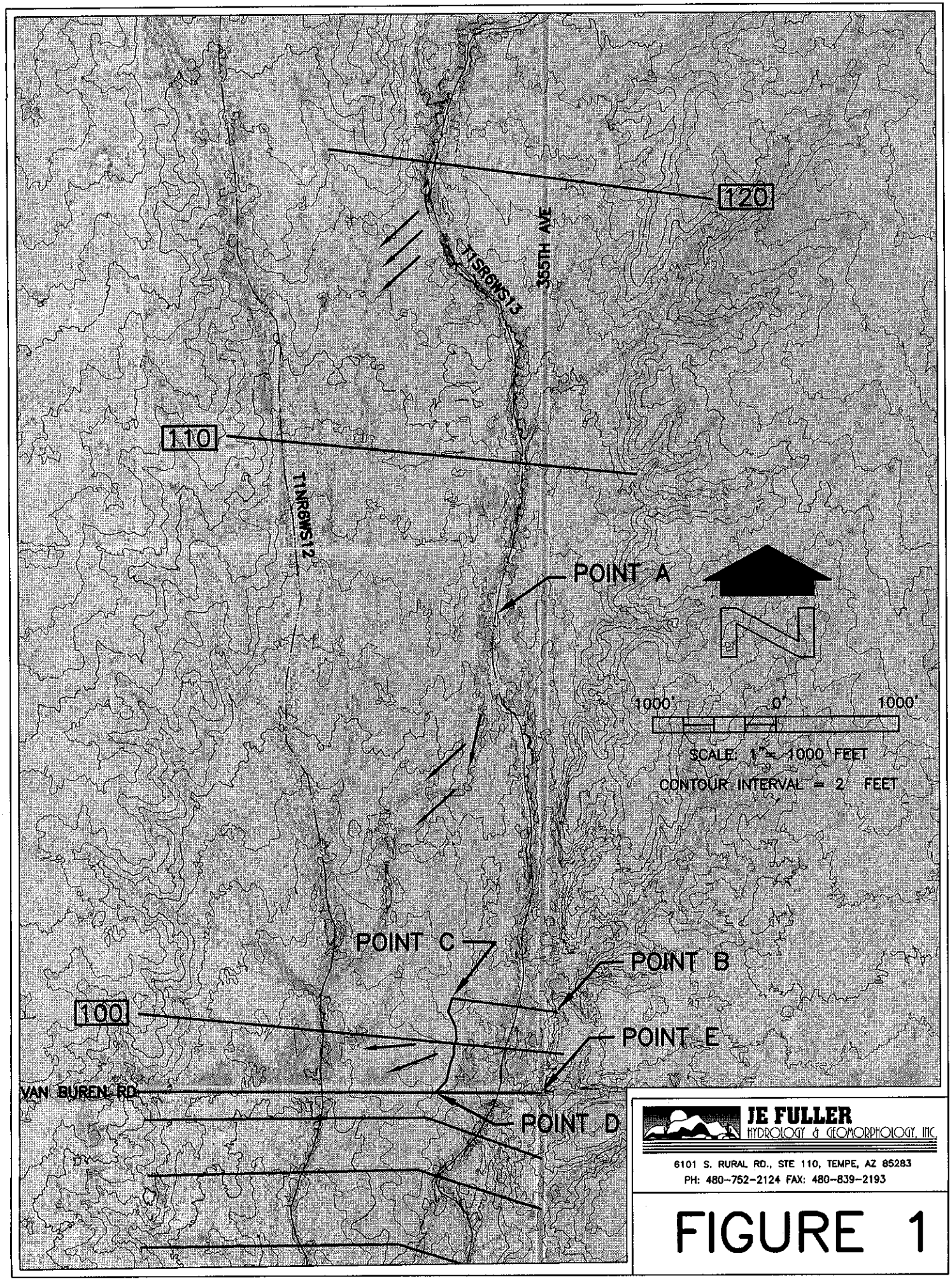
TB – Top of Bank
BB – Bottom of Bank
GS – Ground Shot

Pt. No.	Northing	Easting	Elevation	Description
104	891087.3	424701.9	1040.962	BB
105	891087.3	424696.1	1041.727	TB
106	891086.3	424680.7	1042.995	TB
107	891085.4	424636.6	1042.547	TB
108	891086	424629	1040.966	FL
109	891085.2	424620.6	1042.62	TB
110	891084.2	424610	1041.953	TB
111	891086.3	424595.5	1037.679	BB
112	891086.2	424588.4	1037.436	BB
113	891085.1	424575.4	1042.813	TB
114	891089.3	424845.1	1042.752	TB
115	891087.8	424856.1	1039.346	BB
116	891087.7	424883.5	1040.541	BB
117	891088.2	424895.2	1044.932	TB
118	890695.5	424450.6	1041.025	TB
119	890697.6	424439.4	1035.667	BB
120	890701.2	424417.4	1036.217	BB
121	890704.9	424396.1	1039.7	TB
122	891467.3	424608.6	1044.632	TB
123	891465.3	424578.2	1044.606	TB
124	891465.9	424573.1	1042.362	BB
125	891466.4	424567.4	1042.289	BB
126	891466.2	424558.5	1043.931	TB
127	891467.7	424621.3	1040.373	BB
128	891467	424628	1040.324	BB
129	891469.6	424645.4	1044.192	TB
130	891758	424590.6	1045.392	TB
131	891757.9	424581	1042.145	BB
132	891757.6	424575.6	1041.947	C1
133	891757.7	424570.7	1045.489	TB
134	892111.4	424581.7	1046.529	TB
135	892111.6	424587	1043.538	BB
136	892111.4	424595.2	1043.805	BB
137	892111.7	424604.2	1048.143	TB

TB – Top of Bank
BB – Bottom of Bank
GS – Ground Shot


95.2
95.1
94.2
94.1
93.2
93.1
92.2
92.1
91
90

APPENDIX C



JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC
6101 S. RURAL RD., STE 110, TEMPE, AZ 85283
PH: 480-752-2124 FAX: 480-839-2193

FIGURE 1

APPENDIX D

Cross Section B-C (Approximately 250 feet Upstream of Section 100)
Worksheet for Irregular Channel

Project Description	
Worksheet	XSection G (Upstream of 100)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.005000	ft/ft
Water Surface Elevation	1,057.00	ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.040	
Elevation Range	1,053.80 to 1,060.00	
Discharge	1,832.36	cfs
Flow Area	524.6	ft²
Wetted Perimeter	339.37	ft
Top Width	338.00	ft
Actual Depth	3.20	ft
Critical Elevation	1,056.24	ft
Critical Slope	0.022540	ft/ft
Velocity	3.49	ft/s
Velocity Head	0.19	ft
Specific Energy	1,057.19	ft
Froude Number	0.49	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+32	0+75	0.035
0+75	2+01	0.065
2+01	2+27	0.025
2+27	2+83	0.065
2+83	5+41	0.035

Natural Channel Points

Station (ft)	Elevation (ft)
0+32	1,060.00
0+45	1,058.00
0+64	1,056.00
0+75.	1,054.50
1+18	1,054.10
1+49	1,054.00

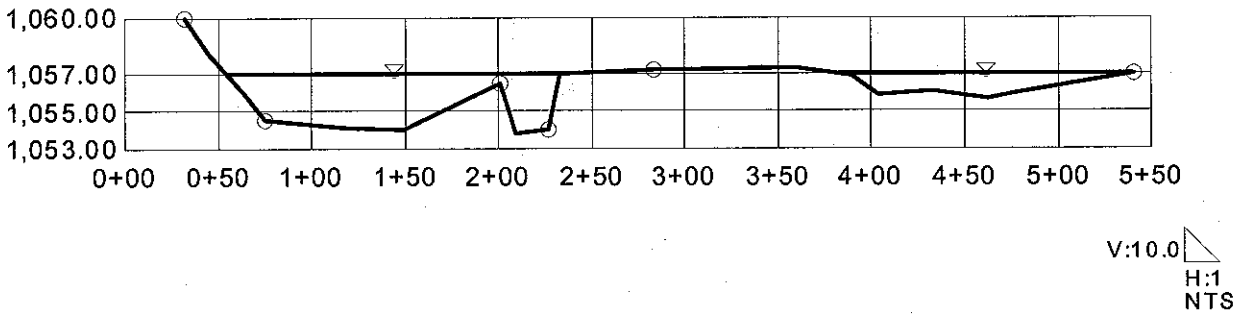
Cross Section B-C (Approximately 250 feet Upstream of Section 100)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
2+01	1,056.50
2+09	1,053.80
2+27	1,054.00
2+33	1,057.00
2+83	1,057.20
3+59	1,057.30
3+89	1,056.90
4+04	1,055.90
4+32	1,056.10
4+62	1,055.60
4+78	1,056.00
5+41	1,057.00

Cross Section B-C (250' Upstream of Section 100)
Cross Section for Irregular Channel

Project Description	
Worksheet	XSection G (Upstream of 100)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.040	
Slope	0.005000	ft/ft
Water Surface Elevation	1,057.00	ft
Elevation Range	1,053.80 to 1,060.00	
Discharge	1,832.36	cfs



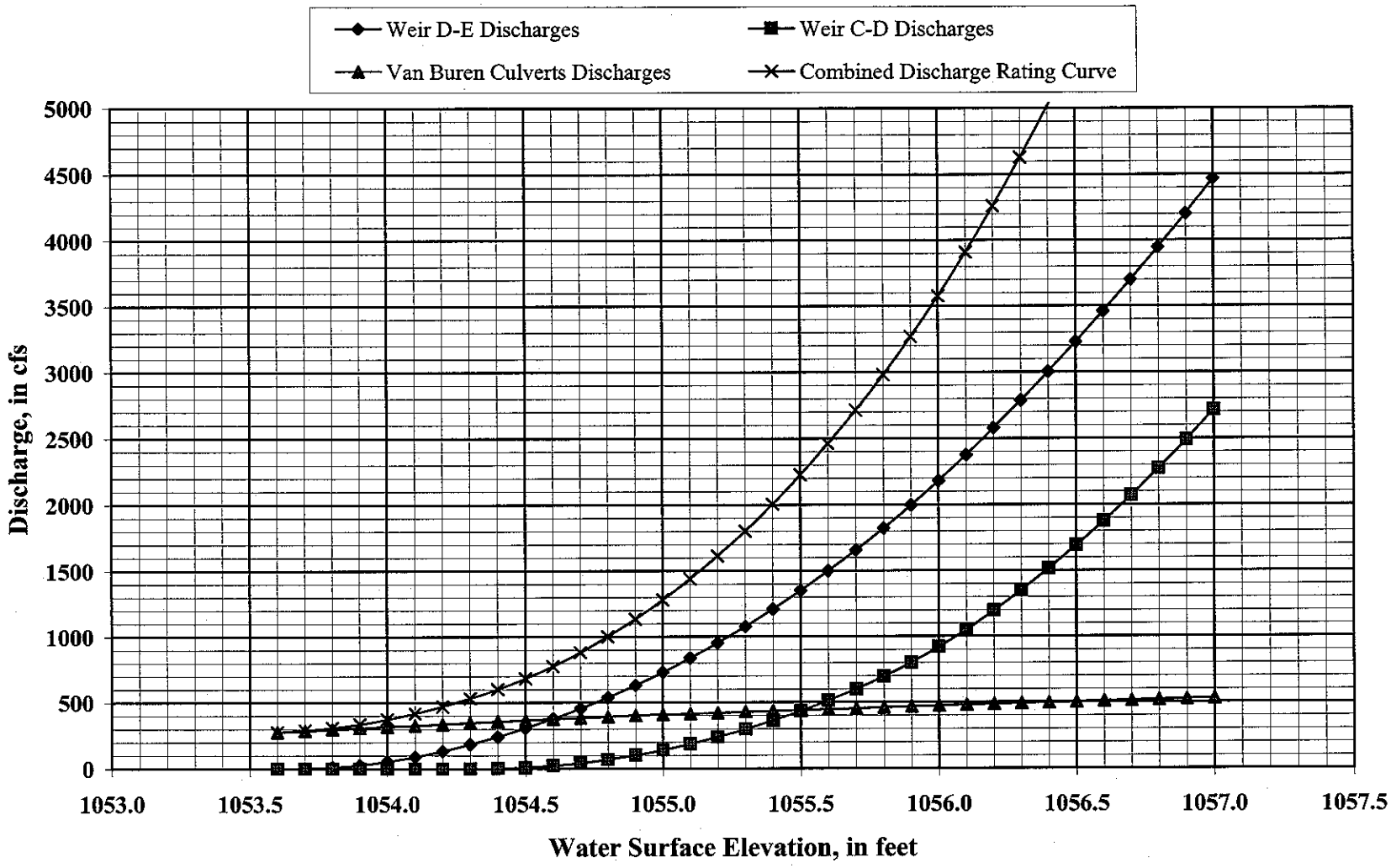


FIGURE 2
Rating Curve for Discharges from T1SR6WS13 at Van Buren Road

FCDMC 2000C013-Task 11

Detailed Floodplain Delineation for T1SR6WS13 (Phillips Wash) and T1NR6WS12

Rating Curve for Discharges from T1SR6WS13 at Van Buren Road

	Weir Section Discharges			
	Van Buren	Side Weir	Culvert	TOTAL
Elevation	Weir D-E	Weir C-D	Discharges	Discharge
ft	cfs	cfs	cfs	cfs
1053.6	0	0	277	277
1053.7	3	0	288	291
1053.8	13	0	298	311
1053.9	30	0	308	337
1054.0	55	0	318	373
1054.1	90	0	328	418
1054.2	134	0	337	472
1054.3	186	1	347	534
1054.4	244	2	357	603
1054.5	308	10	366	683
1054.6	378	24	375	777
1054.7	455	44	384	883
1054.8	540	70	393	1003
1054.9	632	103	401	1136
1055.0	731	142	408	1281
1055.1	839	187	415	1441
1055.2	954	239	421	1615
1055.3	1078	298	428	1804
1055.4	1211	363	434	2008
1055.5	1351	435	441	2227
1055.6	1500	514	448	2462
1055.7	1658	601	454	2713
1055.8	1824	696	461	2981
1055.9	1999	803	467	3269
1056.0	2183	920	474	3577
1056.1	2376	1052	481	3909
1056.2	2578	1196	486	4260
1056.3	2787	1352	491	4630
1056.4	3004	1517	497	5017
1056.5	3228	1692	502	5422
1056.6	3460	1876	508	5844
1056.7	3699	2070	513	6283
1056.8	3947	2275	519	6740
1056.9	4203	2490	524	7216
1057.0	4467	2715	530	7711

CURRENT DATE: 06-01-2001 FILE DATE: 06-01-2001
CURRENT TIME: 11:49:41 FILE NAME: VBCLVRTS

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 6.0 **********
****

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1049.50	1049.00	60.00	4 CSP	4.00	4.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

****

SUMMARY OF CULVERT FLOWS (cfs) FILE: VBCLVRTS DATE: 06-01-2001

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1049.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1051.22	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1052.00	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1052.64	180.0	180.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1053.24	240.0	240.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1053.82	300.0	300.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1054.43	360.0	360.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1054.88	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1056.09	480.0	480.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1057.19	540.0	540.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1058.48	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1060.00	716.3	716.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: VBCLVRTS DATE: 06-01-2001

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1049.50	0.000	0.00	0.00	0.00
1051.22	0.000	60.00	0.00	0.00
1052.00	0.000	120.00	0.00	0.00
1052.64	0.000	180.00	0.00	0.00
1053.24	0.000	240.00	0.00	0.00
1053.82	0.000	300.00	0.00	0.00
1054.43	0.000	360.00	0.00	0.00
1054.88	0.000	400.00	0.00	0.00
1056.09	0.000	480.00	0.00	0.00
1057.19	0.000	540.00	0.00	0.00
1058.48	0.000	600.00	0.00	0.00

****

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

****

CURRENT DATE: 06-01-2001 FILE DATE: 06-01-2001
CURRENT TIME: 11:49:41 FILE NAME: VBCLVRTS

****

PERFORMANCE CURVE FOR CULVERT 1 - 4(4.00 (ft) BY 4.00 (ft)) CSP

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1049.50	0.00	-0.50	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
60.00	1051.22	1.55	1.72	2-M2c	1.24	1.12	1.12	1.01	5.16	2.21
120.00	1052.00	2.27	2.50	2-M2c	1.81	1.62	1.62	1.51	6.28	2.83
180.00	1052.64	2.89	3.14	2-M2c	2.31	2.01	2.01	1.92	7.13	3.26
240.00	1053.24	3.47	3.74	2-M2c	2.82	2.33	2.33	2.27	7.91	3.59
300.00	1053.82	4.05	4.32	2-M2c	3.56	2.61	2.61	2.58	8.64	3.86
360.00	1054.43	4.69	4.93	2-M2c	4.00	2.87	2.87	2.86	9.34	4.10
400.00	1054.88	5.16	5.38	3-M2t	4.00	3.02	3.04	3.04	9.79	4.24
480.00	1056.09	6.21	6.59	3-M2t	4.00	3.28	3.37	3.37	10.67	4.49
540.00	1057.19	7.13	7.69	3-M2t	4.00	3.44	3.60	3.60	11.34	4.66
600.00	1058.48	8.16	8.98	3-M2t	4.00	3.59	3.82	3.82	12.23	4.82

****

El. inlet face invert 1049.50 ft El. outlet invert 1049.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	100.00 ft
INLET ELEVATION	1049.50 ft
OUTLET STATION	160.00 ft
OUTLET ELEVATION	1049.00 ft
NUMBER OF BARRELS	4
SLOPE (V/H)	0.0083
CULVERT LENGTH ALONG SLOPE	60.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 06-01-2001 FILE DATE: 06-01-2001
CURRENT TIME: 11:49:41 FILE NAME: VBCLVRTS

****
********** TAILWATER **********
****

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	25.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.005
MANNING'S n (.01-0.1)	0.045
CHANNEL INVERT ELEVATION	1049.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	1049.00 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1049.00	0.000	0.00	0.00	0.00
60.00	1050.01	0.388	1.01	2.21	0.31
120.00	1050.51	0.406	1.51	2.83	0.47
180.00	1050.92	0.414	1.92	3.26	0.60
240.00	1051.27	0.420	2.27	3.59	0.71
300.00	1051.58	0.424	2.58	3.86	0.80
360.00	1051.86	0.427	2.86	4.10	0.89
400.00	1052.04	0.429	3.04	4.24	0.95
480.00	1052.37	0.431	3.37	4.49	1.05
540.00	1052.60	0.433	3.60	4.66	1.12
600.00	1052.82	0.434	3.82	4.82	1.19

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	1060.00 ft

****

```
*********************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
*********************************************


    PROJECT:  FCDMC 2000C013-Task11
    ENGINEER:  wso
    DATE:   6/ 1/2001
    TIME:  10:38. 1




---------------------------------------------
    INPUT PARAMETERS
---------------------------------------------


    STARTING WSEL:      1053.60
    MAXIMUM WSEL:       1057.00
    STEP SIZE:             0.10
    BREADTH OF WEIR:      60.00

*********************************************
    INPUT ELEVATION/STATION TABLE.
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:38. 1
*********************************************
```

POINT	ELEVATION	STATION
1	1058.00	0.00
2	1057.17	25.30
3	1056.61	42.60
4	1057.53	69.20
5	1057.10	85.60
6	1056.50	105.30
7	1056.00	116.50
8	1055.20	204.20
9	1054.50	235.80
10	1055.20	268.00
11	1054.00	317.50
12	1053.60	379.20
13	1053.60	407.90
14	1053.90	469.30
15	1054.00	498.90
16	1054.10	515.80

```
*******************************************
    WEIR COEFFICIENT TABLE
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:38. 1
*******************************************
```

REFERENCE: COE CHART - LOWER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.5833
2	0.10	2.5056	17	1.60	2.5889
3	0.20	2.5111	18	1.70	2.5944
4	0.30	2.5167	19	1.80	2.6000
5	0.40	2.5222	20	1.90	2.6056
6	0.50	2.5278	21	2.00	2.6111
7	0.60	2.5333	22	2.10	2.6167
8	0.70	2.5389	23	2.20	2.6222
9	0.80	2.5444	24	2.30	2.6278
10	0.90	2.5500	25	2.40	2.6333
11	1.00	2.5556	26	2.50	2.6389
12	1.10	2.5611	27	2.60	2.6444
13	1.20	2.5667	28	2.70	2.6500
14	1.30	2.5722	29	2.80	2.6556
15	1.40	2.5778	30	2.90	2.6611

```
*******************************************
    WEIR COEFFICIENT TABLE
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:38. 1
*******************************************
```

REFERENCE: COE CHART - LOWER CURVE

POINT	HEAD	COEFFICIENT
31	3.00	2.6667
32	3.10	2.6722
33	3.20	2.6778
34	3.30	2.6833
35	3.40	2.6889

```
*******************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:38. 1
*******************************************
```

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1053.60	0.00	1055.10	838.82
1053.70	3.41	1055.20	954.40
1053.80	12.87	1055.30	1078.36
1053.90	29.60	1055.40	1210.59
1054.00	55.07	1055.50	1351.19
1054.10	90.36	1055.60	1500.25
1054.20	134.36	1055.70	1657.88
1054.30	185.65	1055.80	1824.21
1054.40	243.56	1055.90	1999.35
1054.50	307.70	1056.00	2183.43
1054.60	378.11	1056.10	2376.40
1054.70	455.37	1056.20	2577.59
1054.80	539.83	1056.30	2786.70
1054.90	631.74	1056.40	3003.52
1055.00	731.33	1056.50	3227.88

```
*******************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:38. 1
*******************************************
```

ELEVATION	DISCHARGE (CFS)
1056.60	3459.71
1056.70	3699.14
1056.80	3946.65
1056.90	4202.54
1057.00	4467.01

```
*******************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
*******************************************


    PROJECT:  FCDMC 2000C013-Task11
    ENGINEER:  wso
    DATE:   6/ 1/2001
    TIME:  10:45.52




---------------------------------------------
    INPUT PARAMETERS
---------------------------------------------


    STARTING WSEL:      1054.10
    MAXIMUM WSEL:       1057.00
    STEP SIZE:             0.10
    BREADTH OF WEIR:     100.00


*******************************************
    INPUT ELEVATION/STATION TABLE.
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:45.52
*******************************************


    POINT    ELEVATION    STATION
    -----    ---------    -------
        1      1054.10       0.00
        2      1055.70      70.70
        3      1055.80      92.90
        4      1056.00     111.70
        5      1056.00     159.40
        6      1055.60     211.50
        7      1054.80     248.60
        8      1054.40     289.60
        9      1054.40     348.40
       10      1056.50     432.70
       11      1057.00     496.70
```

```
*******************************************
    WEIR COEFFICIENT TABLE
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:45.52
*******************************************
```

REFERENCE: COE CHART - LOWER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.5500
2	0.10	2.5033	17	1.60	2.5533
3	0.20	2.5067	18	1.70	2.5567
4	0.30	2.5100	19	1.80	2.5600
5	0.40	2.5133	20	1.90	2.5633
6	0.50	2.5167	21	2.00	2.5667
7	0.60	2.5200	22	2.10	2.5700
8	0.70	2.5233	23	2.20	2.5733
9	0.80	2.5267	24	2.30	2.5767
10	0.90	2.5300	25	2.40	2.5800
11	1.00	2.5333	26	2.50	2.5833
12	1.10	2.5367	27	2.60	2.5867
13	1.20	2.5400	28	2.70	2.5900
14	1.30	2.5433	29	2.80	2.5933
15	1.40	2.5467	30	2.90	2.5967

```
*******************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 1/2001
    TIME:  10:45.52
*******************************************
```

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1054.10	0.00	1055.60	513.88
1054.20	0.14	1055.70	600.54
1054.30	0.79	1055.80	696.24
1054.40	2.18	1055.90	802.62
1054.50	9.57	1056.00	920.00
1054.60	23.55	1056.10	1051.93
1054.70	43.63	1056.20	1196.40
1054.80	70.00	1056.30	1351.66
1054.90	102.80	1056.40	1516.92
1055.00	141.88	1056.50	1691.68
1055.10	187.28	1056.60	1876.04
1055.20	239.12	1056.70	2070.32
1055.30	297.54	1056.80	2274.77
1055.40	362.70	1056.90	2489.55
1055.50	434.76	1057.00	2714.81

APPENDIX E

```
                    HEC-RAS September 1998 Version 2.2
                      U.S. Army Corp of Engineers
                     Hydrologic Engineering Center
                       609 Second Street, Suite D
                      Davis, California 95616-4687
                            (916) 756-1104

          X     X  XXXXXX    XXXX        XXXX       XX      XXXX
          X     X  X        X    X       X   X     X  X    X
          X     X  X        X            X   X    X    X   X
          XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
          X     X  X        X            X  X     X    X        X
          X     X  X        X    X       X   X    X    X        X
          X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: T1SR6WS13 and T1NR6WS12 - Reach 90 to 100
Project File : 1S6WS13_90to100.prj
Run Date and Time: 6/18/2001 2:17:26 PM

Project in English units

Project Description:
FCD 2000C013 - Task 11
Detailed Floodplain Delineation
Washes T1SR6WS13 and
T1NR6WS12 between Sections 90 and 100
Original Zone A Delineation per
Watershed "PP" (FCD 99-03)

PLAN DATA

Plan Title: 100-yr Floodplain/Floodway
Plan File : x:\projects\Agency\FCDMC\2000c013\DetailFP\Task11\HECRAS\1S6WS13_90to100.p02

Geometry Title: Detailed FP Delineation - 2 Washes
Geometry File : x:\projects\Agency\FCDMC\2000c013\DetailFP\Task11\HECRAS\1S6WS13_90to100.g01

Flow Title : 100-yr Peak Discharges
Flow File : x:\projects\Agency\FCDMC\2000c013\DetailFP\Task11\HECRAS\1S6WS13_90to100.f01

Plan Description:
Floodway Model

Plan Summary Information:

Number of:	Cross Sections	= 10	Mulitple Openings	=	0
	Culverts	= 0	Inline Weirs	=	0
	Bridges	= 0			

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 10
Right Offset = 10

River = T1SR6WS13 Reach = 90_100 Lower

RS	Profile	Method	Value1	Value2
91	PF 2	1	991.4	1500
90	*PF 2*	1	*1313.5*	*1668.3*

River = T1SR6WS13		Reach = 90_100 Upper		
RS	Profile	Method	Value1	Value2
95.1	PF 2	1	274.2	478.4
94.1	PF 2	1	298.7	649.7
93.1	PF 2	1	422.5	749.4
92.1	PF 2	1	644.5	973.6

River = T1SR6WS13		Reach = 90_100		
RS	Profile	Method	Value1	Value2
95.2	PF 2	4	1	
94.2	PF 2	4	1	
93.2	PF 2	4	1	
92.2	PF 2	4	1	

River = T1NR6WS12		Reach = 90_100 Upper		
RS	Profile	Method	Value1	Value2
95.1	PF 2	1	274.2	478.4
94.1	PF 2	1	298.7	649.7
93.1	PF 2	1	422.5	749.4
92.1	PF 2	1	644.5	973.6

River = T1NR6WS12		Reach = 90_100		
RS	Profile	Method	Value1	Value2
95.2	PF 2	1	1190.9	1494.1
94.2	PF 2	1	1223	1466.4
93.2	PF 2	1	1227.71	1471.1
92.2	PF 2	1	1189.7	1450

River = T1NR6WS12		Reach = 90_100 Lower		
RS	Profile	Method	Value1	Value2
91	PF 2	4	1	
90	PF 2	4	1	

FLOW DATA

Flow Title: 100-yr Peak Discharges
Flow File : x:\projects\Agency\FCDMC\2000c013\DetailFP\Task11\HECRAS\1S6WS13_90to100.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2
T1SR6WS13	90_100 Upper	95.1	2300	2300
T1SR6WS13	90_100 Lower	91	4950	4950
T1NR6WS12	90_100	95.2	3400	3400

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
T1SR6WS13	90_100 Upper	PF 1	Normal S = .005	
T1SR6WS13	90_100 Lower	PF 1		Normal S = .0045
T1NR6WS12	90_100	PF 1	Normal S = .0074	

GEOMETRY DATA

Geometry Title: Detailed FP Delineation - 2 Washes
Geometry File : x:\projects\Agency\FCDMC\2000c013\DetailFP\Task11\HECRAS\1S6WS13_90to100.g01

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
T1SR6WS13	90_100 Upper		Junction 1
T1SR6WS13	90_100 Lower	Junction 1	
T1NR6WS12	90_100		Junction 1

JUNCTION INFORMATION

Name: Junction 1
Description: Confluence of T1SR6WS13 and T1NR6WS12
Energy computation Method

Length across Junction Tributary

River	Reach		River	Reach	Length	Angle
T1SR6WS13	90_100 Upper	to	T1SR6WS13	90_100 Lower	440	
T1NR6WS12	90_100	to	T1SR6WS13	90_100 Lower	390	

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Upper RS: 95.1

INPUT
Description: 5th cross section upstream of Section 90.
Surveyed Cross Section
A per this study.
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1058.5	130.3	1058	173.6	1056	191.1	1054.8	225.3	1054.4
240.1	1054	255.1	1053.3	284.2	1052	297.3	1049.6	317	1049.6
319.1	1048	327.4	1048.2	331.3	1049.4	360.3	1052.4	379.1	1050.45
414.6	1051.3	422.5	1046.6	436.2	1047.4	458.3	1051.1	468.4	1051.8
501.9	1051.6	535.6	1051.4	556.9	1051	568.4	1050.9	582.6	1050.35
604.3	1051.2	626.4	1052.2	667.1	1053.83	692.3	1054		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	284.2	.055	468.4	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
284.2	468.4	250	250	250	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1052.82	Element			
Vel Head (ft)	0.18	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1052.64	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	4.55	473.56	211.86
E.G. Slope (ft/ft)	0.005176	Area (sq ft)	4.55	473.56	211.86
Q Total (cfs)	2300.00	Flow (cfs)	5.04	1709.78	585.18
Top Width (ft)	367.39	Top Width (ft)	14.27	184.20	168.92
Vel Total (ft/s)	3.33	Avg. Vel. (ft/s)	1.11	3.61	2.76
Max Chl Dpth (ft)	6.04	Hydr. Depth (ft)	0.32	2.57	1.25
Conv. Total (cfs)	31969.4	Conv. (cfs)	70.0	23765.5	8133.8
Length Wtd. (ft)	250.00	Wetted Per. (ft)	14.28	187.05	168.99
Min Ch El (ft)	1046.60	Shear (lb/sq ft)	0.10	0.82	0.41
Alpha	1.05	Stream Power (lb/ft s)	0.11	2.95	1.12
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)	0.58	22.35	7.48
C & E Loss (ft)	0.01	Cum SA (acres)	0.74	6.83	2.90

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1053.12	Element			
Vel Head (ft)	0.31	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1052.81	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	5.87	505.47	10.40
E.G. Slope (ft/ft)	0.007280	Area (sq ft)	5.87	505.47	10.40
Q Total (cfs)	2300.00	Flow (cfs)	11.32	2260.55	28.13
Top Width (ft)	204.20	Top Width (ft)	10.00	184.20	10.00
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)	1.93	4.47	2.70
Max Chl Dpth (ft)	6.21	Hydr. Depth (ft)	0.59	2.74	1.04
Conv. Total (cfs)	26956.1	Conv. (cfs)	132.7	26493.7	329.6
Length Wtd. (ft)	250.00	Wetted Per. (ft)	10.37	187.05	11.07
Min Ch El (ft)	1046.60	Shear (lb/sq ft)	0.26	1.23	0.43
Alpha	1.02	Stream Power (lb/ft s)	0.50	5.49	1.15
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	0.26	24.09	3.78
C & E Loss (ft)	0.04	Cum SA (acres)	0.22	6.83	0.86

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Upper RS: 94.1

INPUT
Description: 4th cross section upstream of Section 90.
Surveyed Cross Section
B per this study.
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1054.5	108.2	1054	138.7	1054	157.3	1055.5	212.9	1056

224.7	1056	294	1052	300.5	1048.9	308.7	1050.5	344.1	1048.8
354	1047	362.6	1046.8	368.7	1048.5	407.9	1049	428.4	1050
447.2	1049.6	488.4	1050.4	518.4	1050	533.8	1050.4	557.2	1051
603.6	1048.8	612.1	1046.4	630.9	1045.8	639.7	1049.2	689.1	1051.6
731.9	1053.2								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	308.7	.055	639.7	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
308.7	639.7	370	370	370	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1051.45	Element			
Vel Head (ft)	0.16	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1051.29	Reach Len. (ft)	370.00	370.00	370.00
Crit W.S. (ft)		Flow Area (sq ft)	19.03	659.04	44.95
E.G. Slope (ft/ft)	0.005726	Area (sq ft)	19.03	659.04	44.95
Q Total (cfs)	2300.00	Flow (cfs)	58.58	2125.84	115.57
Top Width (ft)	387.23	Top Width (ft)	13.21	331.00	43.02
Vel Total (ft/s)	3.18	Avg. Vel. (ft/s)	3.08	3.23	2.57
Max Chl Dpth (ft)	5.49	Hydr. Depth (ft)	1.44	1.99	1.04
Conv. Total (cfs)	30395.3	Conv. (cfs)	774.2	28093.8	1527.4
Length Wtd. (ft)	370.00	Wetted Per. (ft)	13.91	332.52	43.07
Min Ch El (ft)	1045.80	Shear (lb/sq ft)	0.49	0.71	0.37
Alpha	1.01	Stream Power (lb/ft s)	1.51	2.29	0.96
Frctn Loss (ft)	2.01	Cum Volume (acre-ft)	0.51	19.10	6.75
C & E Loss (ft)	0.00	Cum SA (acres)	0.66	5.35	2.29

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1051.52	Element			
Vel Head (ft)	0.16	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1051.36	Reach Len. (ft)	370.00	370.00	370.00
Crit W.S. (ft)		Flow Area (sq ft)	17.29	682.92	19.19
E.G. Slope (ft/ft)	0.005358	Area (sq ft)	17.29	682.92	19.19
Q Total (cfs)	2300.00	Flow (cfs)	53.44	2182.00	64.56
Top Width (ft)	351.00	Top Width (ft)	10.00	331.00	10.00
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	3.09	3.20	3.36
Max Chl Dpth (ft)	5.56	Hydr. Depth (ft)	1.73	2.06	1.92
Conv. Total (cfs)	31422.9	Conv. (cfs)	730.1	29810.7	882.0
Length Wtd. (ft)	370.00	Wetted Per. (ft)	11.95	332.52	11.69
Min Ch El (ft)	1045.80	Shear (lb/sq ft)	0.48	0.69	0.55
Alpha	1.00	Stream Power (lb/ft s)	1.50	2.19	1.85
Frctn Loss (ft)	2.20	Cum Volume (acre-ft)	0.20	20.68	3.70
C & E Loss (ft)	0.00	Cum SA (acres)	0.16	5.36	0.80

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Upper RS: 93.1

INPUT
Description: 3rd cross section upstream of Section 90.
Surveyed Cross Section
C per this study.
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1058.6	126.9	1058	147.9	1058.1	155.3	1058.2	164.9	1058
190.5	1056	229.9	1055.4	265	1053.5	277.5	1054.2	290	1054
299.5	1052	302.8	1051.4	326.1	1050	358.6	1049.6	401.8	1049.3
432.5	1048.7	459.5	1047.4	470.2	1044	484.4	1044.2	491.6	1046.8
520.1	1048.1	550	1048	581.4	1047.3	614.1	1047	646	1047.5
675.9	1048.1	707.3	1046.2	714.9	1043.8	723.9	1043	731.3	1047
739.4	1048.2	765.7	1049	780.2	1050	825.6	1051.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	432.5	.055	739.4	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
432.5	739.4	320	360	350	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1049.44	Element			
Vel Head (ft)	0.17	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1049.27	Reach Len. (ft)	320.00	360.00	350.00
Crit W.S. (ft)		Flow Area (sq ft)	8.29	685.38	18.13
E.G. Slope (ft/ft)	0.005165	Area (sq ft)	8.29	685.38	18.13
Q Total (cfs)	2300.00	Flow (cfs)	8.51	2260.89	30.60
Top Width (ft)	366.23	Top Width (ft)	29.13	306.90	30.20
Vel Total (ft/s)	3.23	Avg. Vel. (ft/s)	1.03	3.30	1.69
Max Chl Dpth (ft)	6.27	Hydr. Depth (ft)	0.28	2.23	0.60
Conv. Total (cfs)	32001.7	Conv. (cfs)	118.5	31457.5	425.7
Length Wtd. (ft)	359.86	Wetted Per. (ft)	29.13	309.53	30.23
Min Ch El (ft)	1043.00	Shear (lb/sq ft)	0.09	0.71	0.19
Alpha	1.03	Stream Power (lb/ft s)	0.09	2.36	0.33
Frctn Loss (ft)	2.50	Cum Volume (acre-ft)	0.39	13.39	6.48
C & E Loss (ft)	0.01	Cum SA (acres)	0.48	2.65	1.98

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1049.31	Element			
Vel Head (ft)	0.20	Wt. n-Val.	0.045	0.055	0.045
W.S. Elev (ft)	1049.12	Reach Len. (ft)	320.00	360.00	350.00
Crit W.S. (ft)		Flow Area (sq ft)	3.17	638.07	7.63
E.G. Slope (ft/ft)	0.006665	Area (sq ft)	3.17	638.07	7.63
Q Total (cfs)	2300.00	Flow (cfs)	3.92	2279.57	16.51
Top Width (ft)	326.90	Top Width (ft)	10.00	306.90	10.00
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	1.24	3.57	2.16
Max Chl Dpth (ft)	6.12	Hydr. Depth (ft)	0.32	2.08	0.76
Conv. Total (cfs)	28172.2	Conv. (cfs)	48.1	27921.9	202.2
Length Wtd. (ft)	359.93	Wetted Per. (ft)	10.22	309.53	10.62
Min Ch El (ft)	1043.00	Shear (lb/sq ft)	0.13	0.86	0.30
Alpha	1.01	Stream Power (lb/ft s)	0.16	3.06	0.65
Frctn Loss (ft)	1.97	Cum Volume (acre-ft)	0.11	15.07	3.58
C & E Loss (ft)	0.01	Cum SA (acres)	0.07	2.65	0.72

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Upper RS: 92.1

INPUT
Description: 2nd cross section upstream of Section 90.
Surveyed Cross Section
D per this study.
Upstream of Junction 1.
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1057.3	163.3	1056.2	211.8	1056.1	226.1	1056.8	245.5	1057.3
274.2	1056	324.3	1054	350.2	1052	379.9	1050	405.7	1048.5
447.6	1048.2	486	1048.1	522	1048.3	587	1048.5	644.5	1049
664.4	1043	685.9	1042.1	697	1044.8	708	1045.7	742.7	1046.2
772.4	1046	791.8	1043.4	811	1044.4	863.1	1045.5	880.3	1045
887.3	1041.9	902.8	1042.2	909.9	1044.7	932.8	1046	948.2	1046.2
960.4	1047.2	973.6	1048	1016.2	1048.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	644.5	.055	973.6	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
644.5	973.6	390	440	410	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1046.93	Element			
Vel Head (ft)	0.25	Wt. n-Val.		0.055	
W.S. Elev (ft)	1046.68	Reach Len. (ft)	440.00	440.00	440.00
Crit W.S. (ft)		Flow Area (sq ft)		569.59	
E.G. Slope (ft/ft)	0.009677	Area (sq ft)		569.59	
Q Total (cfs)	2300.00	Flow (cfs)		2300.00	
Top Width (ft)	301.84	Top Width (ft)		301.84	
Vel Total (ft/s)	4.04	Avg. Vel. (ft/s)		4.04	
Max Chl Dpth (ft)	4.78	Hydr. Depth (ft)		1.89	
Conv. Total (cfs)	23381.1	Conv. (cfs)		23381.1	

Length Wtd. (ft)	440.00	Wetted Per. (ft)		304.13	
Min Ch El (ft)	1041.90	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		4.57	
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	0.15	5.79	2.47
C & E Loss (ft)	0.05	Cum SA (acres)			

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1047.33	Element			
Vel Head (ft)	0.16	Wt. n-Val.		0.055	
W.S. Elev (ft)	1047.17	Reach Len. (ft)	440.00	440.00	440.00
Crit W.S. (ft)		Flow Area (sq ft)		719.58	
E.G. Slope (ft/ft)	0.004590	Area (sq ft)		719.58	
Q Total (cfs)	2300.00	Flow (cfs)		2300.00	
Top Width (ft)	309.45	Top Width (ft)		309.45	
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)		3.20	
Max Chl Dpth (ft)	5.27	Hydr. Depth (ft)		2.33	
Conv. Total (cfs)	33947.8	Conv. (cfs)		33947.8	
Length Wtd. (ft)	440.00	Wetted Per. (ft)		311.83	
Min Ch El (ft)	1041.90	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		2.11	
Frctn Loss (ft)	1.05	Cum Volume (acre-ft)	0.04	6.97	1.37
C & E Loss (ft)	0.01	Cum SA (acres)			

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Lower RS: 91

INPUT
Description: 1st cross section upstream of Section 90.
Surveyed Cross Section
E per this study.
Downstream of Junction 1.
Station Elevation Data num= 58

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1052.4	126.9	1052.1	156.3	1052.8	194.2	1052	208.7	1050.9
226.8	1051.4	257.4	1052.7	307.7	1052.6	337.7	1052.5	410.4	1048
439.3	1047.2	488.1	1046.2	541.6	1046.3	601.8	1046.3	701.7	1045.9
716.6	1046.2	773.2	1047	815.8	1046.5	895.6	1045.7	1001.4	1044.5
1009.4	1040.1	1030.2	1039.2	1047.6	1043	1080.7	1043.7	1100.8	1043.2
1140.6	1042.8	1159.4	1042.5	1165.6	1041	1172.3	1040.9	1178.6	1041.8
1193.5	1043	1237.9	1042.6	1245.2	1041	1253.6	1042.62	1264.5	1041.95
1278.6	1037.7	1285.9	1037.7	1298.8	1042.8	1316.3	1043.5	1332.4	1043.8
1368.1	1043.3	1390.1	1043	1427.7	1042.6	1467.8	1042.5	1498.6	1042.8
1531.1	1043.4	1574	1042.8	1588.4	1042.9	1617.8	1043.1	1666.7	1043.9
1703	1044	1731.9	1046	1770.3	1046	1811.1	1044.9	1843.6	1045.4
1858.2	1046	1948.4	1048	1997.9	1050				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	1001.4	.065	1332.4	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1001.4	1332.4		430	560	390	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1045.73	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1045.65	Reach Len. (ft)	430.00	560.00	390.00
Crit W.S. (ft)		Flow Area (sq ft)	58.52	1154.23	979.26
E.G. Slope (ft/ft)	0.001743	Area (sq ft)	58.52	1154.23	979.26
Q Total (cfs)	4950.00	Flow (cfs)	55.84	2513.60	2380.56
Top Width (ft)	893.58	Top Width (ft)	101.58	331.00	461.00
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	0.95	2.18	2.43
Max Chl Dpth (ft)	7.95	Hydr. Depth (ft)	0.58	3.49	2.12
Conv. Total (cfs)	118574.5	Conv. (cfs)	1337.7	60211.8	57025.0
Length Wtd. (ft)	507.70	Wetted Per. (ft)	101.59	334.84	461.11
Min Ch El (ft)	1037.70	Shear (lb/sq ft)	0.06	0.38	0.23
Alpha	1.03	Stream Power (lb/ft s)	0.06	0.82	0.56

Frctn Loss (ft)	1.34	Cum Volume (acre-ft)	2.12	15.18	4.76
C & E Loss (ft)	0.01	Cum SA (acres)	2.46	4.41	2.67

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1046.27	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1046.16	Reach Len. (ft)	430.00	560.00	390.00
Crit W.S. (ft)		Flow Area (sq ft)	16.00	1321.39	542.80
E.G. Slope (ft/ft)	0.001859	Area (sq ft)	16.00	1321.39	542.80
Q Total (cfs)	4950.00	Flow (cfs)	28.33	3252.27	1669.40
Top Width (ft)	508.60	Top Width (ft)	10.00	331.00	167.60
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)	1.77	2.46	3.08
Max Chl Dpth (ft)	8.46	Hydr. Depth (ft)	1.60	3.99	3.24
Conv. Total (cfs)	114814.4	Conv. (cfs)	657.0	75435.8	38721.5
Length Wtd. (ft)	530.95	Wetted Per. (ft)	11.54	334.84	170.94
Min Ch El (ft)	1037.70	Shear (lb/sq ft)	0.16	0.46	0.37
Alpha	1.04	Stream Power (lb/ft s)	0.28	1.13	1.13
Frctn Loss (ft)	1.46	Cum Volume (acre-ft)	0.08	17.12	2.43
C & E Loss (ft)	0.01	Cum SA (acres)	0.05	4.41	0.75

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1SR6WS13
REACH: 90_100 Lower RS: 90

INPUT
Description: Original Zone A Cross Section 90 Location
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1050.3	118.7	1049.7	168.1	1049.5	248.9	1048	306.8	1046
336.8	1045.3	351.1	1044.7	380.7	1044.9	435	1044.7	501	1044.8
557.1	1044	583	1043.5	603	1043.6	614.8	1047.2	644	1046.8
657.8	1043.2	677	1043.4	739.6	1043.3	766.9	1044	792.5	1044.7
844.3	1045.9	891.7	1045.2	923.7	1044.3	970.8	1044.6	1031	1045
1092.4	1044.4	1148.6	1043	1222.7	1042.6	1284.9	1042.9	1313.5	1043.4
1372.2	1042.9	1406.3	1041	1416.6	1035.7	1439.6	1036.2	1461.4	1039.7
1508.9	1040.8	1572.1	1040.4	1607	1040.9	1627.4	1042	1653	1042.2
1668.3	1042.2	1737.6	1044	1803.5	1044.2	1850	1045.1	1870.2	1046
1908.9	1048	1936.9	1050						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	1313.5	.065	1668.3	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1313.5	1668.3	0	0	0	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
100	844.3	1045.9

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1044.38	Element			
Vel Head (ft)	0.17	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1044.21	Reach Len. (ft)			
Crit W.S. (ft)	1042.37	Flow Area (sq ft)	255.04	1207.73	84.21
E.G. Slope (ft/ft)	0.004501	Area (sq ft)	371.70	1207.73	84.21
Q Total (cfs)	4950.00	Flow (cfs)	636.07	4178.26	135.67
Top Width (ft)	887.31	Top Width (ft)	396.78	354.80	135.73
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	2.49	3.46	1.61
Max Chl Dpth (ft)	8.51	Hydr. Depth (ft)	1.19	3.40	0.62
Conv. Total (cfs)	73783.8	Conv. (cfs)	9481.1	62280.4	2022.3
Length Wtd. (ft)		Wetted Per. (ft)	213.50	356.47	135.75
Min Ch El (ft)	1035.70	Shear (lb/sq ft)	0.34	0.95	0.17
Alpha	1.07	Stream Power (lb/ft s)	0.84	3.29	0.28
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1044.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.065	
W.S. Elev (ft)	1044.59	Reach Len. (ft)			
Crit W.S. (ft)	1042.37	Flow Area (sq ft)		1342.30	
E.G. Slope (ft/ft)	0.004502	Area (sq ft)		1342.30	
Q Total (cfs)	4950.00	Flow (cfs)		4950.00	
Top Width (ft)	354.80	Top Width (ft)		354.80	
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)		3.69	
Max Chl Dpth (ft)	8.89	Hydr. Depth (ft)		3.78	
Conv. Total (cfs)	73777.3	Conv. (cfs)		73777.3	
Length Wtd. (ft)		Wetted Per. (ft)		360.05	
Min Ch El (ft)	1035.70	Shear (lb/sq ft)		1.05	
Alpha	1.00	Stream Power (lb/ft s)		3.86	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION RIVER: T1NR6WS12
REACH: 90_100 RS: 95.2

INPUT
Description: 5th cross section upstream of Section 90.
Surveyed Cross Section
A per this study.
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
692.3	1054	732	1053.5	758.3	1053.1	770.6	1053	797.9	1053.1
835.4	1052.5	855.1	1052	866.6	1051.5	916.1	1051.1	931.7	1051
950.5	1050.7	967.9	1050.5	978.6	1050.2	993.4	1050	1009.1	1049.6
1025.4	1049.8	1081.4	1050.5	1100.1	1050.7	1140.4	1050	1166.6	1049.4
1200.9	1049.7	1208.7	1045.26	1216.5	1045.2	1221.4	1048.5	1238.6	1048.9
1269.5	1048.5	1307.8	1048.8	1322.8	1049.4	1373	1049.8	1405.5	1049.7
1423.9	1049.7	1436.5	1049.9	1467.2	1049.5	1509	1049.1	1545.4	1049.6
1563.5	1049.8	1588.6	1049.4	1614.7	1049.5	1645.2	1050	1669.7	1050
1699.4	1050.3	1739.9	1051	1823.4	1051.6	1862.4	1052	1921.7	1052.9
1958.5	1054	1986.8	1054.1	2066.8	1057.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
692.3	.045	1200.9	.065	1322.8	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1200.9	1322.8	280	290	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1051.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1051.26	Reach Len. (ft)	280.00	290.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	311.46	354.21	637.46
E.G. Slope (ft/ft)	0.004098	Area (sq ft)	311.46	354.21	637.46
Q Total (cfs)	3400.00	Flow (cfs)	667.33	1042.99	1689.68
Top Width (ft)	881.04	Top Width (ft)	305.19	121.90	453.95
Vel Total (ft/s)	2.61	Avg. Vel. (ft/s)	2.14	2.94	2.65
Max Chl Dpth (ft)	6.06	Hydr. Depth (ft)	1.02	2.91	1.40
Conv. Total (cfs)	53111.0	Conv. (cfs)	10424.3	16292.4	26394.3
Length Wtd. (ft)	292.01	Wetted Per. (ft)	305.23	124.10	453.98
Min Ch El (ft)	1045.20	Shear (lb/sq ft)	0.26	0.73	0.36
Alpha	1.04	Stream Power (lb/ft s)	0.56	2.15	0.95
Frctn Loss (ft)	1.26	Cum Volume (acre-ft)	7.50	13.02	17.17
C & E Loss (ft)	0.00	Cum SA (acres)	5.47	2.75	8.42

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1052.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1052.20	Reach Len. (ft)	280.00	290.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	25.44	468.26	439.30
E.G. Slope (ft/ft)	0.003942	Area (sq ft)	25.44	468.26	439.30
Q Total (cfs)	3400.00	Flow (cfs)	84.31	1628.83	1686.86
Top Width (ft)	303.20	Top Width (ft)	10.00	121.90	171.30
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)	3.31	3.48	3.84
Max Chl Dpth (ft)	7.00	Hydr. Depth (ft)	2.54	3.84	2.56

Conv. Total (cfs)	54156.1	Conv. (cfs)	1342.9	25944.4	26868.7
Length Wtd. (ft)	293.09	Wetted Per. (ft)	12.59	124.10	174.26
Min Ch El (ft)	1045.20	Shear (lb/sq ft)	0.50	0.93	0.62
Alpha	1.01	Stream Power (lb/ft s)	1.65	3.23	2.38
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	2.57	15.49	10.65
C & E Loss (ft)	0.01	Cum SA (acres)	0.75	2.75	2.92

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1NR6WS12
REACH: 90_100 RS: 94.2

INPUT
Description: 4th cross section upstream of Section 90.
Surveyed Cross Section
B per this study.
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
731.9	1053.2	795.2	1053	849.8	1052	871.3	1051.1	893.1	1050.8
925.6	1050.6	995.5	1049.7	1013.7	1049.8	1048.9	1049.7	1094	1048.6
1145.3	1048.4	1183.1	1048	1195.2	1047.6	1243.2	1047.7	1279.8	1048.1
1288.4	1043.8	1296.6	1043.5	1302.8	1046.5	1344	1048	1366.8	1048.2
1412.4	1047.8	1439.7	1047.8	1463.3	1048.4	1471.5	1048.3	1500.9	1047.5
1546.6	1047.9	1611.9	1050	1684.3	1052	1716.7	1049.8	1760.3	1050
1787.9	1050.1	1822.7	1050.4	1904.4	1052	1928.9	1052.3	1966.2	1053.3
2043.4	1056.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
731.9	.045	1279.8	.065	1366.8	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1279.8	1366.8	370	370	355	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1050.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1049.96	Reach Len. (ft)	370.00	370.00	355.00
Crit W.S. (ft)		Flow Area (sq ft)	403.35	270.79	437.44
E.G. Slope (ft/ft)	0.004586	Area (sq ft)	403.35	270.79	437.44
Q Total (cfs)	3400.00	Flow (cfs)	1088.34	881.99	1429.68
Top Width (ft)	671.61	Top Width (ft)	304.28	87.00	280.34
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)	2.70	3.26	3.27
Max Chl Dpth (ft)	6.46	Hydr. Depth (ft)	1.33	3.11	1.56
Conv. Total (cfs)	50206.4	Conv. (cfs)	16071.0	13023.9	21111.5
Length Wtd. (ft)	363.44	Wetted Per. (ft)	304.30	88.74	280.40
Min Ch El (ft)	1043.50	Shear (lb/sq ft)	0.38	0.87	0.45
Alpha	1.02	Stream Power (lb/ft s)	1.02	2.85	1.46
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	5.20	10.94	13.47
C & E Loss (ft)	0.01	Cum SA (acres)	3.52	2.05	5.89

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1051.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1050.94	Reach Len. (ft)	370.00	370.00	355.00
Crit W.S. (ft)		Flow Area (sq ft)	177.41	356.71	295.21
E.G. Slope (ft/ft)	0.004203	Area (sq ft)	177.41	356.71	295.21
Q Total (cfs)	3400.00	Flow (cfs)	781.60	1336.56	1281.84
Top Width (ft)	243.40	Top Width (ft)	56.80	87.00	99.60
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)	4.41	3.75	4.34
Max Chl Dpth (ft)	7.44	Hydr. Depth (ft)	3.12	4.10	2.96
Conv. Total (cfs)	52444.1	Conv. (cfs)	12056.0	20616.0	19772.1
Length Wtd. (ft)	363.59	Wetted Per. (ft)	60.09	88.74	102.19
Min Ch El (ft)	1043.50	Shear (lb/sq ft)	0.77	1.05	0.76
Alpha	1.02	Stream Power (lb/ft s)	3.41	3.95	3.29
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	1.92	12.75	8.13
C & E Loss (ft)	0.01	Cum SA (acres)	0.53	2.05	1.98

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1NR6WS12
REACH: 90_100 RS: 93.2

INPUT
Description: 3rd cross section upstream of Section 90.
Surveyed Cross Section
C per this study.
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
825.6	1051.5	882.5	1050	926	1049	988.4	1048.8	1027.4	1048
1053.5	1047.6	1114.1	1047.3	1126	1046.7	1147.7	1046.3	1179.2	1046.1
1207.3	1046.3	1262.1	1045.8	1294.3	1045.4	1303	1042.2	1310.9	1042
1314.2	1045.4	1327.9	1047	1338.5	1047.1	1384.1	1046.6	1452.7	1046
1463.7	1045.8	1493.3	1045.8	1522.9	1048	1547.1	1048.6	1562.4	1048.1
1615.3	1047.4	1645.9	1046.8	1682.8	1047	1750.7	1048	1778.1	1048.5
1817.5	1049	1834.8	1048.6	1888.5	1048.8	1939.3	1050	2055	1052
2082	1053.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
825.6	.045	1262.1	.065	1338.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1262.1	1338.5		280	290	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1048.52	Element			
Vel Head (ft)	0.13	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1048.40	Reach Len. (ft)	280.00	290.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	394.15	239.68	561.94
E.G. Slope (ft/ft)	0.004110	Area (sq ft)	394.15	239.68	561.94
Q Total (cfs)	3400.00	Flow (cfs)	1118.13	739.24	1542.63
Top Width (ft)	750.01	Top Width (ft)	254.05	76.40	419.55
Vel Total (ft/s)	2.84	Avg. Vel. (ft/s)	2.84	3.08	2.75
Max Chl Dpth (ft)	6.40	Hydr. Depth (ft)	1.55	3.14	1.34
Conv. Total (cfs)	53033.6	Conv. (cfs)	17440.7	11530.7	24062.2
Length Wtd. (ft)	292.92	Wetted Per. (ft)	254.08	78.51	419.67
Min Ch El (ft)	1042.00	Shear (lb/sq ft)	0.40	0.78	0.34
Alpha	1.01	Stream Power (lb/ft s)	1.13	2.42	0.94
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)	1.81	8.77	9.40
C & E Loss (ft)	0.01	Cum SA (acres)	1.14	1.36	3.04

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1049.26	Element			
Vel Head (ft)	0.36	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1048.90	Reach Len. (ft)	280.00	290.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	101.18	278.04	327.66
E.G. Slope (ft/ft)	0.006961	Area (sq ft)	101.18	278.04	327.66
Q Total (cfs)	3400.00	Flow (cfs)	543.36	1232.08	1624.56
Top Width (ft)	243.39	Top Width (ft)	34.39	76.40	132.60
Vel Total (ft/s)	4.81	Avg. Vel. (ft/s)	5.37	4.43	4.96
Max Chl Dpth (ft)	6.90	Hydr. Depth (ft)	2.94	3.64	2.47
Conv. Total (cfs)	40752.4	Conv. (cfs)	6512.7	14767.7	19472.0
Length Wtd. (ft)	293.48	Wetted Per. (ft)	37.18	78.51	135.71
Min Ch El (ft)	1042.00	Shear (lb/sq ft)	1.18	1.54	1.05
Alpha	1.01	Stream Power (lb/ft s)	6.35	6.82	5.20
Frctn Loss (ft)	1.85	Cum Volume (acre-ft)	0.74	10.05	5.59
C & E Loss (ft)	0.02	Cum SA (acres)	0.14	1.36	1.04

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: T1NR6WS12
REACH: 90_100 RS: 92.2

INPUT
Description: 2nd cross section upstream of Section 90.
Surveyed Cross Section
D per this study.
Upstream of Junction 1.
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1016.2	1048.6	1055.3	1047	1069.9	1047.1	1119.1	1047.5	1146	1047.1

1185.4	1046.8	1216.9	1045.5	1236.7	1044.2	1254	1040.8	1260.7	1040.4
1273.7	1044.6	1302.9	1044.6	1308.8	1042.3	1314.5	1042.3	1323.9	1043.9
1342.1	1044.3	1373.8	1044.1	1393	1044.4	1438.6	1044.1	1458	1044.7
1513.8	1045.3	1557.6	1046	1586.6	1046.2	1628.8	1047.3	1654.9	1048
1684.4	1048.4	1792.8	1048	1809.9	1047.7	1840.1	1047.6	1851.2	1048
1949.1	1048.7	1999.4	1050	2058.5	1052				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1016.2	.045	1236.7	.065	1342.1	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1236.7	1342.1	400	430	390	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1046.89	Element			
Vel Head (ft)	0.27	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1046.62	Reach Len. (ft)	390.00	390.00	390.00
Crit W.S. (ft)		Flow Area (sq ft)	50.28	346.52	424.93
E.G. Slope (ft/ft)	0.007794	Area (sq ft)	50.28	346.52	424.93
Q Total (cfs)	3400.00	Flow (cfs)	153.28	1531.01	1715.71
Top Width (ft)	413.00	Top Width (ft)	46.96	105.40	260.65
Vel Total (ft/s)	4.14	Avg. Vel. (ft/s)	3.05	4.42	4.04
Max Chl Dpth (ft)	6.22	Hydr. Depth (ft)	1.07	3.29	1.63
Conv. Total (cfs)	38513.0	Conv. (cfs)	1736.2	17342.3	19434.5
Length Wtd. (ft)	390.00	Wetted Per. (ft)	47.02	106.98	260.67
Min Ch El (ft)	1040.40	Shear (lb/sq ft)	0.52	1.58	0.79
Alpha	1.02	Stream Power (lb/ft s)	1.59	6.96	3.20
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	0.36	4.13	4.09
C & E Loss (ft)	0.06	Cum SA (acres)			

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1047.40	Element			
Vel Head (ft)	0.31	Wt. n-Val.	0.045	0.065	0.045
W.S. Elev (ft)	1047.09	Reach Len. (ft)	390.00	390.00	390.00
Crit W.S. (ft)		Flow Area (sq ft)	72.10	395.45	307.19
E.G. Slope (ft/ft)	0.005758	Area (sq ft)	72.10	395.45	307.19
Q Total (cfs)	3400.00	Flow (cfs)	238.53	1640.04	1521.43
Top Width (ft)	260.30	Top Width (ft)	47.00	105.40	107.90
Vel Total (ft/s)	4.39	Avg. Vel. (ft/s)	3.31	4.15	4.95
Max Chl Dpth (ft)	6.69	Hydr. Depth (ft)	1.53	3.75	2.85
Conv. Total (cfs)	44806.1	Conv. (cfs)	3143.4	21612.9	20049.9
Length Wtd. (ft)	390.00	Wetted Per. (ft)	47.53	106.98	110.54
Min Ch El (ft)	1040.40	Shear (lb/sq ft)	0.55	1.33	1.00
Alpha	1.04	Stream Power (lb/ft s)	1.80	5.51	4.95
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.36	4.73	2.59
C & E Loss (ft)	0.06	Cum SA (acres)			

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

SUMMARY OF MANNING'S N VALUES

River:T1SR6WS13

Reach	River Sta.	n1	n2	n3
90_100 Upper	95.1	.045	.055	.045
90_100 Upper	94.1	.045	.055	.045
90_100 Upper	93.1	.045	.055	.045
90_100 Upper	92.1	.045	.055	.045
90_100 Lower	91	.045	.065	.045
90_100 Lower	90	.045	.065	.045

River:T1NR6WS12

Reach	River Sta.	n1	n2	n3

90_100	95.2	.045	.065	.045
90_100	94.2	.045	.065	.045
90_100	93.2	.045	.065	.045
90_100	92.2	.045	.065	.045

SUMMARY OF REACH LENGTHS

River: T1SR6WS13

Reach	River Sta.	Left	Channel	Right
90_100 Upper	95.1	250	250	250
90_100 Upper	94.1	370	370	370
90_100 Upper	93.1	320	360	350
90_100 Upper	92.1	390	440	410
90_100 Lower	91	430	560	390
90_100 Lower	90	0	0	0

River: T1NR6WS12

Reach	River Sta.	Left	Channel	Right
90_100	95.2	280	290	300
90_100	94.2	370	370	355
90_100	93.2	280	290	300
90_100	92.2	400	430	390

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: T1SR6WS13

Reach	River Sta.	Contr.	Expan.
90_100 Upper	95.1	.1	.3
90_100 Upper	94.1	.1	.3
90_100 Upper	93.1	.1	.3
90_100 Upper	92.1	.1	.3
90_100 Lower	91	.1	.3
90_100 Lower	90	.1	.3

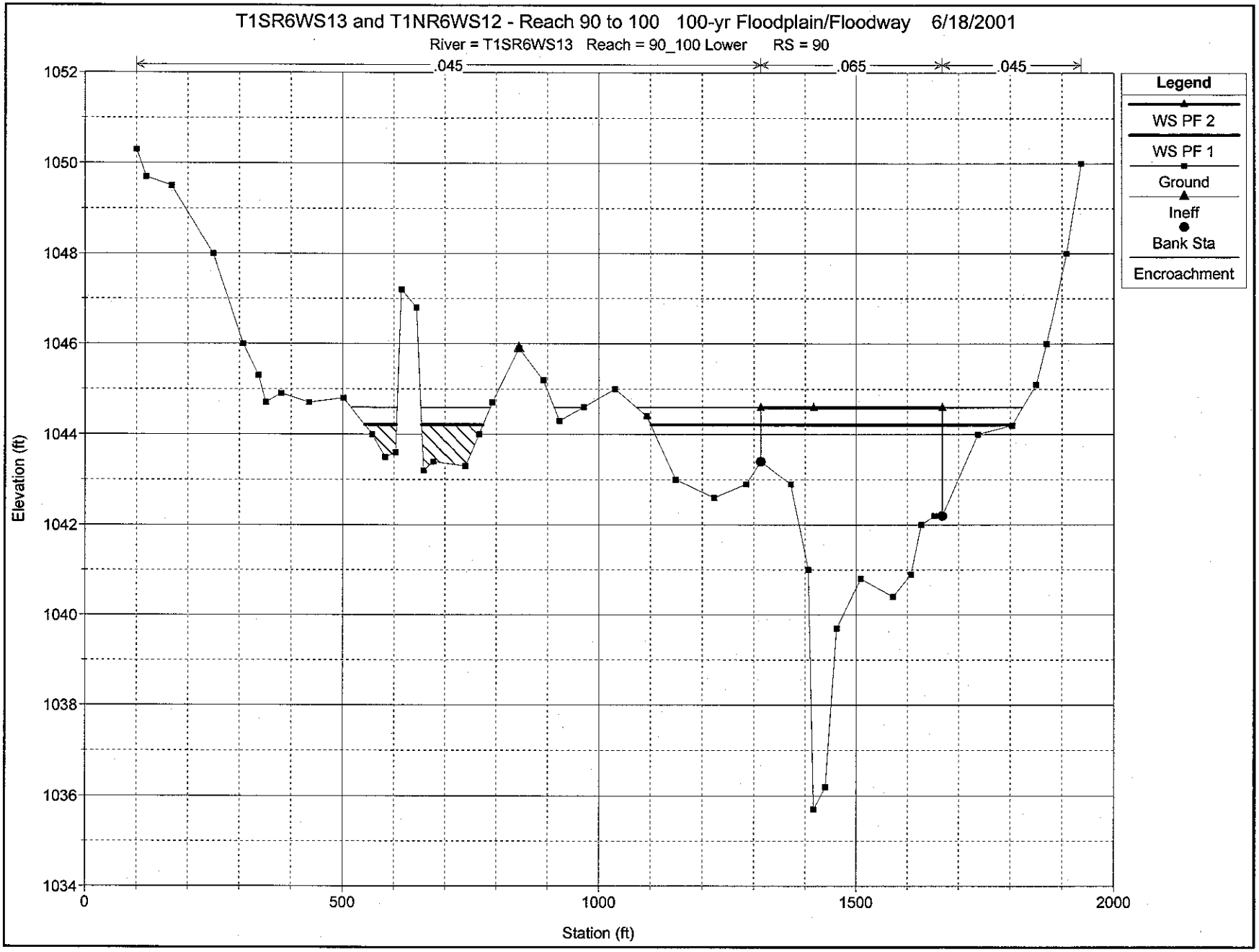
River: T1NR6WS12

Reach	River Sta.	Contr.	Expan.
90_100	95.2	.1	.3
90_100	94.2	.1	.3
90_100	93.2	.1	.3
90_100	92.2	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : FP/FW

River: T1SR6WS13 Reach: 90_100 Upper RS: 95.1 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 95.1 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 94.1 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 94.1 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 93.1 Profile: PF 1

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 93.1 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 92.1 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Upper RS: 92.1 Profile: PF 2
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Lower RS: 91 Profile: PF 1
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Lower RS: 91 Profile: PF 2
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1SR6WS13 Reach: 90_100 Lower RS: 90 Profile: PF 1
Warning:Divided flow computed for this cross-section.
River: T1NR6WS12 Reach: 90_100 RS: 95.2 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 95.2 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 94.2 Profile: PF 1
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 94.2 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 93.2 Profile: PF 1
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 93.2 Profile: PF 2
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 92.2 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: T1NR6WS12 Reach: 90_100 RS: 92.2 Profile: PF 2
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.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River = T1SR6WS13 Reach = 90_100 Lower RS = 90
.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1052
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1048
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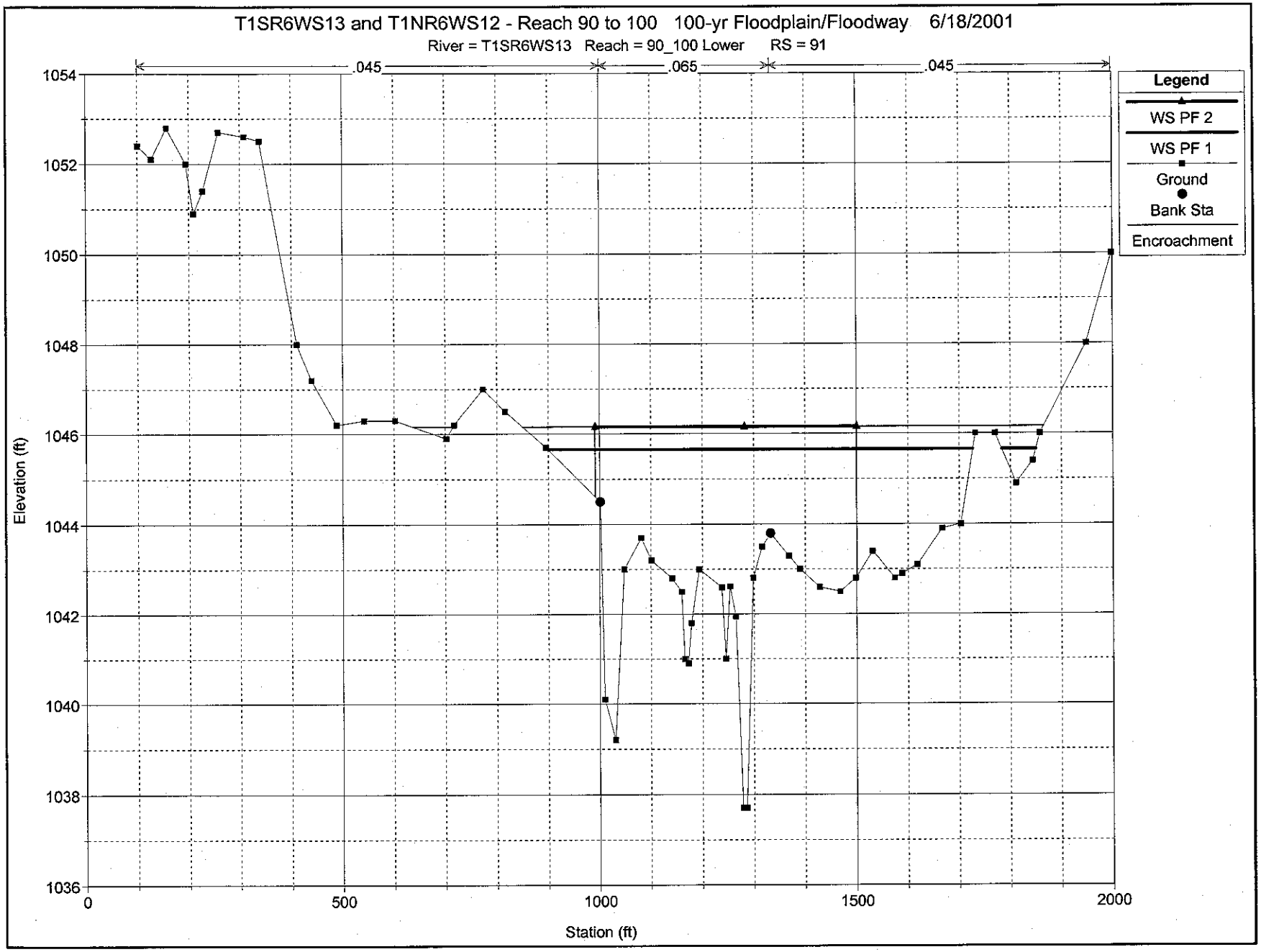
1040
1038
1036
1034
0
500
1000
1500
2000
Station (ft)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River = T1SR6WS13 Reach = 90_100 Lower RS = 91
.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1054
1052
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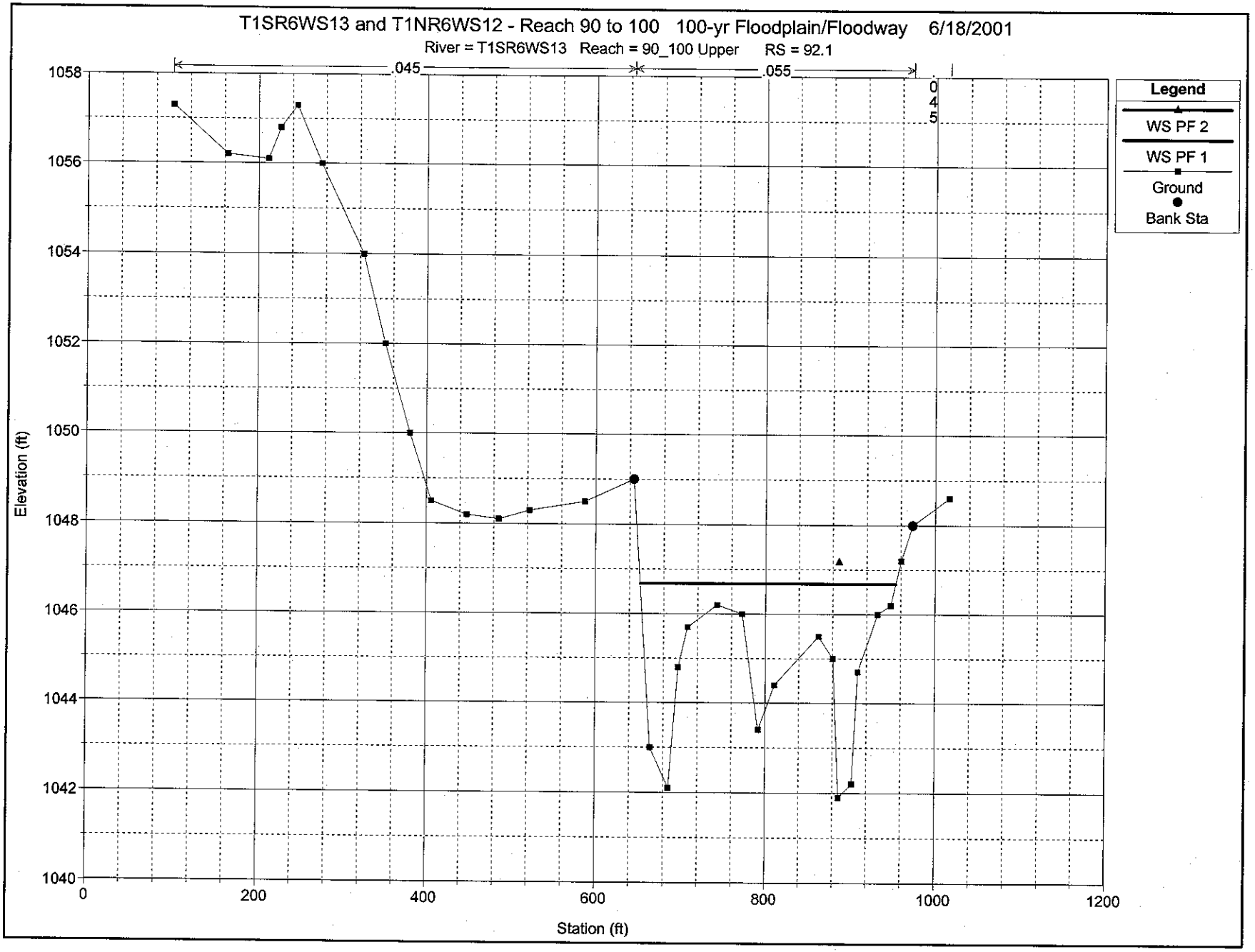
2000
Station (ft)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.045
.055
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1058
1056
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1052
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1046
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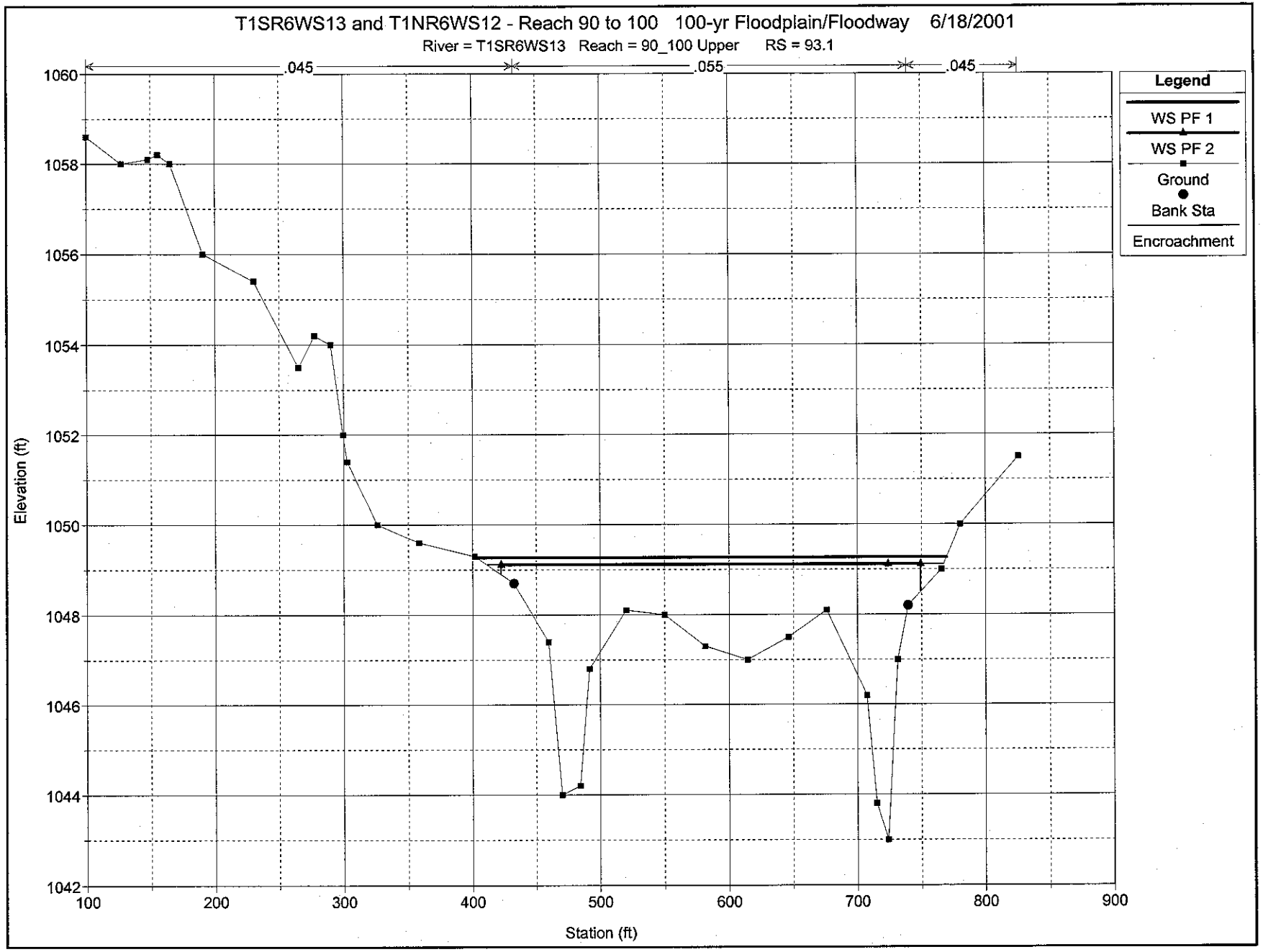
1040
0
200
400
600
800
1000
1200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River = T1SR6WS13 Reach = 90_100 Upper RS = 93.1
.045
.055
.045
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
1060
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1042
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200
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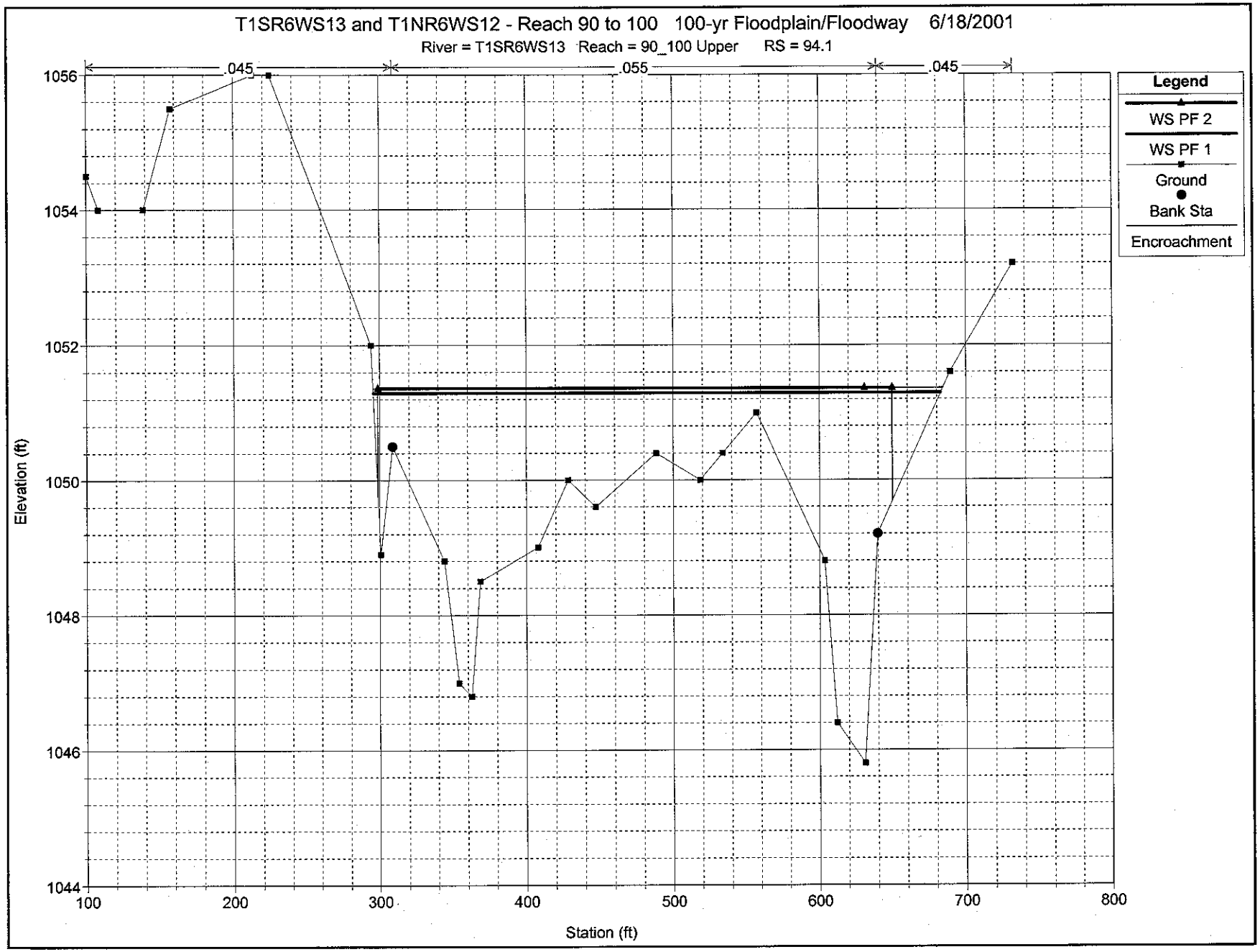
600
700
800
900
Station (ft)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.045
.055
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
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200
300
400
500
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700
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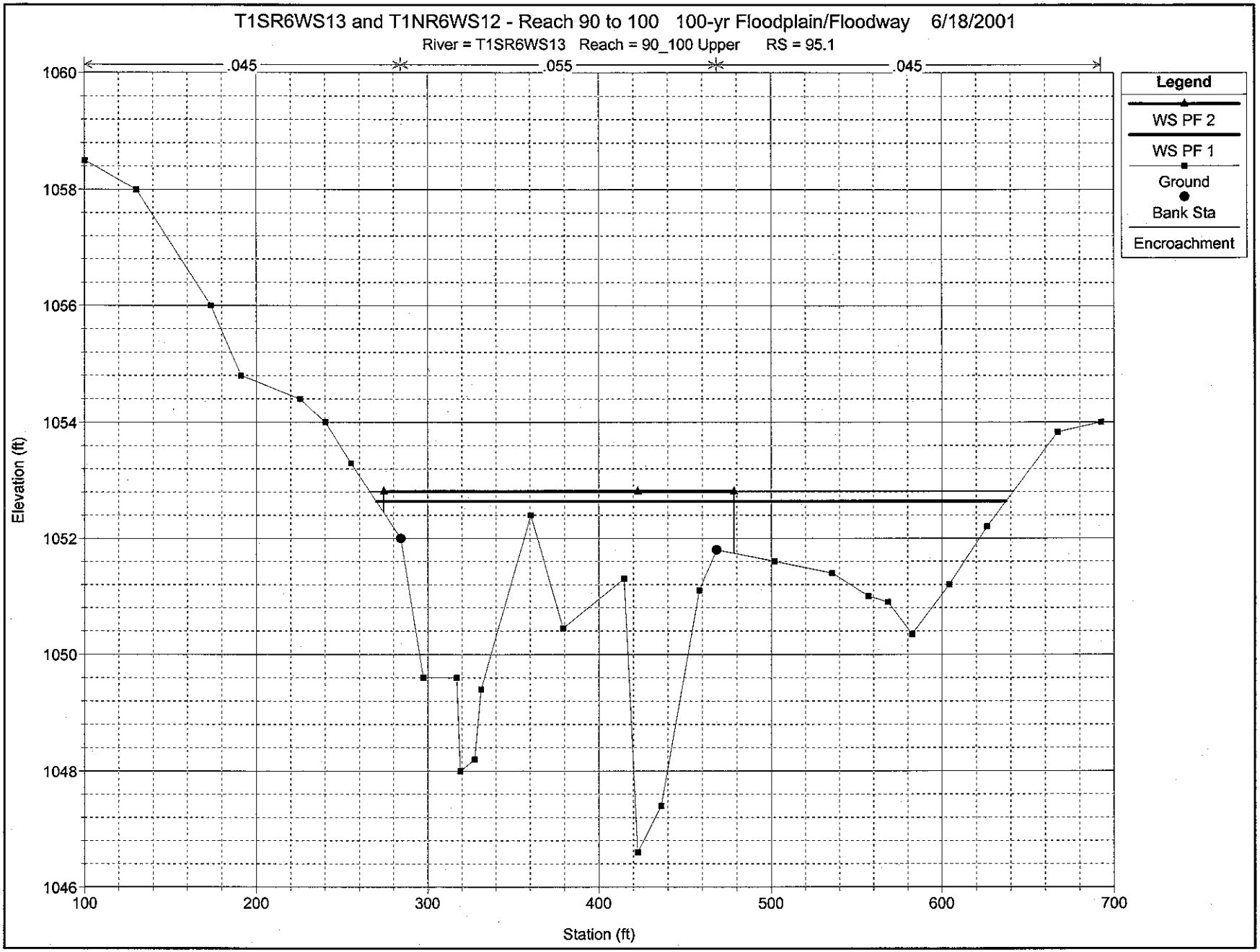
Station (ft)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.045
.055
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1060
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1054
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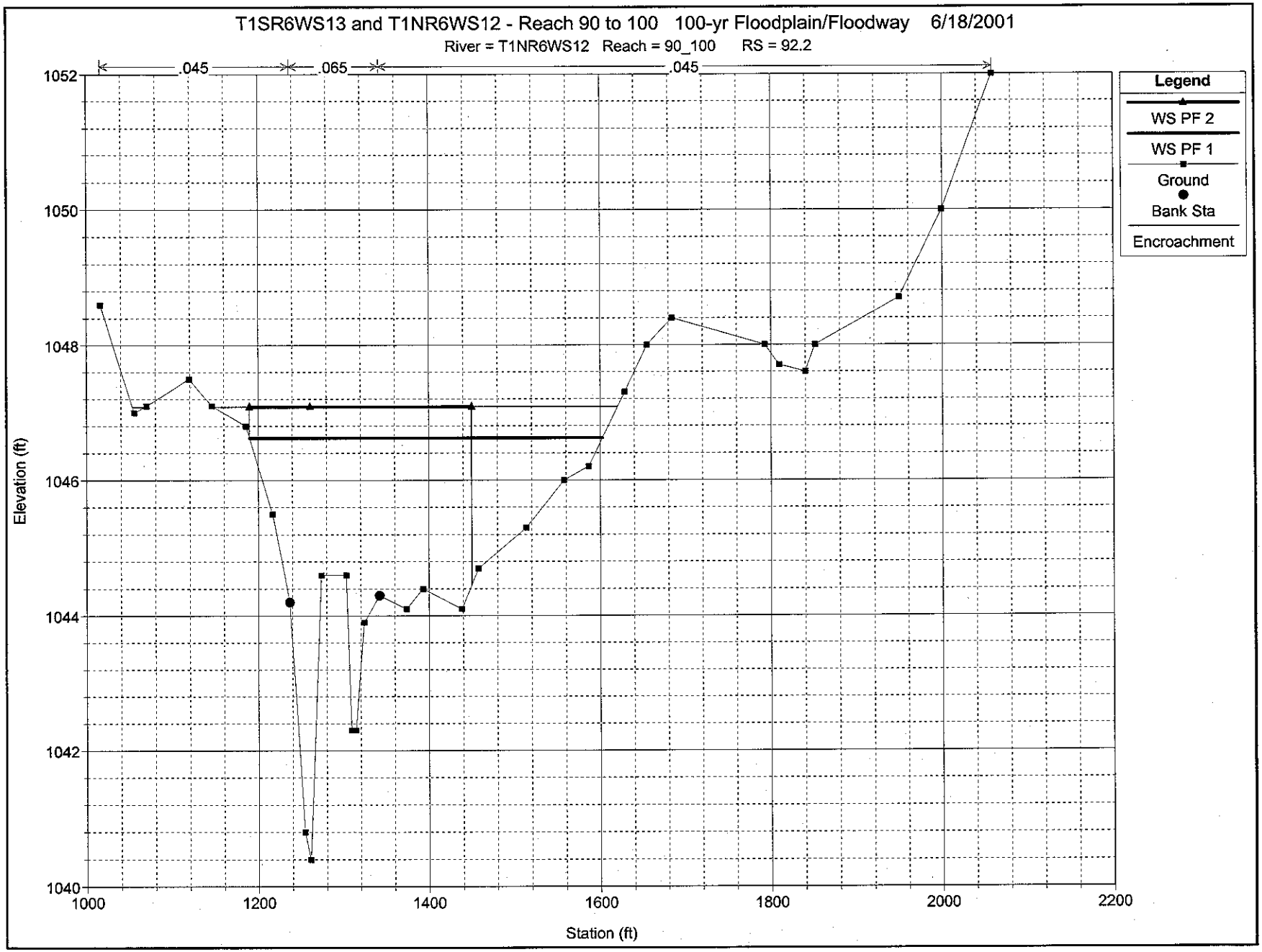
1046
100
200
300
400
500
600
700
Station (ft)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.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1052
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1048
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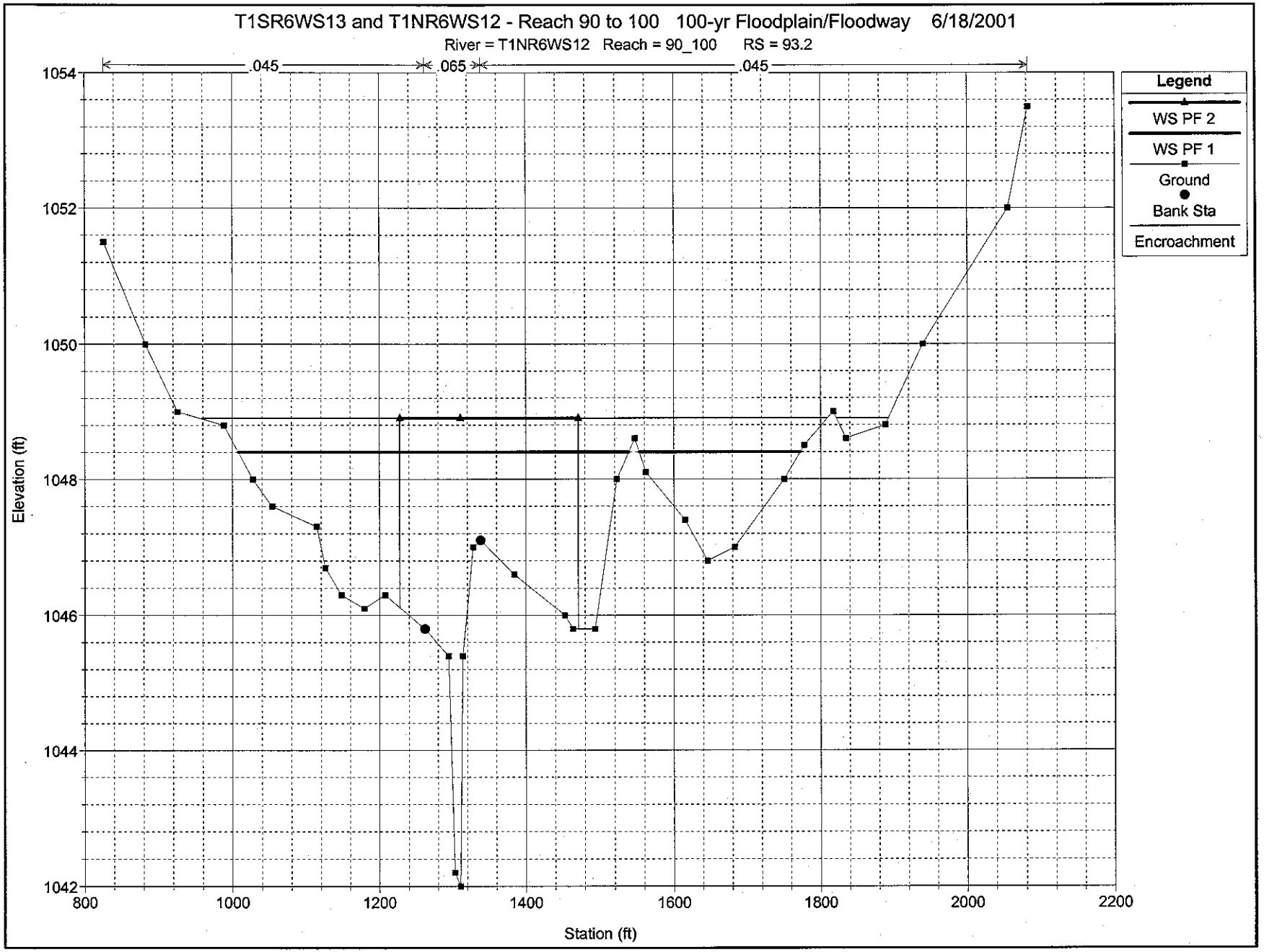
1044
1042
1040
1000
1200
1400
1600
1800
2000
2200
Station (ft)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.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1054
1052
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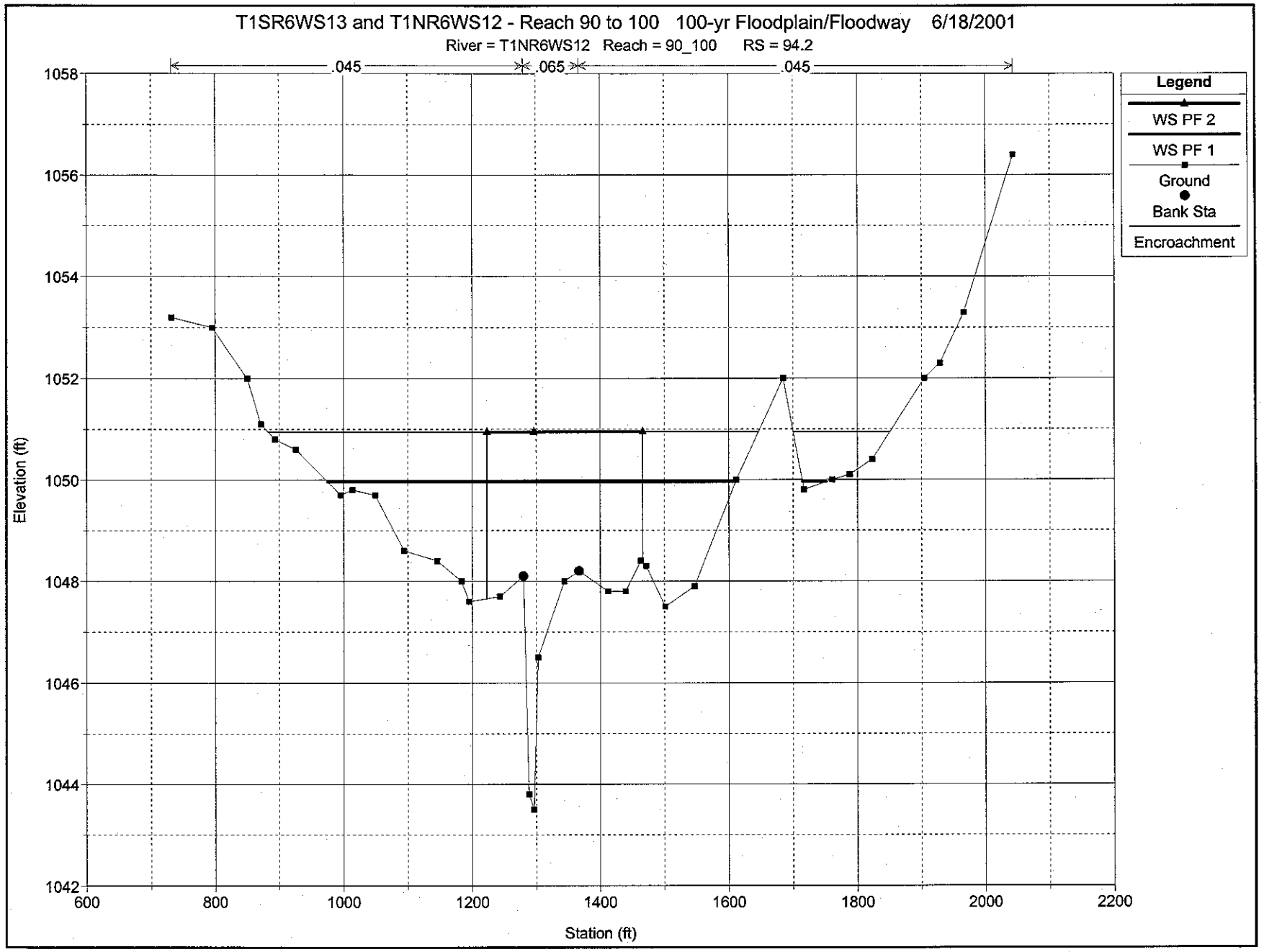
1044
1042
800
1000
1200
1400
1600
1800
2000
2200
Station (ft)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.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1058
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600
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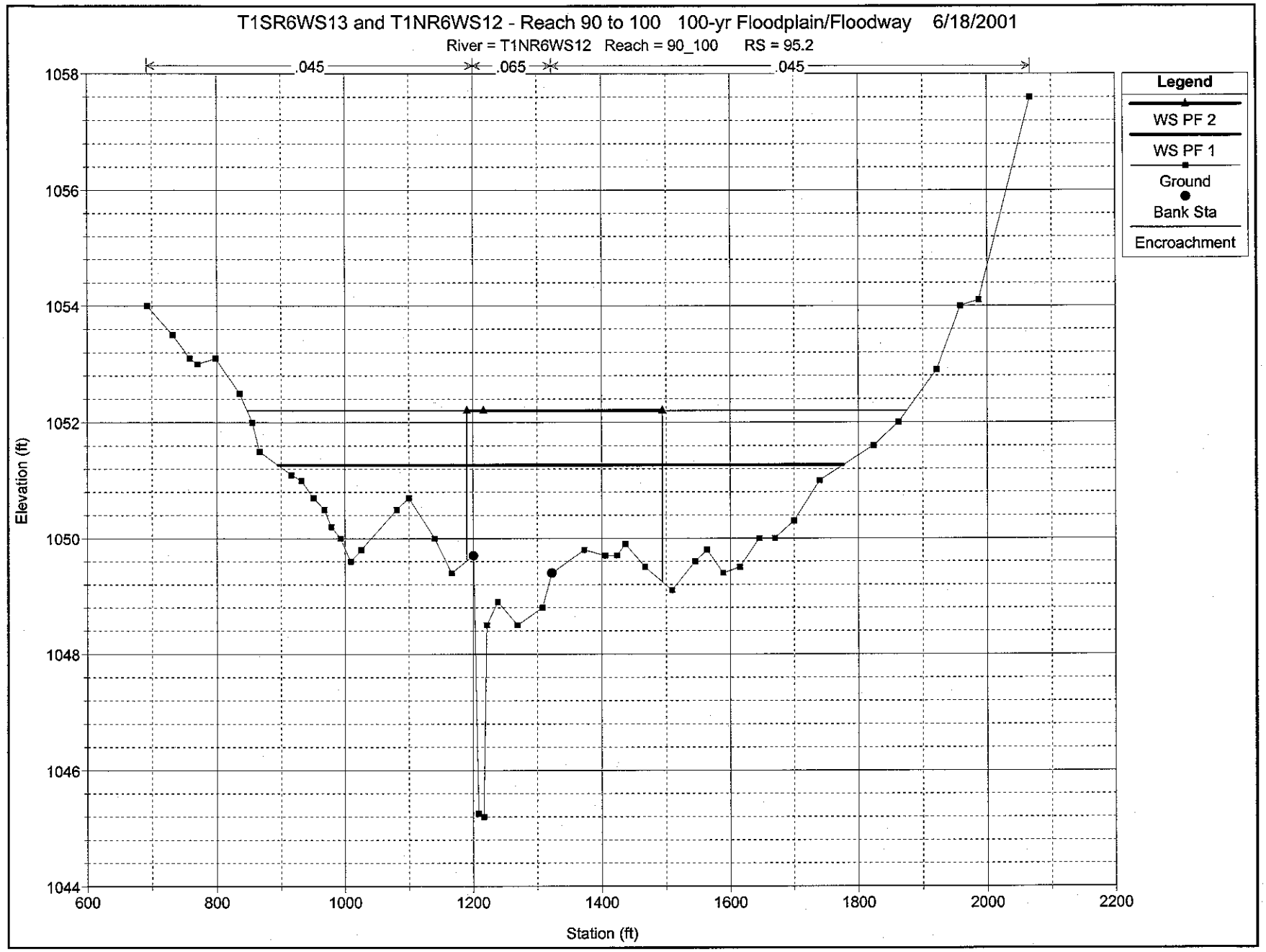
1600
1800
2000
2200
Station (ft)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.045
.065
.045
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1058
1056
1054
1052
1050
1048
1046
1044
600
800
1000
1200
1400
1600
1800
2000
2200
Station (ft)

APPENDIX F

FCDMC 2000C013-Task 11

Detailed Floodplain Delineation for T1SR6WS13 (Phillips Wash) and T1NR6WS12

Discharge rating curve for flows spilling over Van Buren at T1NR6WS12

Elevation ft	Floodplain Van Buren Weir cfs	Culvert Discharges cfs	Floodplain TOTAL Discharge cfs	Floodway Van Buren Weir cfs	Floodway TOTAL Discharge cfs
1046.5	0	0	0	0	0
1047.9	0	25	25	0	25
1048.5	0	50	50	0	50
1049.1	0	75	75	0	75
1049.6	0	100	100	0	100
1050.2	0	125	125	0	125
1050.9	0	150	150	0	150
1051.0	0	151	151	0	151
1051.1	1.54	153	155	1.54	155
1051.2	8.22	156	164	8.22	164
1051.3	21.24	158	179	21.24	179
1051.4	42.82	160	203	42.82	203
1051.5	80.53	162	242	80.53	242
1051.6	142.72	164	307	142.72	307
1051.7	226.24	166	392	226.24	392
1051.8	329.61	168	498	329.61	498
1051.9	452.02	171	623	451.8	622
1052.0	591.91	173	765	590.61	763
1052.1	750.95	175	926	745.14	920
1052.2	934.17	177	1111	914.66	1092
1052.3	1141.45	179	1321	1097.6	1277
1052.4	1372.05	181	1553	1293.02	1474
1052.5	1627.35	184	1811	1500.22	1684
1052.6	1906.05	186	2092	1718.68	1904
1052.7	2207.73	188	2396	1947.96	2136
1052.8	2532.26	190	2722	2187.67	2378
1052.9	2879.62	192	3072	2437.5	2630
1053.0	3249.46	195	3444	2697.17	2892
1053.1	3641.75	197	3838	2966.43	3163
1053.2	4056.51	199	4255	3245.07	3444
1053.3	4493.94	201	4695	3532.89	3734
1053.4	4954.42	203	5157	3829.72	4033
1053.5	5438.17	205	5643	4135.4	4340
1053.6	5947.74	207	6155	4449.77	4657
1053.7	6487.55	209	6696	4772.73	4982
1053.8	7055.91	211	7267	5104.13	5315
1053.9	7652.63	213	7865	5443.87	5657

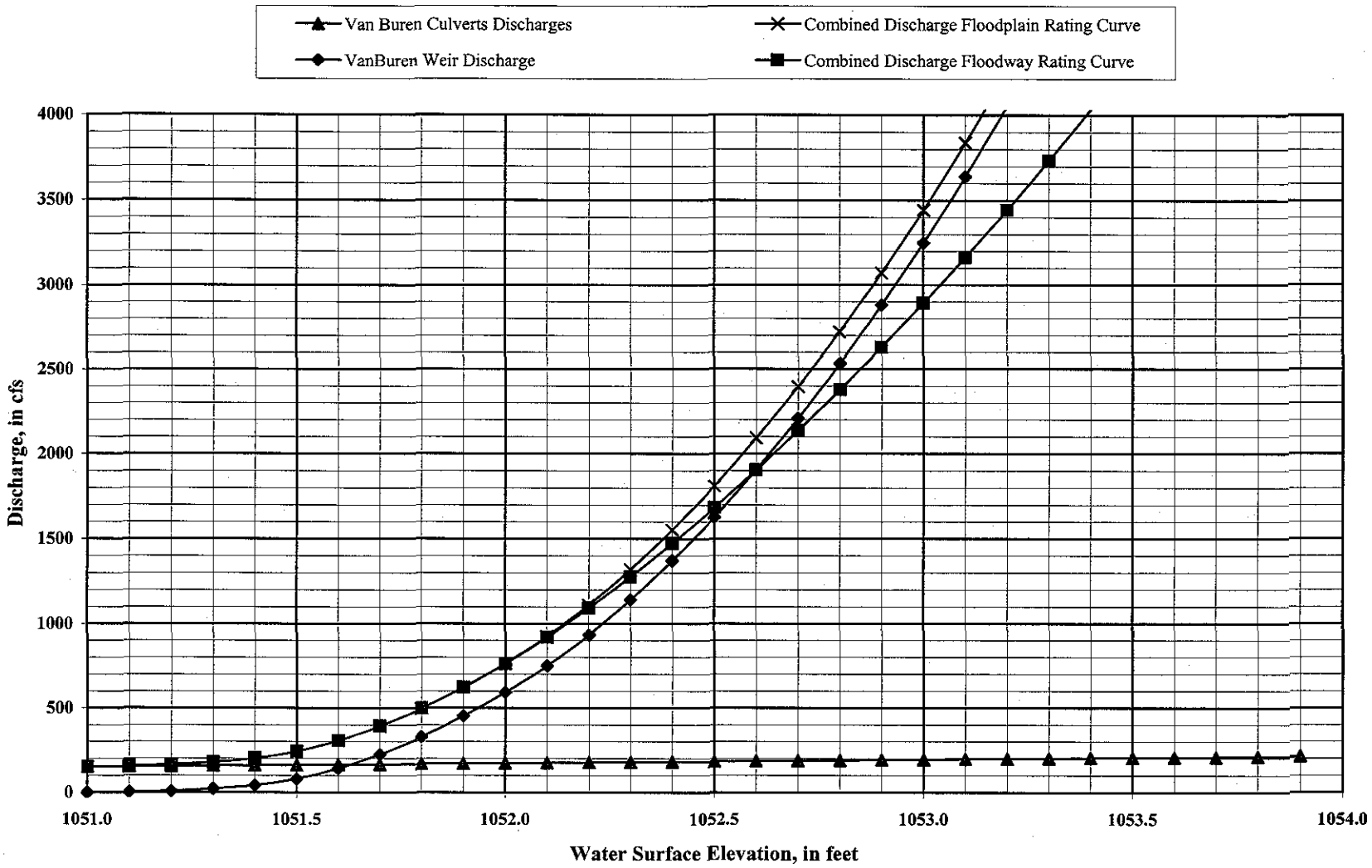


FIGURE 3
Rating Curve for T1NR6WS12 at Van Buren Road Crossing

CURRENT DATE: 06-02-2001 FILE DATE: 06-02-2001
CURRENT TIME: 14:08:56 FILE NAME: 1N6WS12

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 6.0 **********
****

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1046.50	1046.00	70.00	3 CSP	3.00	3.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

****

SUMMARY OF CULVERT FLOWS (cfs) FILE: 1N6WS12 DATE: 06-02-2001

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1046.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1047.88	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1048.53	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1049.08	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1049.61	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1050.17	125.0	125.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1050.94	150.0	150.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1052.11	175.0	175.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1053.25	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1054.52	225.0	225.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1055.91	250.0	250.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1056.00	251.1	251.1	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 1N6WS12 DATE: 06-02-2001

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1046.50	0.000	0.00	0.00	0.00
1047.88	0.000	25.00	0.00	0.00
1048.53	0.000	50.00	0.00	0.00
1049.08	0.000	75.00	0.00	0.00
1049.61	0.000	100.00	0.00	0.00
1050.17	0.000	125.00	0.00	0.00
1050.94	0.000	150.00	0.00	0.00
1052.11	0.000	175.00	0.00	0.00
1053.25	0.000	200.00	0.00	0.00
1054.52	0.000	225.00	0.00	0.00
1055.91	0.000	250.00	0.00	0.00

****

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

****

CURRENT DATE: 06-02-2001 FILE DATE: 06-02-2001
CURRENT TIME: 14:08:56 FILE NAME: 1N6WS12

PERFORMANCE CURVE FOR CULVERT 1 - 3(3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1046.50	0.00	-0.50	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
25.00	1047.88	1.24	1.38	2-M2c	1.06	0.91	0.91	0.73	4.61	2.18
50.00	1048.53	1.84	2.03	2-M2c	1.58	1.30	1.30	1.11	5.68	2.81
75.00	1049.08	2.35	2.58	2-M2c	2.07	1.61	1.61	1.41	6.49	3.24
100.00	1049.61	2.85	3.11	2-M2c	3.00	1.87	1.87	1.68	7.20	3.58
125.00	1050.17	3.37	3.67	2-M2c	3.00	2.10	2.10	1.91	7.88	3.86
150.00	1050.94	3.97	4.44	2-M2c	3.00	2.29	2.29	2.13	8.64	4.11
175.00	1052.11	4.65	5.61	2-M2c	3.00	2.46	2.46	2.34	9.43	4.32
200.00	1053.25	5.44	6.75	2-M2c	3.00	2.59	2.59	2.53	10.30	4.51
225.00	1054.52	6.34	8.02	2-M2c	3.00	2.73	2.73	2.71	11.10	4.69
250.00	1055.91	7.36	9.41	3-M2t	3.00	2.86	2.88	2.88	12.03	4.85

El. inlet face invert 1046.50 ft El. outlet invert 1046.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	100.00 ft
INLET ELEVATION	1046.50 ft
OUTLET STATION	170.00 ft
OUTLET ELEVATION	1046.00 ft
NUMBER OF BARRELS	3
SLOPE (V/H)	0.0071
CULVERT LENGTH ALONG SLOPE	70.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 06-02-2001 FILE DATE: 06-02-2001
CURRENT TIME: 14:08:56 FILE NAME: 1N6WS12

****
********** TAILWATER **********
****

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	15.00 ft
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (ft/ft)	0.007
MANNING'S n (.01-0.1)	0.045
CHANNEL INVERT ELEVATION	1046.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	1046.00 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1046.00	0.000	0.00	0.00	0.00
25.00	1046.73	0.450	0.73	2.18	0.34
50.00	1047.11	0.470	1.11	2.81	0.51
75.00	1047.41	0.481	1.41	3.24	0.65
100.00	1047.68	0.488	1.68	3.58	0.77
125.00	1047.91	0.492	1.91	3.86	0.88
150.00	1048.13	0.495	2.13	4.11	0.99
175.00	1048.34	0.498	2.34	4.32	1.08
200.00	1048.53	0.500	2.53	4.51	1.17
225.00	1048.71	0.502	2.71	4.69	1.25
250.00	1048.88	0.503	2.88	4.85	1.33

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	60.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	1056.00 ft

****

```
*********************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
*********************************************


    PROJECT:  FCDMC 2000C013-Task11
    ENGINEER:  wso
    DATE:   6/ 2/2001
    TIME:  13:56. 2




---------------------------------------------
    INPUT PARAMETERS
---------------------------------------------


    STARTING WSEL:       1051.00
    MAXIMUM WSEL:        1054.00
    STEP SIZE:              0.10
    BREADTH OF WEIR:       60.00


*********************************************
    INPUT ELEVATION/STATION TABLE.
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 2/2001
    TIME:  13:56. 2
*********************************************
```

POINT	ELEVATION	STATION
1	1054.10	615.80
2	1054.00	628.90
3	1053.80	685.90
4	1053.60	726.60
5	1053.50	816.60
6	1053.40	830.80
7	1053.20	861.70
8	1053.00	886.90
9	1052.40	959.50
10	1052.30	1006.80
11	1052.00	1037.70
12	1051.80	1060.80
13	1051.10	1158.00
14	1051.00	1187.40
15	1051.30	1244.90
16	1051.50	1353.30
17	1051.40	1427.70
18	1051.60	1508.30
19	1051.80	1559.20
20	1052.00	1573.70
21	1052.20	1598.80
22	1052.00	1646.50
23	1052.10	1694.60
24	1052.80	1802.00
25	1053.30	1854.40
26	1054.00	1926.70
27	1055.00	2014.80

```
*******************************************
    WEIR COEFFICIENT TABLE
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 2/2001
    TIME:  13:56. 2
*******************************************
```

REFERENCE: COE CHART - LOWER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.5833
2	0.10	2.5056	17	1.60	2.5889
3	0.20	2.5111	18	1.70	2.5944
4	0.30	2.5167	19	1.80	2.6000
5	0.40	2.5222	20	1.90	2.6056
6	0.50	2.5278	21	2.00	2.6111
7	0.60	2.5333	22	2.10	2.6167
8	0.70	2.5389	23	2.20	2.6222
9	0.80	2.5444	24	2.30	2.6278
10	0.90	2.5500	25	2.40	2.6333
11	1.00	2.5556	26	2.50	2.6389
12	1.10	2.5611	27	2.60	2.6444
13	1.20	2.5667	28	2.70	2.6500
14	1.30	2.5722	29	2.80	2.6556
15	1.40	2.5778	30	2.90	2.6611

```
*******************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
    PROJECT:  FCDMC 2000C013-Task11
    DATE:   6/ 2/2001
    TIME:  13:56. 2
*******************************************
```

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1051.00	0.00	1052.50	1627.35
1051.10	1.54	1052.60	1906.05
1051.20	8.22	1052.70	2207.73
1051.30	21.24	1052.80	2532.26
1051.40	42.82	1052.90	2879.62
1051.50	80.53	1053.00	3249.46
1051.60	142.72	1053.10	3641.75
1051.70	226.24	1053.20	4056.51
1051.80	329.61	1053.30	4493.94
1051.90	452.02	1053.40	4954.42
1052.00	591.91	1053.50	5438.17
1052.10	750.95	1053.60	5947.74
1052.20	934.17	1053.70	6487.55
1052.30	1141.45	1053.80	7055.91
1052.40	1372.05	1053.90	7652.63

```
*********************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
*********************************************


    PROJECT:  FCD 2000C013 - TASK 11
    ENGINEER:  WSO
    DATE:   6/18/2001
    TIME:  18: 6.47




---------------------------------------------
    INPUT PARAMETERS
---------------------------------------------


    STARTING WSEL:       1051.00
    MAXIMUM WSEL:        1054.00
    STEP SIZE:              0.10
    BREADTH OF WEIR:       60.00


*********************************************
    INPUT ELEVATION/STATION TABLE.
    PROJECT:  FCD 2000C013 - TASK 11
    DATE:   6/18/2001
    TIME:  18: 6.47
*********************************************
```

POINT	ELEVATION	STATION
1	1060.00	1020.00
2	1052.10	1021.00
3	1052.00	1037.70
4	1051.80	1060.80
5	1051.10	1158.00
6	1051.00	1187.40
7	1051.30	1244.90
8	1051.50	1353.30
9	1051.40	1427.70
10	1051.60	1508.30
11	1051.80	1559.20
12	1060.00	1560.00

```
*********************************************
    WEIR COEFFICIENT TABLE
    PROJECT:  FCD 2000C013 - TASK 11
    DATE:   6/18/2001
    TIME:  18: 6.47
*********************************************
```

REFERENCE: COE CHART - LOWER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.5833
2	0.10	2.5056	17	1.60	2.5889
3	0.20	2.5111	18	1.70	2.5944
4	0.30	2.5167	19	1.80	2.6000
5	0.40	2.5222	20	1.90	2.6056
6	0.50	2.5278	21	2.00	2.6111
7	0.60	2.5333	22	2.10	2.6167
8	0.70	2.5389	23	2.20	2.6222
9	0.80	2.5444	24	2.30	2.6278
10	0.90	2.5500	25	2.40	2.6333
11	1.00	2.5556	26	2.50	2.6389
12	1.10	2.5611	27	2.60	2.6444
13	1.20	2.5667	28	2.70	2.6500
14	1.30	2.5722	29	2.80	2.6556
15	1.40	2.5778	30	2.90	2.6611

```
*********************************************
    UNEVEN WEIR FLOW PROGRAM
    FORTRAN VERSION 1.0
    PROJECT:  FCD 2000C013 - TASK 11
    DATE:   6/18/2001
    TIME:  18: 6.47
*********************************************
```

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1051.00	0.00	1052.50	1500.22
1051.10	1.54	1052.60	1718.68
1051.20	8.22	1052.70	1947.96
1051.30	21.24	1052.80	2187.67
1051.40	42.82	1052.90	2437.50
1051.50	80.53	1053.00	2697.17
1051.60	142.72	1053.10	2966.43
1051.70	226.24	1053.20	3245.07
1051.80	329.61	1053.30	3532.89
1051.90	451.80	1053.40	3829.72
1052.00	590.61	1053.50	4135.40
1052.10	745.14	1053.60	4449.77
1052.20	914.66	1053.70	4772.73
1052.30	1097.60	1053.80	5104.13
1052.40	1293.02	1053.90	5443.87

APPENDIX G

HEC-RAS Plan: FP/FW

River	Reach	River Sta	W.S. Elev (ft)	Prof Delta WS (ft)	E.G. Elev (ft)	Top Wdth Act (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
T1SR6WS13	90_100 Lower	90	1044.21		1044.38	704.01	636.07	4178.26	135.67		1313.50	1668.30		542.36	1804.03
T1SR6WS13	90_100 Lower	90	1044.59	0.38	1044.80	354.80		4950.00		1313.50	1313.50	1668.30	1668.30	1313.50	1668.30
T1SR6WS13	90_100 Lower	91	1045.65		1045.73	893.58	55.84	2513.60	2380.56		1001.40	1332.40		899.82	1849.73
T1SR6WS13	90_100 Lower	91	1046.16	0.51	1046.27	508.60	28.33	3252.27	1669.40	991.40	1001.40	1332.40	1500.00	991.40	1500.00
T1SR6WS13	90_100 Upper	92.1	1046.68		1046.93	301.84		2300.00			644.50	973.60		652.20	954.04
T1SR6WS13	90_100 Upper	92.1	1047.17	0.49	1047.33	309.45		2300.00		644.50	644.50	973.60	973.60	650.57	960.03
T1SR6WS13	90_100 Upper	93.1	1049.27		1049.44	366.23	8.51	2260.89	30.60		432.50	739.40		403.37	769.60
T1SR6WS13	90_100 Upper	93.1	1049.12	-0.15	1049.31	326.90	3.92	2279.57	16.51	422.50	432.50	739.40	749.40	422.50	749.40
T1SR6WS13	90_100 Upper	94.1	1051.29		1051.45	387.23	58.58	2125.84	115.57		308.70	639.70		295.49	682.72
T1SR6WS13	90_100 Upper	94.1	1051.36	0.07	1051.52	351.00	53.44	2182.00	64.56	298.70	308.70	639.70	649.70	298.70	649.70
T1SR6WS13	90_100 Upper	95.1	1052.64		1052.82	367.39	5.04	1709.78	585.18		284.20	468.40		269.93	637.32
T1SR6WS13	90_100 Upper	95.1	1052.81	0.17	1053.12	204.20	11.32	2260.55	28.13	274.20	284.20	468.40	478.40	274.20	478.40
T1NR6WS12	90_100	92.2	1046.62		1046.89	413.00	153.28	1531.01	1715.71		1236.70	1342.10		1189.74	1602.75
T1NR6WS12	90_100	92.2	1047.09	0.46	1047.40	260.30	238.53	1640.04	1521.43	1189.70	1236.70	1342.10	1450.00	1189.70	1450.00
T1NR6WS12	90_100	93.2	1048.40		1048.52	750.01	1118.13	739.24	1542.63		1262.10	1338.50		1008.05	1772.45
T1NR6WS12	90_100	93.2	1048.90	0.50	1049.26	243.39	543.36	1232.08	1624.56	1227.71	1262.10	1338.50	1471.10	1227.71	1471.10
T1NR6WS12	90_100	94.2	1049.96		1050.11	671.61	1088.34	881.99	1429.68		1279.80	1366.80		975.52	1750.96
T1NR6WS12	90_100	94.2	1050.94	0.99	1051.21	243.40	781.60	1336.56	1281.84	1223.00	1279.80	1366.80	1466.40	1223.00	1466.40
T1NR6WS12	90_100	95.2	1051.26		1051.37	881.04	667.33	1042.99	1689.68		1200.90	1322.80		895.71	1776.75
T1NR6WS12	90_100	95.2	1052.20	0.94	1052.41	303.20	84.31	1628.83	1686.86	1190.90	1200.90	1322.80	1494.10	1190.90	1494.10

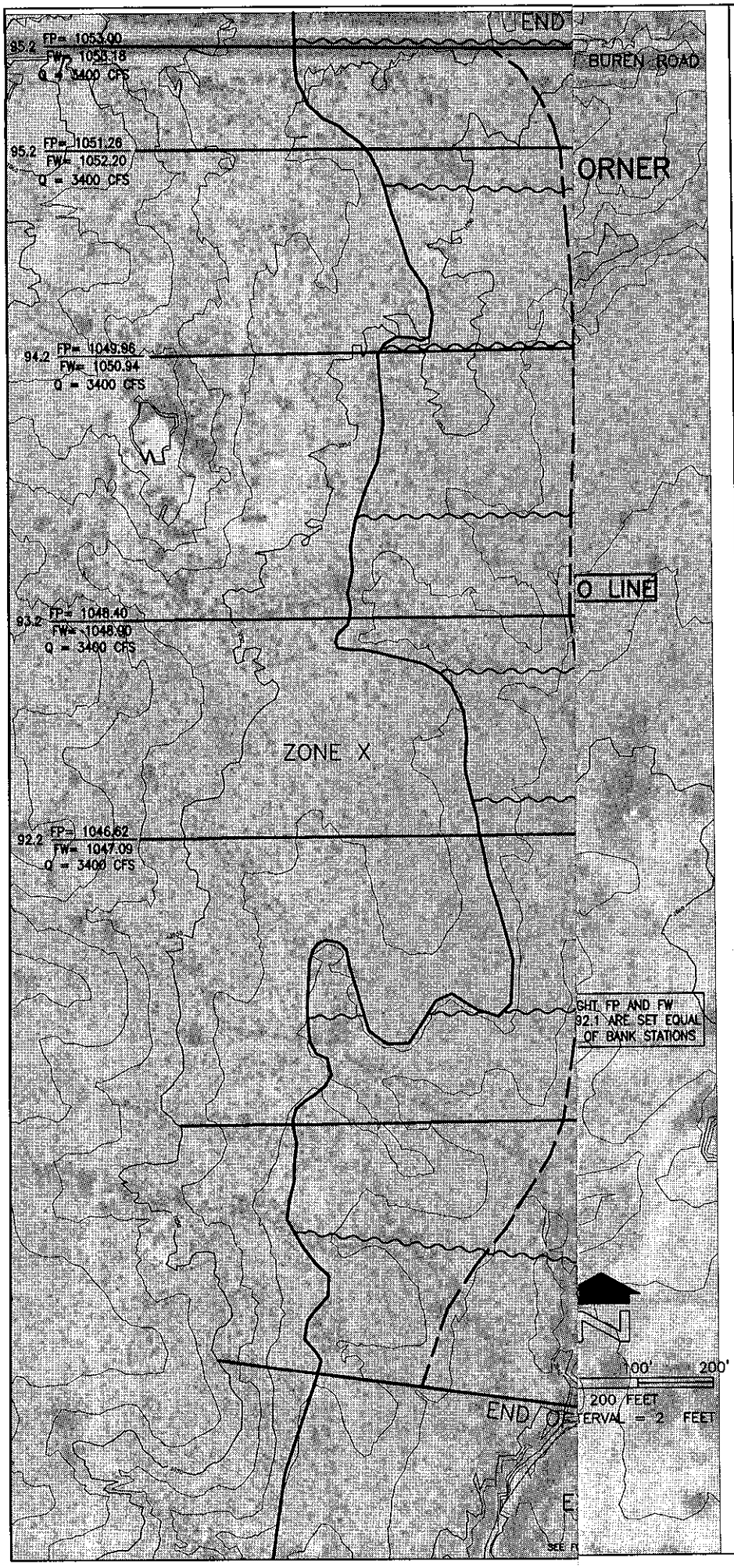
HEC-RAS Plan: FP/FW

River	Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
			(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
T1SR6WS13	90_100 Lower	90	704.01	1663.64	3.20	1044.21	1044.21	
T1SR6WS13	90_100 Lower	90	354.80	1342.30	3.69	1044.59	1044.21	0.38
T1SR6WS13	90_100 Lower	91	893.58	2192.00	2.26	1045.65	1045.65	
T1SR6WS13	90_100 Lower	91	508.60	1880.19	2.63	1046.16	1045.65	0.51
T1SR6WS13	90_100 Upper	92.1	301.84	569.59	4.04	1046.68	1046.68	
T1SR6WS13	90_100 Upper	92.1	309.45	719.58	3.20	1047.17	1046.68	0.49
T1SR6WS13	90_100 Upper	93.1	366.23	711.80	3.23	1049.27	1049.27	
T1SR6WS13	90_100 Upper	93.1	326.90	648.87	3.54	1049.12	1049.27	-0.15
T1SR6WS13	90_100 Upper	94.1	387.23	723.02	3.18	1051.29	1051.29	
T1SR6WS13	90_100 Upper	94.1	351.00	719.40	3.20	1051.36	1051.29	0.07
T1SR6WS13	90_100 Upper	95.1	367.39	689.97	3.33	1052.64	1052.64	
T1SR6WS13	90_100 Upper	95.1	204.20	521.75	4.41	1052.81	1052.64	0.17
T1NR6WS12	90_100	92.2	413.00	821.73	4.14	1046.62	1046.62	
T1NR6WS12	90_100	92.2	260.30	774.75	4.39	1047.09	1046.62	0.46
T1NR6WS12	90_100	93.2	750.01	1195.76	2.84	1048.40	1048.40	
T1NR6WS12	90_100	93.2	243.39	706.87	4.81	1048.90	1048.40	0.50
T1NR6WS12	90_100	94.2	671.61	1111.58	3.06	1049.96	1049.96	
T1NR6WS12	90_100	94.2	243.40	829.32	4.10	1050.94	1049.96	0.99
T1NR6WS12	90_100	95.2	881.04	1303.13	2.61	1051.26	1051.26	
T1NR6WS12	90_100	95.2	303.20	933.01	3.64	1052.20	1051.26	0.94

HEC-RAS Plan: FP/FW

River	Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
T1SR6WS13	90_100 Lower	90	4950.00	1035.70	1044.21	1042.37	1044.38	0.004501	3.46	1546.98	887.31	0.33
T1SR6WS13	90_100 Lower	90	4950.00	1035.70	1044.59	1042.37	1044.80	0.004502	3.69	1342.30	354.80	0.33
T1SR6WS13	90_100 Lower	91	4950.00	1037.70	1045.65		1045.73	0.001743	2.18	2192.00	893.58	0.21
T1SR6WS13	90_100 Lower	91	4950.00	1037.70	1046.16		1046.27	0.001859	2.46	1880.19	508.60	0.22
T1SR6WS13	90_100 Upper	92.1	2300.00	1041.90	1046.68		1046.93	0.009677	4.04	569.59	301.84	0.52
T1SR6WS13	90_100 Upper	92.1	2300.00	1041.90	1047.17		1047.33	0.004590	3.20	719.58	309.45	0.37
T1SR6WS13	90_100 Upper	93.1	2300.00	1043.00	1049.27		1049.44	0.005165	3.30	711.80	366.23	0.39
T1SR6WS13	90_100 Upper	93.1	2300.00	1043.00	1049.12		1049.31	0.006665	3.57	648.87	326.90	0.44
T1SR6WS13	90_100 Upper	94.1	2300.00	1045.80	1051.29		1051.45	0.005726	3.23	723.02	387.23	0.40
T1SR6WS13	90_100 Upper	94.1	2300.00	1045.80	1051.36		1051.52	0.005358	3.20	719.40	351.00	0.39
T1SR6WS13	90_100 Upper	95.1	2300.00	1046.60	1052.64		1052.82	0.005176	3.61	689.97	367.39	0.40
T1SR6WS13	90_100 Upper	95.1	2300.00	1046.60	1052.81		1053.12	0.007280	4.47	521.75	204.20	0.48
T1NR6WS12	90_100	92.2	3400.00	1040.40	1046.62		1046.89	0.007794	4.42	821.73	413.00	0.43
T1NR6WS12	90_100	92.2	3400.00	1040.40	1047.09		1047.40	0.005758	4.15	774.75	260.30	0.38
T1NR6WS12	90_100	93.2	3400.00	1042.00	1048.40		1048.52	0.004110	3.08	1195.76	750.01	0.31
T1NR6WS12	90_100	93.2	3400.00	1042.00	1048.90		1049.26	0.006961	4.43	706.87	243.39	0.41
T1NR6WS12	90_100	94.2	3400.00	1043.50	1049.96		1050.11	0.004586	3.26	1111.58	671.61	0.33
T1NR6WS12	90_100	94.2	3400.00	1043.50	1050.94		1051.21	0.004203	3.75	828.32	243.40	0.33
T1NR6WS12	90_100	95.2	3400.00	1045.20	1051.26		1051.37	0.004098	2.94	1303.13	881.04	0.30
T1NR6WS12	90_100	95.2	3400.00	1045.20	1052.20		1052.41	0.003942	3.48	933.01	303.20	0.31

APPENDIX H



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

T1SR6WS13 AND T1N6WS12
SECTIONS 90 TO 100

FLOOD DELINEATION STUDY OF FCD NO. 2000C013-TASK11

LEGEND

100-YR FLOODPLAIN BOUNDARY

FLOODWAY BOUNDARY

CROSS SECTION — 0.10 (CROSS SECTION DESIGNATOR NUMBER) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION) / FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION) / Q = xxx CFS (100 YR DISCHARGE)

TEMPORARY BENCH MARK — TBM XXX

BASE FLOOD ELEVATIONS — 1221

ZONE DESIGNATIONS — ZONE AE

TEMPORARY BENCH MARKS (TBM)

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988.

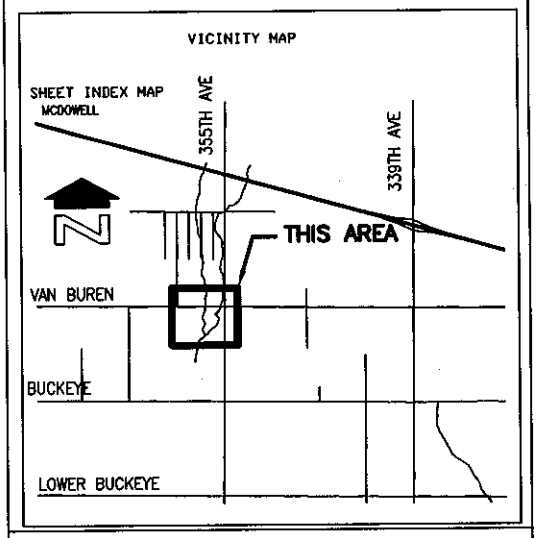
NGVD29 + 1.97 FEET = NVAD88

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
TBM #1	1047.48	NW CORNER OF CONCRETE PAD FOR WELL HEAD N: 891298.89 E: 425377.57
TBM #2	1048.92	NW CORNER OF CONCRETE PAD FOR WELL HEAD N: 891477.80 E: 424876.76

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 100 UNLESS NOTED OTHERWISE. BASELINE IS ALONG THE 355TH AVE ALIGNMENT AS INDICATED ON MAP

2- FLOODPLAIN AND FLOODWAY SHARE A COMMON BOUNDARY WHERE NO SEPARATE FLOODWAY LINE IS SHOWN

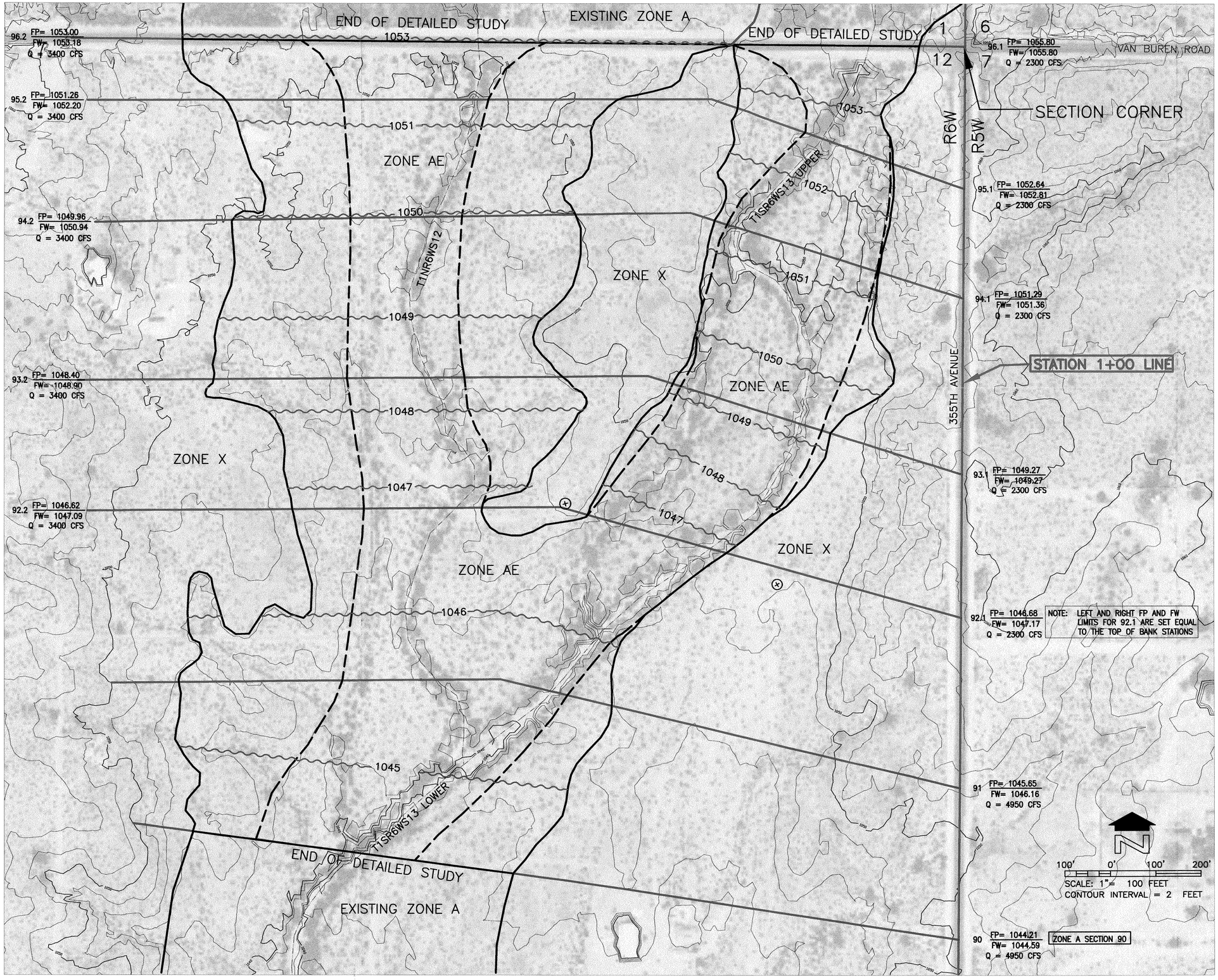


JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
8101 SOUTH RURAL RD, STE 110, TEMPE, AZ 85283 PHN: 480-752-2124, FAX: 480-839-2193

EXHIBIT 1

	BY	DATE
DESIGN	-	-
DESIGN CHK.	-	-
PLANS	-	-
PLANS CHK.	-	-

SHEET 1 OF 1



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

T1SR6WS13 AND T1N6WS12
SECTIONS 90 TO 100

FLOOD DELINEATION STUDY OF
FCD NO. 2000C013–TASK11

LEGEND

100–YR FLOODPLAIN BOUNDARY

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CROSS SECTION — 0.10 (CROSS SECTION DESIGNATION NUMBER) FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION) FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION) Q = xxx CFS (100 YEAR DISCHARGE)

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BASE FLOOD ELEVATIONS — 1221

ZONE DESIGNATIONS — ZONE AE

TEMPORARY BENCH MARKS (TBM)

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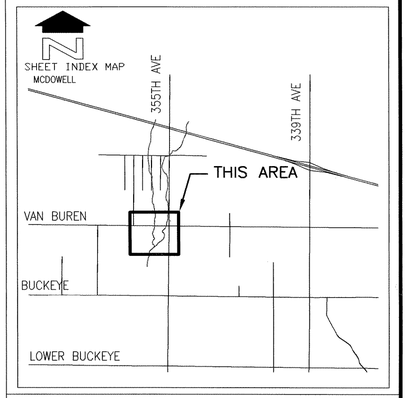

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PLATE 1

	BY	DATE
DESIGN	–	–
DESIGN CHK.	–	–
PLANS	–	–
PLANS CHK.	–	–

SHEET 1 OF 1

SEE FCD CONTRACT NO. 99–03 FOR SURVEY CONTROL AND AERIAL MAPPING DATA. BASE MAPPING FOR THIS MAP IS PER THAT STUDY

APPENDIX I